General Information

Installation Test Procedure

TO: USERS OF THIS MANUAL

This manual contains information concerning TD-100 EPABX organization and operation, and installation. It is divided into two categories. Documents prefixed by the letters OA contain general information; documents prefixed by the letters OB contain installation information and strapping data. A summary of the material in each document follows:

OA-000-001, GENERAL INFORMATION. This section serves as an introduction to the TD-100 EPABX. Notable items include,

- Summary of Technical Specifications . . . . . .paragraph 2.00
- Documents and Drawings . . . . . .table 1.00
- Features and Services . . . . . .paragraph 3.00
- Brief Circuit Descriptions . . . . . .paragraph 4.00
- Maintenance Aids . . . . . .paragraph 5.00
- General System Concepts . . . . . .paragraph 6.00
- Typical Call Processing Operations . . . . . .paragraph 7.00

OB-000-001, GENERAL INSTALLATION. This section serves as an index to installation documents. Notable items include,

- Console and Cabinet Location . . . . . .paragraph 3.00
- Power and Grounding Requirements . . . . . .paragraph 3.00
- Use of Other Installation Documents. . . . . .paragraph 4.00

OB-000-002, CABINET AND APPARATUS INSTALLATION. Pre-installation activities such as, unpacking, inspecting, and moving the equipment, and instructions for connecting the cabinet to commercial power.

OB-000-004, CONSOLE INSTALLATION. Provides instructions for unpacking and inspecting the console, performing visual console checks, and locating and assembling the console. Notable items include,

- Reporting Equipment Shortages. . . . . .paragraph 3.00
- Handset Installation Instructions . . . . . .paragraph 4.00
- Instructions for Inserting Designation Tabs. . . . . .paragraph 4.00

OB-000-005, CABLE CONNECTIONS AT CROSS-CONNECT TERMINALS. Provides information concerning interconnection of the console, cabinet, station lines, and trunks.

OB-000-006, CABINET TESTS AND INSPECTIONS. This document includes,

- Cabinet Ground Tests. . . . . .paragraph 3.00
- Power Supply Output Tests. . . . . .tables 1.00 and 1.01
- System Transmission Parameters . . . . . .table 1.02

OB-000-007, CONSOLE OPERATION TESTS. Contains test procedures for checking console operation prior to system cutover.

OB-000-008, STATION OPERATION TESTS. Provides test procedures for checking system operation from station telephone sets, prior to cutover.

OB-401-601, NUMERICAL INDEX OF FEATURE STRAPPING DOCUMENTS. This section lists the feature strapping documents for the various TD-100 PCBs.

OB-410-XXX, FEATURE STRAPPING. Each feature strapping document gives detailed instructions for strapping the circuit(s) involved. A document is provided for each standard feature PCB on which strapping is required. Document numbers are derived from circuit numbers. For example, the CO trunk schematic number is 410-637, hence the strapping document is OB-410-153.

f. The cabinet must not be located near sweating pipes or steam pipes.

g. The location must not be subject to corrosive fumes or exhaust from machinery or where steam vents are present.

h. The cabinet should not be located near a passageway used for moving machinery or vehicles.

i. The cabinet must not be located next to a reproducing or copying machine.

j. The cabinet should not be located near the building heating system or a window, from which the heat could cause the temperature in the cabinet to rise above the safe operating range.

k. The cabinet air vents must not be blocked.

3.04 System Power and Grounding. The following requirements must be met for cabinet power and grounding:

a. The power required is 115V AC, 60 Hz, single phase. 1300 watts.

b. The power receptacle should be individually fused with a 20-amp circuit breaker.

c. The power receptacle should be located in a place which would prevent accidental removal of the power cord.

d. Warning tags should be attached to the circuit breaker and to the plug end of the power cord to prevent accidental removal of power.

e. The power receptacle should be the three-way type, with a U-ground connector.

f. The power receptacle should be within eight feet of the cabinet.

g. The power cord between the cabinet and the power receptacle must not present a hazard to the personnel.

h. An approved local ground (metal coldwater pipe, grounding rod) must be run to the cabinet ground cable via a 10 AWG (minimum) copper wire or 8 AWG (minimum) aluminum wire. This ground must be provided in addition to the ground wire in the power cord.

4.00 INSTALLATION

4.01 General. The EPABX should be installed in the order outlined in the following individual detailed installation sections. Basically, the installation procedure to be followed is to install the cabinet and apparatus, perform the feature strapping, install the console, install the cross-connect wiring, perform tests and inspections on the cabinet, and then check out the system by performing the console and station operation tests.

Installation sections, in addition to this section, are:

a. Section OB-000-002: Cabinet and Apparatus Installation.

b. Section OB-000-003: Feature Strapping.

c. Section OB-000-004; Console Installation.

d. Section OB-000-005: Cable Connections at Cross-Connect Terminals.

e. Section OB-000-006: Cabinet Tests and Inspections at Installation.

f. Section OB-000-007: Console Operation Tests.

g. Section OB-000-008: Station Operation Tests.

For detailed operating instructions for the consoles, refer to Section OG-000-002: Attendant's Manual.

GENERAL INSTALLATION
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides general information for the installation of the TD-100 Electronic Private Automatic Branch Exchange (EPABX). For detailed installation instructions, refer to table 1.00 for the applicable sections.

1.02 Purpose of Equipment. The TD-100 EPABX (figures 1.00 and 1.01) is an electronic switching system suitable for private automatic exchange or private automatic branch exchange service. It is designed for use where many extensions require the use of trunk circuits as well as to make local station-to-station calls. Any extension, with the appropriate class of service, can access a trunk circuit, transfer a trunk call to another station, or make use of special features, such as conferencing.

1.03 System Subassemblies. The EPABX has a maximum capacity of 100 lines, 12 local links, and 24 trunks. Many additional features are provided in the system, some integral and others optional. In the case of trunks, the maximum capacity is 24; however, up to 10 of these may be substituted with tie trunks, and up to 14 may be substituted with DID trunks. Figure 1.02 shows the complete range of subassemblies in a complete 100-line system. For detailed descriptions of the functions performed by each subassembly, refer to Section OA-000-001, General Information.

The cabinet is shipped completely prewired; connections to external equipment, such as station telephone sets and trunk lines, are made via plug-in cables.

The cabinet is equipped with three printed circuit board subracks. All circuit boards in the system are plug-in.

The plug-in boards fit into guides on a subrack and have connectors to mate to the motherboard at the rear of the subrack. Each board is equipped with two extractors, which are used when removing a board. Boards that require time slots (trunks, links, registers, etc.) have BUSY switches located at the front of the board to remove the circuit from service, if required. Also, boards other than the common control circuitry, (processor, memory, etc.), have light emitting diodes (LED's) which, when lit, indicate the circuit is "busy." Boards which have several strapping options available, such as the class of service and vacant number intercept must have the strapping completed at the time of installation. Refer to section OB-000-003 (Feature Strapping) for the strapping options available for the system.

The system power is provided by a power supply located at the bottom of the cabinet. A 115V AC, 60 Hz supply is required by the power supply.

TABLE 1.00 Documents and Drawings

TITLE	NUMBER
General Information	OA-000-001
General Installation	OB-000-001
Cabinet and Apparatus Installation	OB-000-002
Feature Strapping	OB-000-003
Console Installation	OB-000-004
Cable Connections at Cross-Connect Terminals	OB-000-005
Cabinet Tests and Inspections	OB-000-006
Console Operation Tests	OB-000-007
Station Operation Tests	OB-000-008
General Maintenance	OC-000-001
Access Test Set	OC-000-002
Console Maintenance	OC-000-003
Station User's Guide	OG-000-001
Console Operating Instructions	OG-000-002
	CIRCUIT NARRATIVE
Trunk Motherboard	TD-4101507 –
Line Circuit	TD-4101517 OL-410-151
Attendant Line and Control	TD-4101527 OL-410-152
Standard Two-Way Trunk	TD-4101537 OL-410-153
Common Control Feature #2	TD-4101547 OL-410-154
Assigned Night Answer	TD-4101557 OL-410-155
Line Motherboard	TD-4101567 –
Conference Network	TD-4101577 OL-410-157
Power Failure Transfer	TD-4101587 OL-410-158
Common Services	TD-4101597 OL-410-159
Class of Service and Vacant Number Intercept	TD-4101607 OL-410-160
Memory	TD-4101617 OL-410-161
Processor Number 1	TD-4101627 OL-410-162
Processor Number 2	TD-4101637 OL-410-163
Tie Trunk, Loop or Battery and Ground Signaling	TD-4101647 OL-410-164
Station Hunting	TD-4101657 OL-410-165
Register	TD-4101667 OL-410-166
Tel[illegible] Receiver	TD-4101677 OL-410-167
Link (Conference and Local)	TD-4101687 OL-410-168
Attendant Register and Links	TD-4101697 OL-410-169
Transfer and Add-On Links	TD-4101707 OL-410-170
Chime Motherboard	TD-4101717 –
Tie Trunk, E & M, and Duplex	TD-4101727 OL-410-172

TABLE 1.00 Documents and Drawings (Cont.)

TITLE	NUMBER	
	CIRCUIT	NARRATIVE
Power Supply Control	TD-4101767	OL-410-176
DID Trunk	TD-4101777	OL-410-177
Alarm Board	TD-4101787	OL-410-178
Power Failure Transfer Card Extender	TD-4101797	–
Line Card Extender	TD-4101807	–
Channel and Trunk Card Extender	TD-4101817	–
Highway Amplifier	TD-4101857	OL-410-185
Private Line and Manual Intercom	TD-4101917	OL-410-191
Paging Access	TD-4101927	OL-410-192
Dictation Access	TD-4101937	OL-410-193
Call Forward - Follow Me	TD-4102247	OL-410-224
Automatic Identification Out-Dialed	TD-4102257	OL-410-225
Message Register #1	TD-4102267	OL-410-226
Message Register #2	TD-4102277	OL-410-227
Toll Restrictor	TD-4102287	OL-410-228
Traffic Measure	TD-4102297	OL-410-229
Attendant's Console	312367( )68	–
Power Mate Power Supply	TD-4200341	–
Ragen Power Supply	TD-4200237	

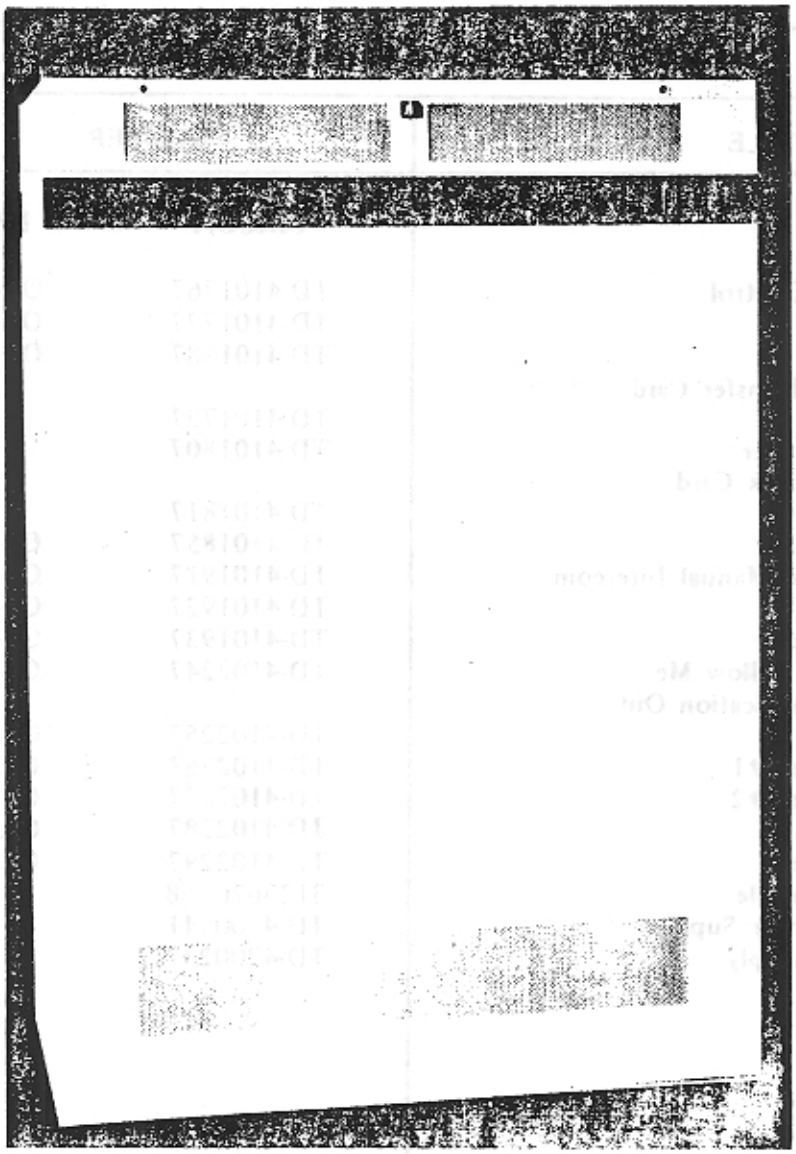

FIGURE 1.00 TD-100 EPABX Cabinet

1.04 Documents and Drawings. Table 1.00 provides a complete list of documents and drawings relating to the TD-100 EPABX.

2.00 PLANNING

2.01 Tools and Test Equipment. The tools and test equipment required for the installation of a TD-100 EPABX are listed in the individual installation sections.

3.00 INSTALLATION REQUIREMENTS

3.01 Console Location. Two attendant's consoles are available (refer to figure 1.01).

Each console is a self-contained unit, equipped with plug-in mounting cables. A console is easily installed by placing it on a desk top and plugging the mounting cables into the connecting cables. All connections to the console are made to the mounting cables (connections are from the cross-connect terminal blocks). For proper console operation, the maximum loop resistance between the console and the cabinet is 50 ohms (approximately 450 feet).

For descriptions and operating instructions for the consoles, refer to Section OG-000-002 (Attendant's Manual).

3.02 Cabinet Floor Space. The EPABX

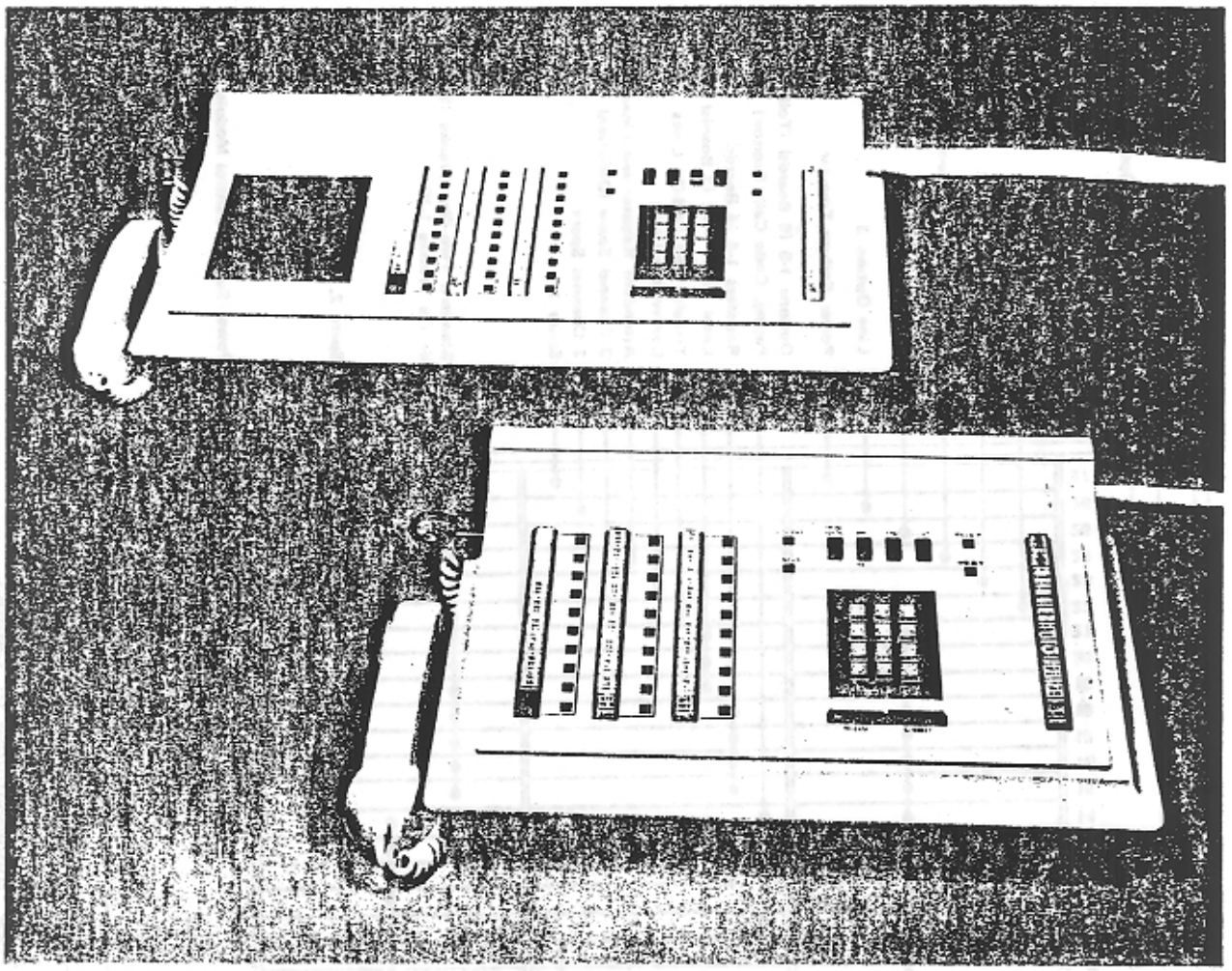

FIGURE 1.01 Attendant's Consoles

measures 55 inches high 36½ inches wide, and 23 inches deep. When completely equipped, it weighs approximately 650 pounds.

When installed, there should be a minimum of 2½ feet clearance at the front and back of the cabinet to allow ease of installation and maintenance.

The cabinet is equipped with full-length removable panels on all sides to permit access to the printed circuit boards, the mother boards, and the cable connectors. Plug-in cables from the cabinet are brought out from the bottom of the cabinet. All connections to the cabinet from the cross-connect terminal blocks are made via the plug-in cables.

3.03 Cabinet Location. The following requirements must be met when installing the cabinet:

a. The cabinet must be level and stand solid with the weight equally distributed over the cabinet base.

b. The cabinet must be located in an area subject to minimum vibrations.

c. The location must be dry and clean.

d. The location must be well ventilated and should be well lit.

e. The ambient room environmental requirements for operation are:

1. 0° C to 38° C (32° F to 100° F)

2. Relative humidity: 90% (maximum) ove

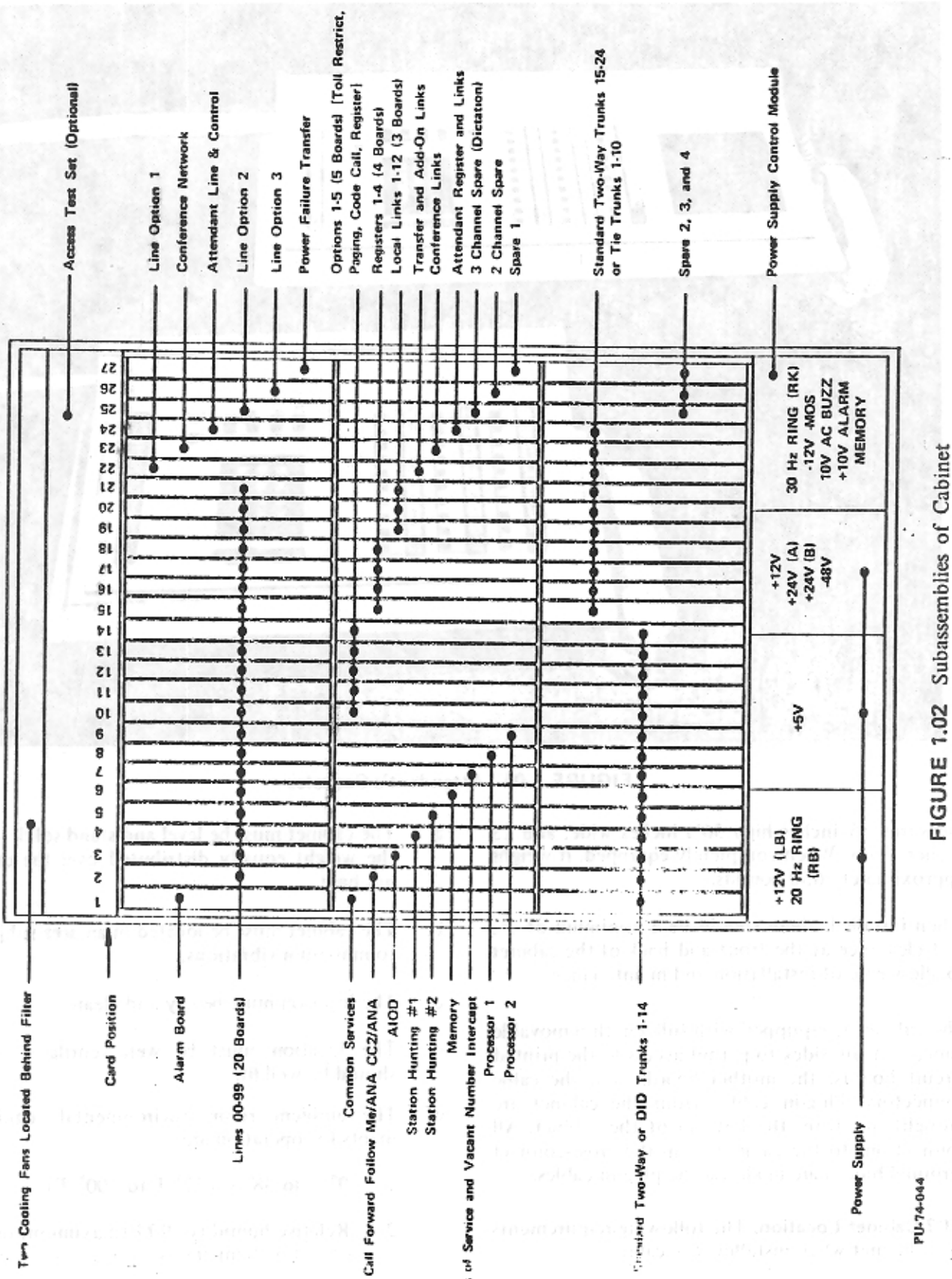

FIGURE 1.02 Subassemblies of Cabinet

f. The cabinet must not be located near sweating pipes or steam pipes.

g. The location must not be subject to corrosive fumes or exhaust from machinery or where steam vents are present.

h. The cabinet should not be located near a passageway used for moving machinery or vehicles.

i. The cabinet must not be located next to a reproducing or copying machine.

j. The cabinet should not be located near the building heating system or a window, from which the heat could cause the temperature in the cabinet to rise above the safe operating range.

k. The cabinet air vents must not be blocked.

3.04 System Power and Grounding. The following requirements must be met for cabinet power and grounding:

a. The power required is 115V AC, 60 Hz, single phase, 1300 watts.

b. The power receptacle should be individually fused with a 20-amp circuit breaker.

c. The power receptacle should be located in a place which would prevent accidental removal of the power cord.

d. Warning tags should be attached to the circuit breaker and to the plug end of the power cord to prevent accidental removal of power.

e. The power receptacle should be the three-way type, with a U-ground connector.

f. The power receptacle should be within eight feet of the cabinet.

g. The power cord between the cabinet and the power receptacle must not present a hazard to the personnel.

h. An approved local ground (metal coldwater pipe, grounding rod) must be run to the cabinet ground cable via a 10 AWG (minimum) copper wire or 8 AWG (minimum) aluminum wire. This ground must be provided in addition to the ground wire in the power cord.

4.00 INSTALLATION

4.01 General. The EPABX should be installed in the order outlined in the following individual detailed installation sections. Basically, the installation procedure to be followed is to install the cabinet and apparatus, perform the feature strapping, install the console, install the cross-connect wiring, perform tests and inspections on the cabinet, and then check out the system by performing the console and station operation tests.

Installation sections, in addition to this section, are:

a. Section OB-000-002: Cabinet and Apparatus Installation.

b. Section OB-000-003: Feature Strapping.

c. Section OB-000-004; Console Installation.

d. Section OB-000-005: Cable Connections at Cross-Connect Terminals.

e. Section OB-000-006; Cabinet Tests and Inspections at Installation.

f. Section OB-000-007: Console Operation Tests.

g. Section OB-000-008: Station Operation Tests.

For detailed operating instructions for the consoles, refer to Section OG-000-002: Attendant's Manual.

CABINET AND APPARATUS INSTALLATION
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1.00 INTRODUCTION

1.01 Purpose of Section. This section contains the recommended procedures for unpacking and installing the TD-100 Electronic Private Automatic Branch Exchange (EPABX) cabinet and cabinet apparatus.

1.02 General. The shipment for an initial system installation normally includes all required parts, including the console. This section is restricted to the cabinet and cabinet apparatus; for information on unpacking and installing a console, refer to Section OB-000-004, Console Installation.

After completing the installation procedures in this section, perform the appropriate strapping options as outlined in the applicable strapping documents. Ensure that the strapping is completed before performing any system tests.

2.00 PLANNING

2.01 General. Prior to unpacking and installing the cabinet, determine where the cabinet is to be located. (Refer to paragraph 3.00, cabinet location.) This location selection may affect where the cabinet is unpacked.

2.02 Tools and Equipment. The following tools and equipment are required to install a cabinet:

a. Hand-operated hydraulic lift trunk.

b. Safety glasses and gloves.

c. Band-cutting tool.

d. Set of blade and phillips screwdrivers.

e. Level.

3.00 CABINET LOCATION

3.01 General. For proper selection of the cabinet location, the installation requirements listed in Section OB-000-001, General Installation, must be met. The following additional requirements should be considered.

a. The maximum loop resistance between the cabinet and the console is 50 ohms.

b. The maximum loop resistance between the cabinet and the key features of a key telephone is 50 ohms.

c. The maximum loop resistance between the cabinet and a standard single line station telephone set is 1000 ohms (excluding telephone set); this loop limit may be extended to 2000 ohms by a strapping option on the line circuit board. The strapping option applies only to the fifth circuit on each line board.

4.00 UNPACKING AND INSPECTION

4.01 General. The cabinet is shipped on a wooden pallet, covered with a corrugated container, and secured with two metal straps. The package measures 60 inches high, 41 to 45 inches long, and 36 inches deep, and weighs approximately 550 to 850 pounds, depending upon how fully it is equipped.

When plug-in printed circuit boards (PCB's) are shipped separate from the cabinet, each board is placed between two poly-foam pads enclosed in a cardboard box. Board identification is marked on the box end-flap.

The console is packaged as a separate item.

4.02 Delivery Checks. All items received at the delivery site should be checked against the packing slip.

All cartons should be checked for visible signs of shipping damage. If any carton show signs of damage, note the damage on the packing slip and on the carrier bills, if available. Report any shortages and/or damaged equipment promptly to the following facility, as applicable.

In USA:

Customer Repair Service
ITT Telecommunications
Telecom Drive
Milan, Tennessee 38358
Telephone: (901) 686-0307

In Canada:

Customer Service Department
ITT Telecommunications
175 Dawson Road
Guelph, Ontario, N1H 1A1
Telephone: (519) 821-2000

4.03 Unpacking Cabinet. The Cabinet is unpacked as follows:

a. Cut the two metal straps.

WARNING: Wear gloves to protect the hands from the metal straps and safety glasses to protect the eyes.

b. Carefully lift the corrugated container up and away from the TD-100 cabinet.

c. Carefully remove the four exterior cabinet panels. The panels are removed by unlocking the keylock, turning the Zuus fasteners, and then lifting the panels up and away from the cabinet.

d. Using the hydraulic lift or other available means, remove the cabinet from the pallet without bumping or dropping the cabinet. It must be raised approximately three inches from the pallet to clear positioning blocks on the pallet. If the cabinet is mounted on casters, ensure that the casters clear the pallet.

e. Carefully position the cabinet in the location chosen.

f. Level the cabinet.

g. Ensure that the delivery checks are complete (refer to paragraph 4.02).

4.04 Inspecting Cabinet. When the cabinet has been unpacked and positioned, a visual inspection should be made. Damaged items should be tagged and the condition recorded and reported per paragraph 4.02. The visual inspection should include the following:

a. Check the outside of the cabinet for scratches and dents.

b. At the rear of the cabinet, carefully examine

the wiring, paying particular attention to the power supply connections. Also check for damage to wirewrap pins.

c. At the front of the cabinet, ensure that all assemblies are securely fastened to the cabinet frame.

d. Check all fuses on the front of the power supply to verify proper insertion, the correct size, and the condition of the fuse holder.

e. Carefully remove each PCB in order to check the subrack guides and motherboard connectors. Refer to paragraph 4.05 for procedures for removing and installing the PCB's. Also check each board as outlined in paragraph 4.06.

4.05 Printed Circuit Boards. TD-100 systems are normally shipped with the printed circuit boards installed. When the boards are shipped separately, they should be inspected before being installed.

Each PCB is equipped with two board extractors. To remove a board from the cabinet, carefully loosen the board from the connectors by operating both extractors simultaneously. The board may then be easily pulled out.

To install a PCB, lace it in the subrack guides. Carefully push the board in, ensuring that the fingers of the board mate properly with the motherboard connector. Do not force the PCB; if it does not slide smoothly, withdraw it and realign it in the guides.

4.06 Inspecting Printed Circuit Boards. Each plug-in board should be checked to ensure that:

a. Connector contacts are not scratched or damaged.

b. The board is not warped or cracked.

c. There are no broken leads or damaged components.

NOTE: Some PCB's are equipped with one or more BUSY switches. On an initial installation, place the BUSY switches in the make busy position before installing the boards. A circuit is made busy when the slide is in the down position.

When the inspection is complete, reinstall each PCB in its proper position in the cabinet. Refer to figure 1.00 to identify the cabinet subassemblies, and to the designation strip above each subrack for the location of each PCB.

5.00 POWER AND GROUNDING

5.01 General. An eight-foot power cord is provided for connecting the AC power receptacle to the cabinet. Instructions are provided in the following paragraphs for connecting the power cord to the cabinet and grounding the cabinet.

5.02 Power. Connect the power cord to the power connector terminal block, located either on the lower left rear of the cabinet or on the lower left side, of the cabinet. Refer to figure 1.01 for a typical AC power connection.

When the optional power line filter is provided, connect the power cord to the filter located directly above the power supply control box. Refer to figure 1.02 when connecting to the power line filter.

5.03 Standby Power Supply. An alternate, independent source of power may be provided to maintain the system for a limited time during a commercial AC power failure.

When a standby power supply is provided, the power cord is to be connected to the TD-100 cabinet as directed in paragraph 5.02 and to the power inverter via the inverter receptacle. Refer to figure 1.03 for a typical standby power connection.

CAUTION: Do not connect the power cord to the AC receptacle at this time.

5.04 Grounding. The system must be connected to an approved ground (metal cold water pipe, grounding rod, etc.) using 10 AWG copper or 8 AWG (minimum) aluminum wire.

Connect the grounding cable to the approved ground and to the cabinet. Refer to figure 1.04. All external equipment connected to the system must be connected to the approved ground.

6.00 INSPECTION

6.01 General. When the above procedures are complete, the cabinet should be given a final visual check before proceeding with the installation. Recheck all steps to verify their completion.

If the installation procedure is to be continued immediately, leave the cabinet panels off.

Consult the applicable strapping documents (OB-410-XXX) for additional instructions.

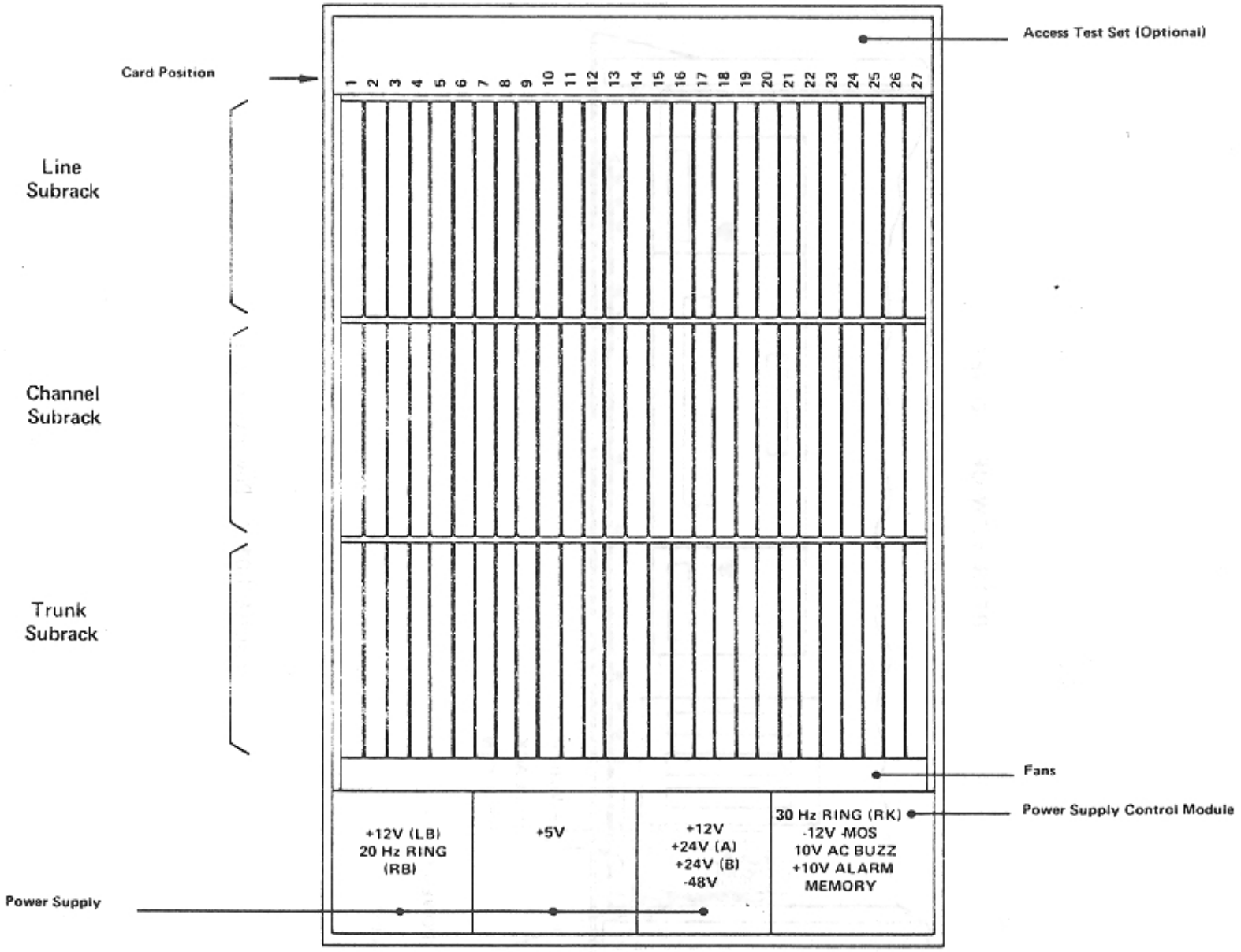

FIGURE 1.00 Subassemblies of Cabinet

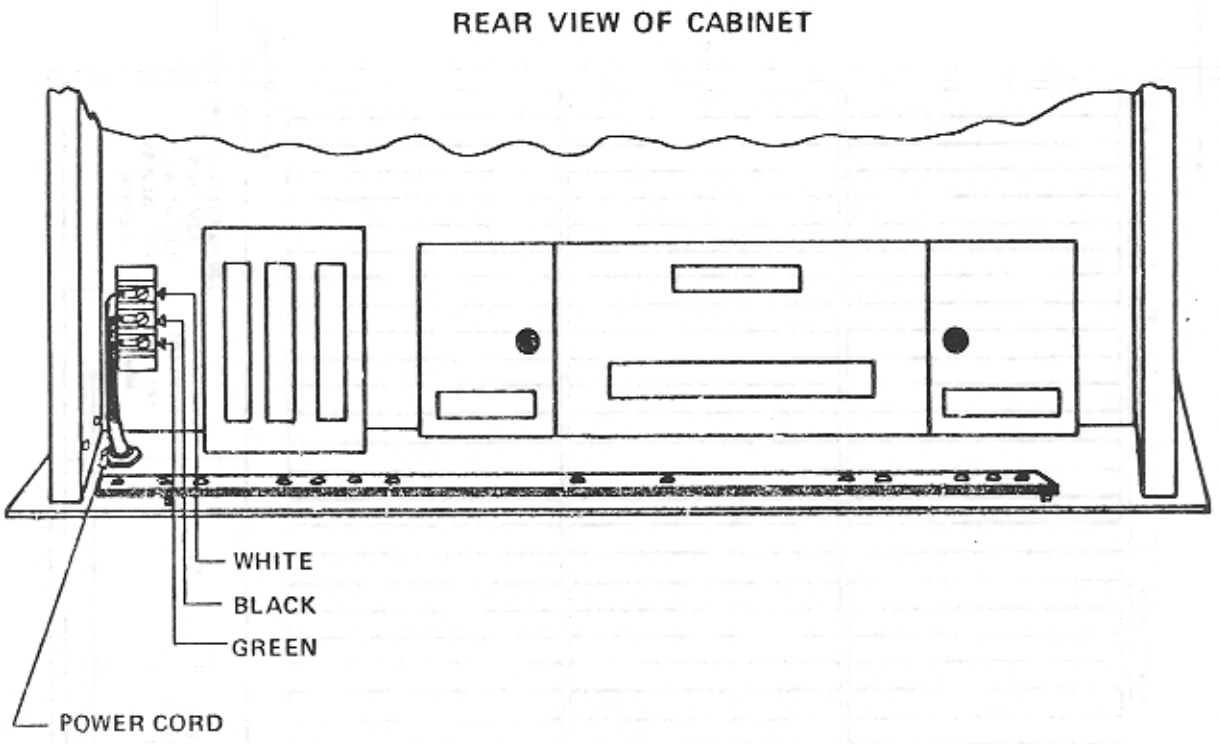

FIGURE 1.01 AC Power Connection

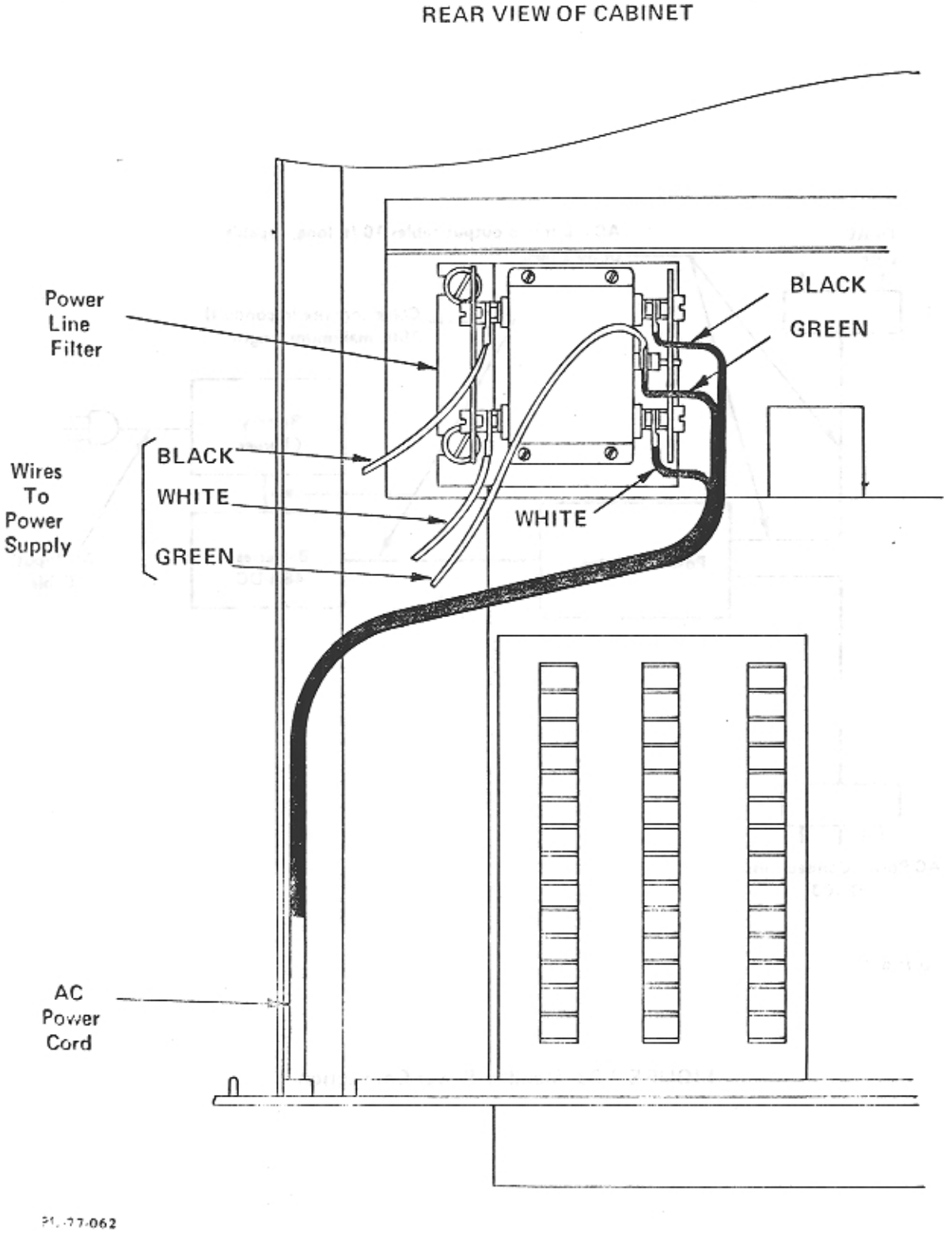

FIGURE 1.02 AC Power Connection to Power Line Filter

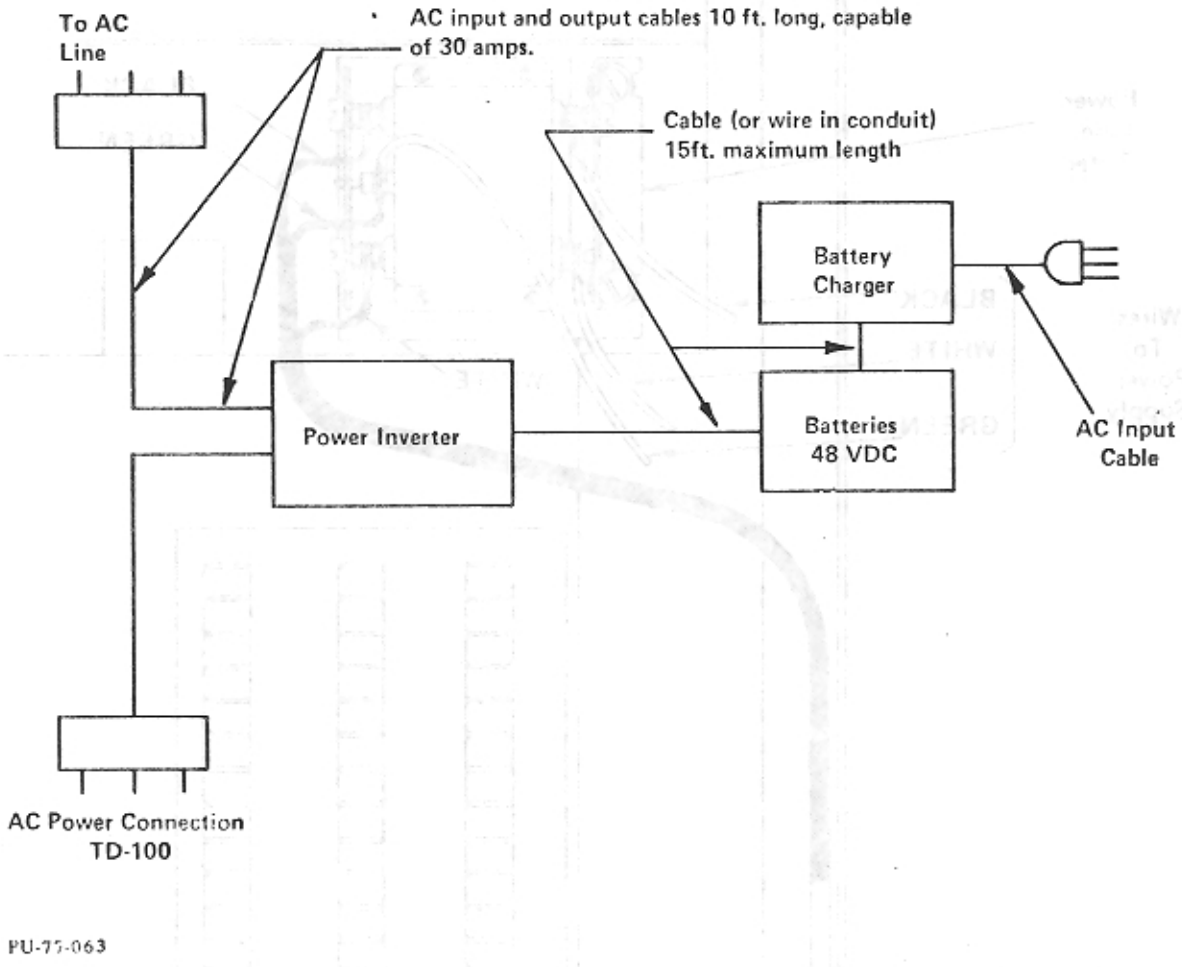

FIGURE 1.03 Standby Power Connection

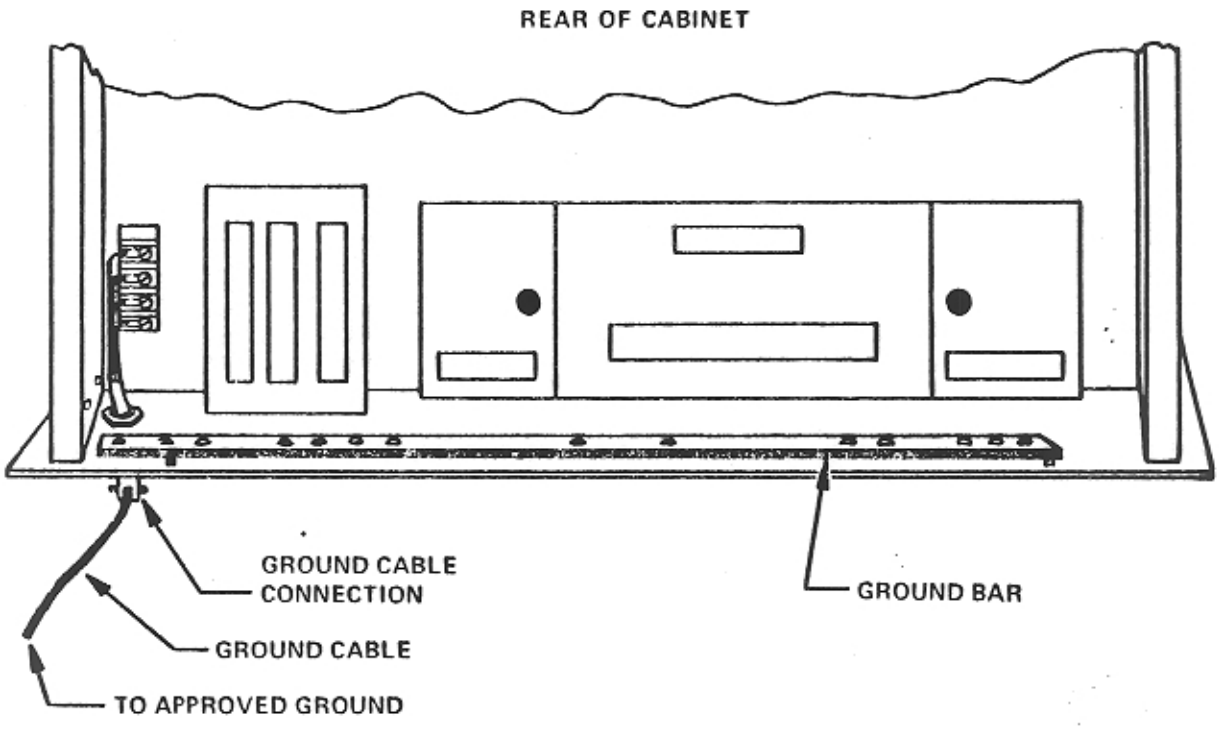

FIGURE 1.04 Ground Connection

FEATURE STRAPPING
TD-100
NOTICE OF CANCELLATION

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1.00 INTRODUCTION

1.01 General. This section serves as a notice of cancellation for section OB-000-003, Feature Strapping, TD-100, Electronic Private Automatic Branch Exchange. This section and addendums 1 through 6 have been replaced by individual strapping documents.

2.00 SUPERSEDING DOCUMENTS

2.01 General. The feature strapping documents listed below replace section OB-000-003, issue 3, and addendums 1 through 6.

OB-410-151	Feature Strapping, TD-100, Line Circuit PCB 4101516.
OB-410-153	Feature Strapping, TD-100, CO Trunk 4101536.
OB-410-155	Feature Strapping, TD-100, Assigned Night Answer Service.
OB-410-157	Feature Strapping, TD-100, Conference Service.
OB-410-160	Feature Strapping, TD-100, Class of Service PCB 4101606.
OB-410-161	Feature Strapping, TD-100, Memory PCB 4101616.
OB-410-163	Feature Strapping, TD-100, Processor II PCB 4101636.
OB-410-164	Feature Strapping, TD-100, Loop Tie Trunk 4101646.
OB-410-165	Feature Strapping, TD-100, Station Hunt PCB 4101656.
OB-410-166	Feature Strapping, TD-100, Register PCB 4101666.
OB-410-168	Feature Strapping, TD-100, Local/Conference Links PCB 4101686.
OB-410-172	Feature Strapping, TD-100, E & M Tie Trunk 4101726.
OB-410-177	Feature Strapping, TD-100, DID Trunk PCB 4101776.
OB-410-178	Feature Strapping, TD-100, Alarm PCB 4101786.
OB-410-191	Feature Strapping, TD-100, Private Line and Manual Intercom PCB 4101916.
OB-410-192	Feature Strapping, TD-100, Paging Access Service.
OB-410-226	Feature Strapping, TD-100, Message Registration Service.
OB-410-228	Feature Strapping, TD-100, Toll Restrictor PCB 4102286.
OB-410-294	Feature Strapping, TD-100, Number Translator PCB 4102946.
OB-410-295	Feature Strapping, TD-100, Recorder Disconnect PCB 4102956.
OB 410-322	Feature Strapping, TD-100, Dial/Directed Call Pickup Service.

CONSOLE INSTALLATION
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section contains the procedures to be followed when the attendant's console for a TD-100 electronic private automatic branch exchange (EPABX) shipment is unpacked and installed.

1.02 General. Although a shipment for an initial installation contains all items required, including the cabinet and cabinet apparatus, this section is restricted to the console. For information on unpacking and installing a cabinet and the cabinet apparatus, refer to Section OB-000-002, Cabinet and Apparatus Installation.

1.03 Consoles. Two consoles are available; a standard console equipped with all features except a busy lamp field, and a console equipped with a 100-line busy lamp field. For additional information concerning the consoles, refer to Section OA-000-001, General Information, TD-100 EPABX.

1.04 Documents. All the instructions required to install a console are contained in this section. Installation tests for the console are provided in Section OB-000-007, Console Operation Tests. Maintenance instructions for the console are included in Section OC-000-003, Console Maintenance.

1.05 Tools and Equipment. The only tools required to install a console are a staple removing tool or other device which may be used to remove heavy metal staples, a screwdriver, and where applicable, tools for cutting out the desk top opening for a flush mounted console.

2.00 CONSOLE LOCATION

2.01 General. The console is arranged for surface or flush mounting on a desk located within approximately 450 feet of the equipment cabinet. This distance is determined by the maximum allowable console-to-cabinet loop resistance. (For proper console operation, the maximum loop resistance between the cabinet and the console must not exceed 50-ohms.)

3.00 UNPACKING AND INSPECTING

3.01 General. The console is shipped in a corrugated cardboard container. The console is protected within the box by foam inserts and packing material. The container for the standard console

(console without the busy lamp field) is 10 inches high, 22 inches long, 18 inches deep, and weighs approximately 25 pounds.

3.02 Delivery Checks. All items should be checked against the packing slip. Any errors or omissions should be promptly reported as follows:

a. In U. S. A. to ITT Telecommunications, Customer Service Department, Milan, Tennessee 38358, Telephone (901) 686-7401.

b. In Canada to ITT Communications, Guelph, Ontario N1H 1A1, Telephone (510) 821-2000.

All containers should be checked for visible signs of possible shipping damage. If cartons show signs of damage, note of such damage should be made on the packing slip and, if available, on the carrier bills.

3.03 Unpacking Console. The console is unpacked as follows.

a. Remove the metal staples from the top flaps of the container.

b. Turn all four flaps of the container out.

c. Remove the packing from the top and sides of the console and carefully remove the console from the container.

d. Remove any packing material adhering to the console.

e. Place the console in a position where it will not be damaged.

f. Ensure the delivery checks are complete (all items listed on the packing slip are present).

CAUTION: Ensure the connectors on the console cables are not in a position to scratch the console or office furniture when it is being moved. Also ensure the four rubber feet are on the bottom of the console.

3.04 Inspecting Console. When the console has been unpacked and temporarily placed in a secure position, a visual inspection of the console should be made. Any damage to the console should be reported at this time. The visual inspection should include the following:

a. Check the console for scratches.

b. Check the mounting cords.

c. Check all console controls for broken, cracked, or loose parts. Make certain each control is operational.

d. Lift and tilt the console. There must be no indication of loose parts inside the console.

e. Each console has double-jack connectors on the right and left ends for connection of an operator's handset or headset. Ensure that these connectors are free of foreign material and that the handset and/or headset supplied with the console will plug into the connectors.

4.00 INSTALLATION

4.01 General. Procedures for installing or mounting the console are outlined in the following paragraphs.

4.02 Surface Mounted Console. Where the console is to be surface mounted, simply place the console in the proper position on the desk, making sure that all four rubber feet make contact with the desk top. Ensure that the connectors on the console cables are not in a position where they will scratch the console or the desk.

4.03 Flush Mounted Console. Where the console is to be flush mounted, the desk top must be cut out to accommodate the console. A dimension drawing for marking the desk top is provided in figure 1.00. Mark the proper position on the desk top, carefully cut out the opening, then feed the console cables through the desk and place the console in the cutout. Exercise proper care so as not to damage the console or the cables.

4.04 Handset Cradle Assembly. The cradle assembly for the handset is installed by removing the four screws on the bottom left side of the console, aligning the holes of the cradle assembly with the four holes in the console, and then replacing the screws. Refer to figure 1.01.

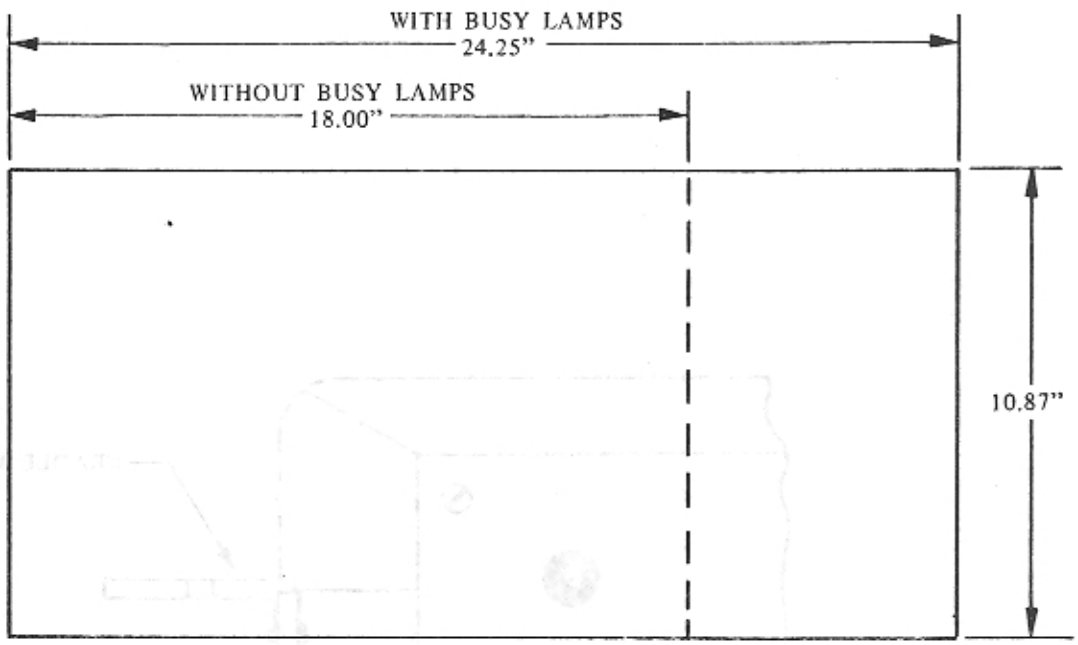

FIGURE 1.00 Desk Top Cutout Dimensions for Flush Mounted TD-100 Consoles

NOTE: Because of the mounting arrangement, the cradle assembly cannot be used on a flush mounted console. If a handset is required for a flush mounted console, an alternative to the cradle assembly must be provided for supporting the handset.

4.05 Designation Tabs. Designation tabs for the console keys are printed for the convenience of installation. The tabs are easily broken out of the strips for installation.

To install a designation tab in a button cap, squeeze both sides of the cap and lift. Insert the designation tab in the cap and install the cap by pressing it down over the button. Note that locking surfaces are located on two sides of the caps and buttons.

5.00 CABLE CONNECTIONS

5.01 General. Procedures to be followed when making connections to the mounting cords are contained in Section OB-000-005, Cable Connections at Cross-Connect Terminals.

6.00 FINAL INSPECTION

6.01 General. When the above procedures are complete, the console should be given a final visual check before proceeding with the installation. At this time, ensure that the console is equipped with an operator's handset or headset, as required.

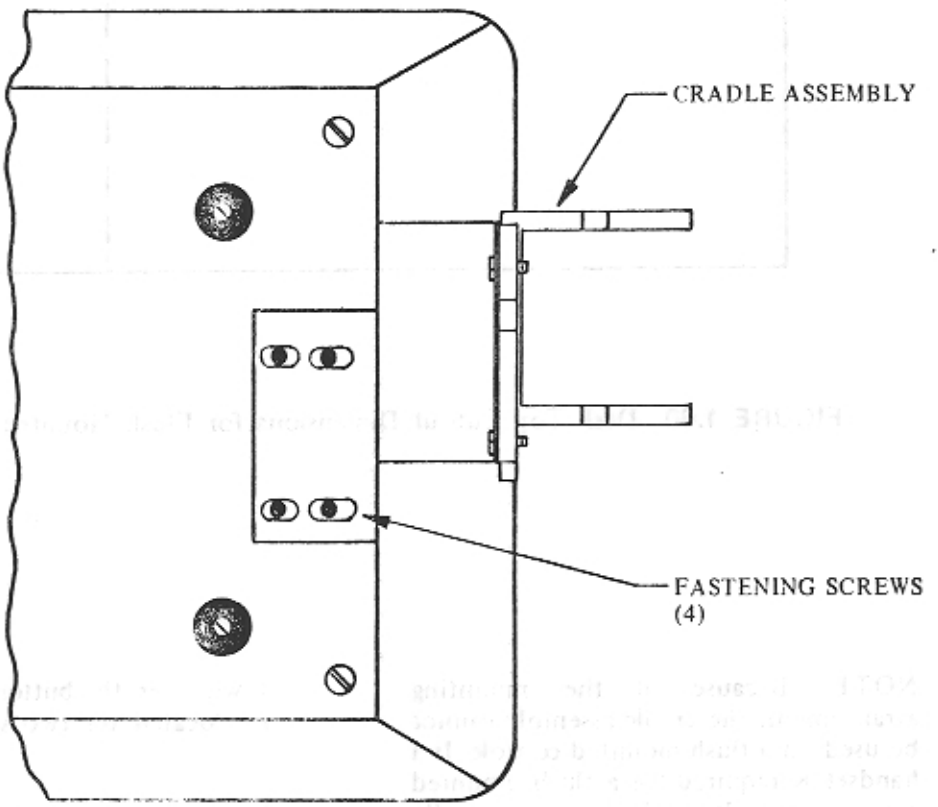

FIGURE 1.01 Handset Cradle Assembly Installation

CABLE CONNECTIONS AT CROSS-CONNECT TERMINALS
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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the TD-100 EPABX cabling and cross-connecting. Tables and illustrations are included to assist installation personnel in laying out a distributing frame to connect the EPABX stations, attendant's console, trunks, and other equipment to the cabinet.

1.02 Documents and Drawings. The major documents and drawings for the system are listed in Section OB-000-001, General Installation, TD-100 EPABX.

1.03 Tools and Equipment. The following tools are recommended for installing and cross-connecting the cables.

a. Quick-connect tool: Siemon' Co. S-714 Automatic Impact Tool, S-66A Connecting Tool, or equivalent.

b. Fire retardant board for mounting the terminal blocks, if mounting frames are not provided.

c. Fish tape for pulling cables in installations where local building codes necessitate the use of conduit.

2.00 DISTRIBUTING FRAMES

2.01 General. Cables from the attendant's console, EPABX stations, outgoing and incoming trunks, and customer provided equipment, connect to the equipment cabinet via terminal blocks on a distributing frame. The frame may be a customer provided frame or it may be the optional swinger frame attached to the TD-100 equipment cabinet.

2.02 Planning. Arrangement of the cross-connect terminal blocks and the distributing frame must be determined prior to installing the connecting cables. A suggested layout for the cross-connect blocks is shown in figure 1.00. Connecting cables are listed in table 1.00.

2.03 Swinger Cross-Connect Frame. The optional swinger cross-connect frame eliminates the need for an external distributing frame. The swinger frame is attached directly to the TD-100 equipment cabinet. (See figures 1.01 and 1.02.) With the cabinet end panel removed, terminal blocks on the front side of the frame are readily accessible. The frame swings out to permit access to terminal blocks on the back side. Sixteen terminal blocks mount on the front of the frame; twelve terminal blocks (eight standard and four optional) mount on the rear of the frame.

Terminal blocks on the front of the frame are marked J001-J016; terminal blocks on the rear are marked J017-J024, J026-J030,and J037-J042. These "J" numbers correspond to the cable numbers in table 1.00. Each terminal block on the front of the frame is associated with one 25-pair cable. The terminal blocks on the rear of the frame are arranged to terminate two 25-pair cables, hence most of them are dual numbered; i.e., J017/018, J019/020, etc. As indicated in figure 1.02, terminal blocks J027-J030 are optional.

2.04 Terminal Blocks. The terminal blocks on the swinger frame are snap-on blocks; they mount on stand-offs and can easily be installed or removed. On the front of each block, there are 200 quick-connect terminals in a 4 X 50 array (4 vertical rows of 50 terminals each). On the rear of each block, there are 100 wire-wrap terminals in a 2 X 50 array, 2 vertical rows of 50 terminals each. (See figure 1.03.) The two quick-connect terminals on the left front side of each horizontal are common with one wire-wrap terminal on the rear of the block. Likewise, the two quick-connect terminals on the right front side of each horizontal are common with the adjacent wire-wrap terminal on the rear of the block. The wire-wrap terminals are factory wired to 25-pair cables which plug into the equipment cabinet. The quick-connect terminals are used to terminate the cable from the external equipment (console, EPABX stations, trunks, etc.) and to make any necessary cross-connections.

3.00 CABLING

3.01 General. Recommendations for running, terminating, and cross-connecting the TD-100 cables are provided in the following paragraphs. Cabling and cross-connecting schemes for some of the system's more common options are also presented.

3.02 Cables and Cabinet Connections. As shown in figure 1.00, cabinet connectors J001-J042 serve to connect the station lines, trunk lines, console, and other equipment to the PCB's in the equipment cabinet. These cables are run from terminal blocks on a customer provided distributing frame or a factory installed swinger cross-connect frame, and/or directly from the equipment to be connected. They can be 25-pair cables or multicore (50-pair, 75-pair, etc.) cables.

If a customer provided distributing frame is used, the installer must run and terminate all cables from the external equipment to the distributing frame, and all cables from the distributing frame to the cabinet. Either factory assembled or installer assembled cables can be used to connect the distributing frame to the cabinet. Information for making up these cables is provided in table 1.01.

On cabinets equipped with a swinger cross-connect frame, cabling between the swinger frame and cabinet is via prefabricated, factory-installed terminal block cables. These cables are fitted with 50-pin connectors which mate with the cabinet connectors. With this arrangement, the installer cables from the external equipment to the swinger frame terminal blocks, and connects the terminal block cables to the respective cabinet connectors.

3.03 Console Connections. Cables J037-J042 connect the attendant's console to the equipment cabinet. They can be run directly, or by way of terminal blocks, to the cabinet. The console cables are fitted with connectors on both ends. For connection via terminal blocks, the ends of the cables must be butted and stripped, and the individual leads connected to the respective terminals on the swinger frame blocks J037-J042, or on the customer provided terminal blocks.

> NOTE: The connectors on factory provided cables are marked with "J" numbers which correspond to the numbers on the mating cabinet and console connectors.

Cables J037-J039 connect the console control leads to the cabinet. Cables J040-J042 connect the (optional) busy lamp field on the console to the cabinet. Arrangement of these cables, including lead designations, pin numbers, wire colors, and use, is provided on the appropriate pages in table 1.01.

3.04 Station Connections. All station telephone sets connect to station terminal blocks J001-J017 on the swinger frame or on the customer provided distributing frame. They must be cross-connected to their respective line circuits by way of jumpers at the terminal blocks.

When single line station telephone sets are used and grounding push buttons are not required, only two leads (T and R) must be connected to the terminal block. When a single-line telephone set and a key telephone set are both assigned to the same line, the single-line set must be modified for A lead operation, and a connection must be made to terminal A.

3.05 Trunk Connections. Central office trunk connections (CO trunks, DID trunks, etc.) are made by way of cross-connect blocks on the swinger frame or on the customer provided distributing frame. These trunks, and any station lines subject to lightning, should be protected with gas tube protectors having a minimum breakdown point of 350 volts.

Figure 1.04 illustrates CO and DID trunk-to-EPABX cabinet connections, where no interconnect device is required. Figure 1.05 illustrates CO trunk-to-EPABX cabinet connections with the CDH interconnect device. E & M trunk connections are shown in figures 1.06-1.08.

3.06 Power Failure Transfer Connections. Figure 1.09 shows how trunks, stations, and the console are connected to the power failure transfer board in the cabinet. The board is capable of connecting as many as 10 trunks to nine stations and the console during a power failure.

When making power failure transfer cross-connections, the installer should ensure that selected lines are routed through the power failure transfer circuit and not connected directly to the trunk and line circuits in the cabinet. If ground start trunks are used, telephone instruments used as power failure transfer stations must be equipped with grounding push buttons.

> NOTE: CO trunks and station telephones that are not to be utilized during a power failure transfer are connected directly to the assigned trunk and line PCB's in the cabinet via the cross-connect terminal blocks and plug-in cables.

To signal incoming calls during a power failure, the power failure transfer stations must be arranged for bridged ringing. (The ringer should be connected across the tip and ring leads.) Also, as shown in figure 1.09, the console must be equipped with an external auxiliary ringer.

3.07 Option Connections. Connections to external equipment for optional features such as paging access and dictation access are made via terminal blocks, cables, and cabinet connectors J023 and J024. Connection schemes for paging access and dictation access are shown in figures 1.10 and 1.11.

3.08 UNA Connections. When the UNA (unassigned night answer) feature is used, connection to the audible signal device is made via terminal block, cable, and cabinet connector J023. UNA cabling is shown in figure 1.12.

> NOTE: With this option, the audible signal is uninterrupted. It will sound continuously until an incoming call is answered or abandoned.

3.09 Music-on-Hold Connections. When the music-on-hold option is employed, connections to the external music source are made as shown in figure 1.13.

> NOTE: Input impedance for this option is 600 ohms.

3.10 Private Line and Manual Intercom Connections. When private line or manual intercom features are provided, the cabinet is equipped with optional private line (KTU) and manual intercom PCB's. Connections to these PCB's are by way of terminal blocks, cables, and cabinet connectors J018, J019, and/or J020. Connecting schemes for private line and manual intercom service are shown in figures 1.14 and 1.15, respectively.

3.11 Recorder Disconnect Connections. Six recorder disconnect circuits are included on the optional recorder disconnect PCB. The circuits are individually assigned to EPABX lines equipped with an answering device. They are used to release the answering device when the calling party goes on-hook. A typical connecting scheme for this service is shown in figure 1.16.

3.12 Audible Alarm Connections. If an external audible alarm device is used to indicate a failure condition, connection to the alarm device is from the alarm panel PCB in the TD-100 cabinet via terminal block, cable, and cabinet connector J023. (Refer to figure 1.17).

3.13 Common Audible Ringer Connections. With the common audible ringer feature, the ringers in several key telephones can be arranged to ring in response to a signal applied to a line common to each key telephone. In the example shown in figure 1.18, a call to line 200 will activate ringer A, a call to line 201 will activate ringers A and B, and a call to line 202 will activate ringer B.

3.14 Message Registration Connections. If message registration service is provided, external peg count meters are used to record completed calls. This option, primarily used in hotel/motel applications, causes a meter to advance one count for each call completion. (Multiple advances can also be obtained when required.) As shown in figure 1.19, cables and cabinet connectors J032 and J033 are used for message registration connections.

3.15 Message Waiting Connections. Message waiting service is common to hotel/motel applications. The message waiting feature allows a lamp on or near a station instrument to be lit to indicate a waiting message. The lamp is controlled from a message waiting console usually located near the attendant's console. A connecting scheme for this service is illustrated in figure 1.20.

4.00 FINAL INSPECTION

4.01 General. When all cabling and cross-connecting is complete, a visual inspection and record of each cross-connection should be made.

4.02 Visual Inspection. Inspect all connections to ensure that:

a. The connecting blocks are properly secured to the mounting frame.

b. The wiring to the connecting blocks is secure and there are no shorts between terminals.

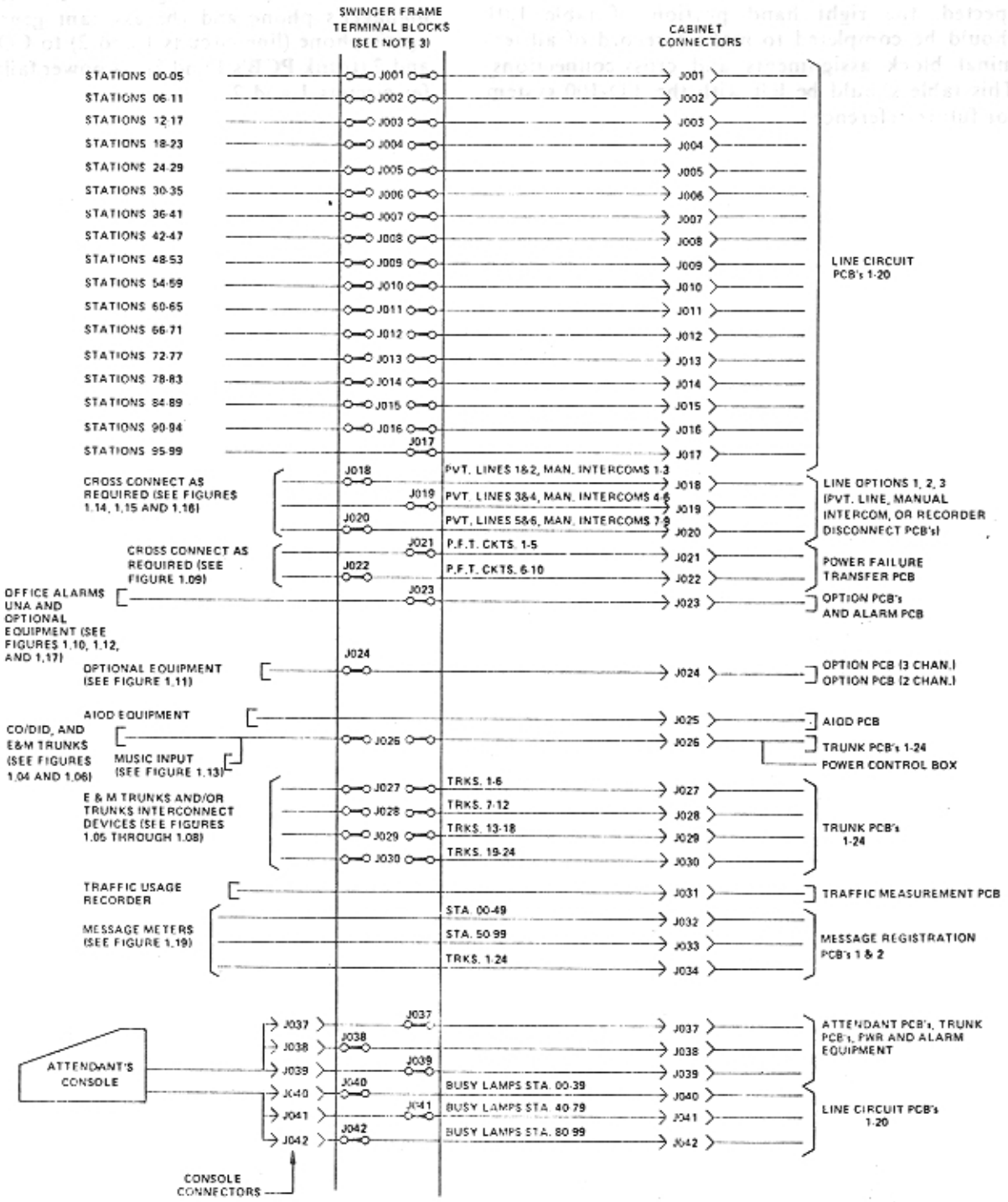
c. All plug-in cables at the console and cabinet are properly secured.

d. All cables are properly laced (if required).

e. All duct covers are replaced (if required).

4.03 Cross-Connect Record. After all cabling and cross-connections have been visually inspected, the right hand portion of table 1.01 should be completed to make a record of all terminal block assignments and cross-connections. This table should be left with the TD-100 system for future reference.

A typical table entry is shown in figure 1.21. The illustration depicts assignment of the general manager's phone and the assistant general manager's phone (line circuits 1 and 2) to CO trunks 1 and 2 (trunk PCB's 1 and 2) via power failure transfer circuits 1 and 2.



NOTES:
1. SUGGESTED CABLE – TYPE A 25A (25 PAIR)
2. AVAILABLE CABLE LENGTHS – 25', 50', 100', 200'
3. WHERE SWINGER FRAME IS NOT PROVIDED, CONNECTING BLOCKS SHOULD BE SELECTED BY THE CUSTOMER TO MEET THE SPECIFIC JOB REQUIREMENTS.

PU-76-022

FIGURE 1.00 Typical EPABX Cross-Connection Scheme

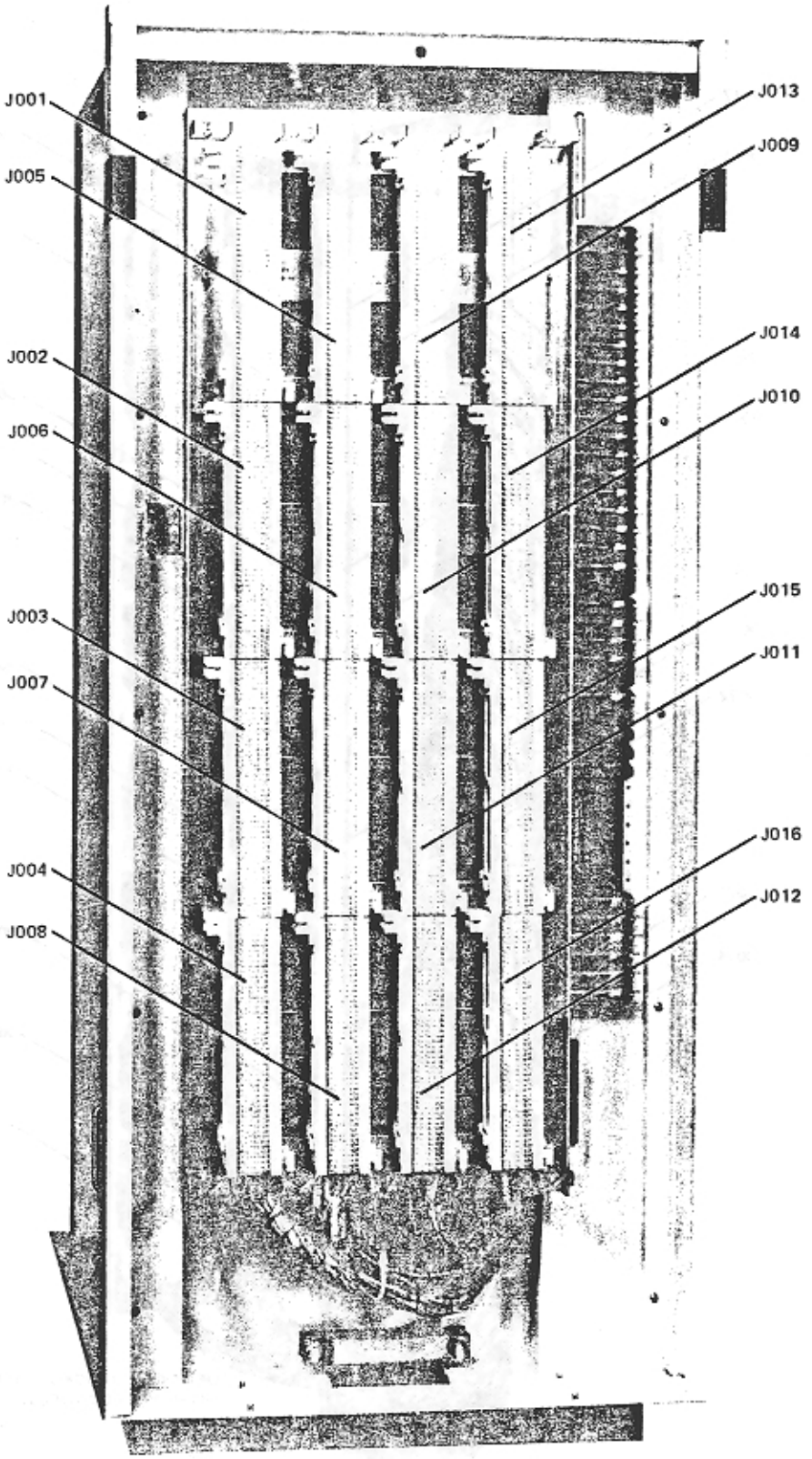


FIGURE 1.01 Front of Swinger Cross-Connect Frame

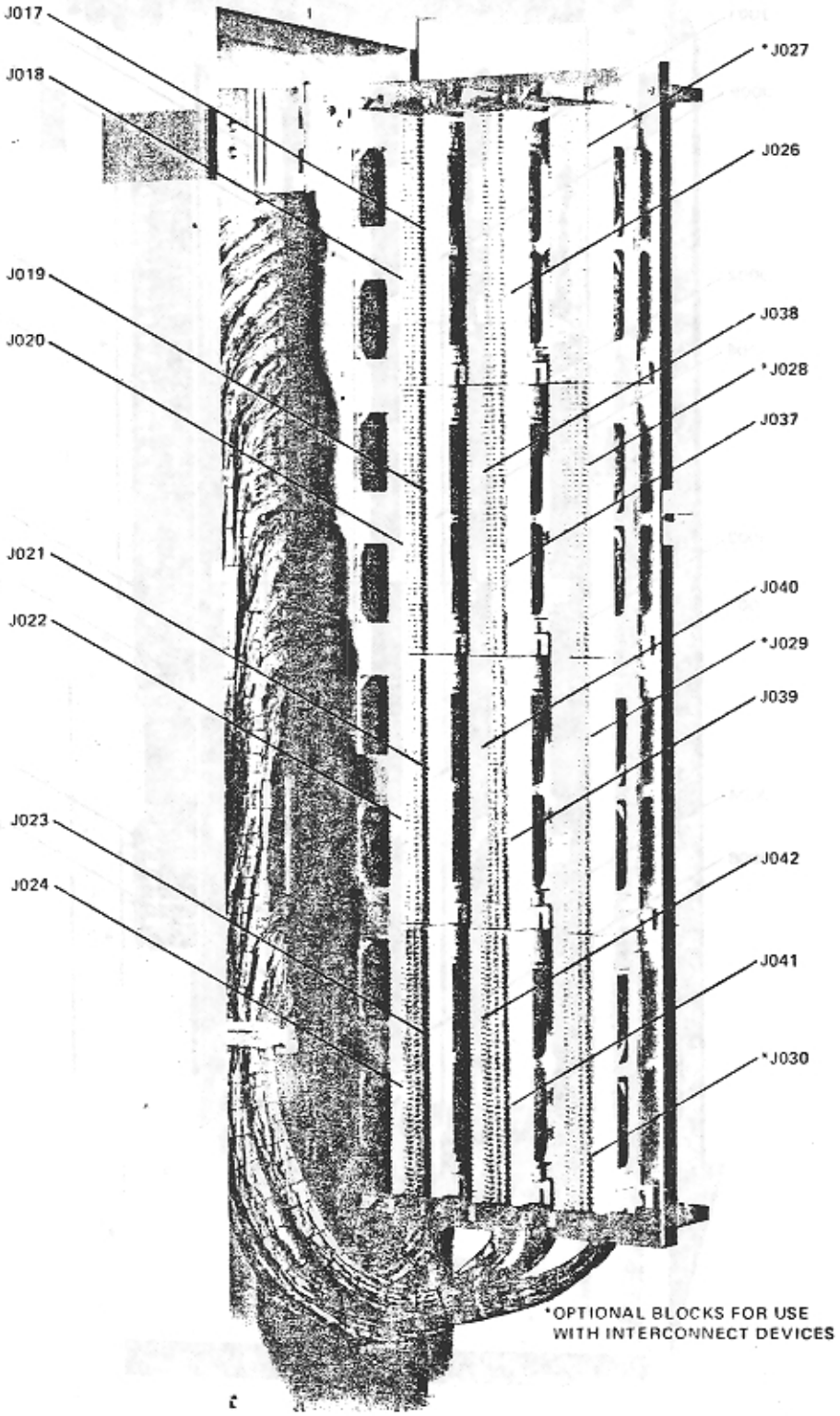


FIGURE 1.02 Rear of Swinger Cross-Connect Frame

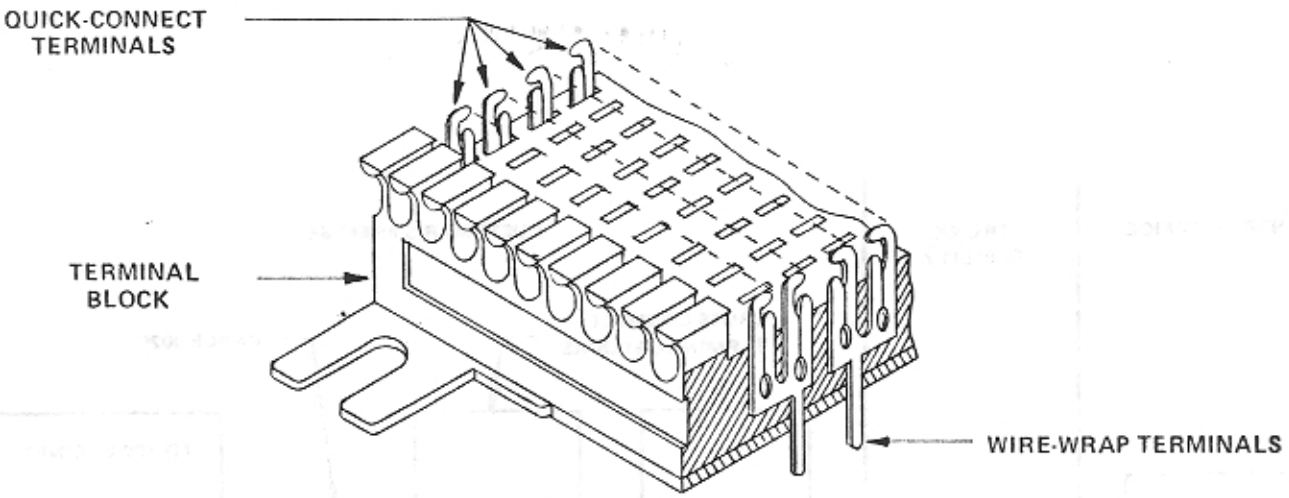


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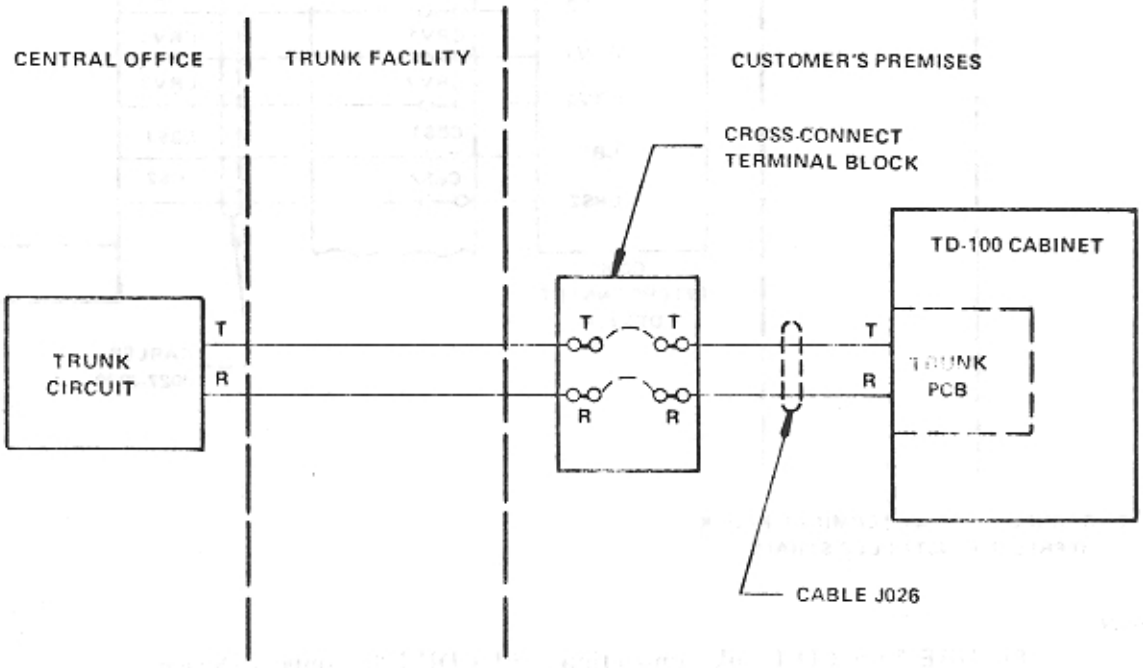
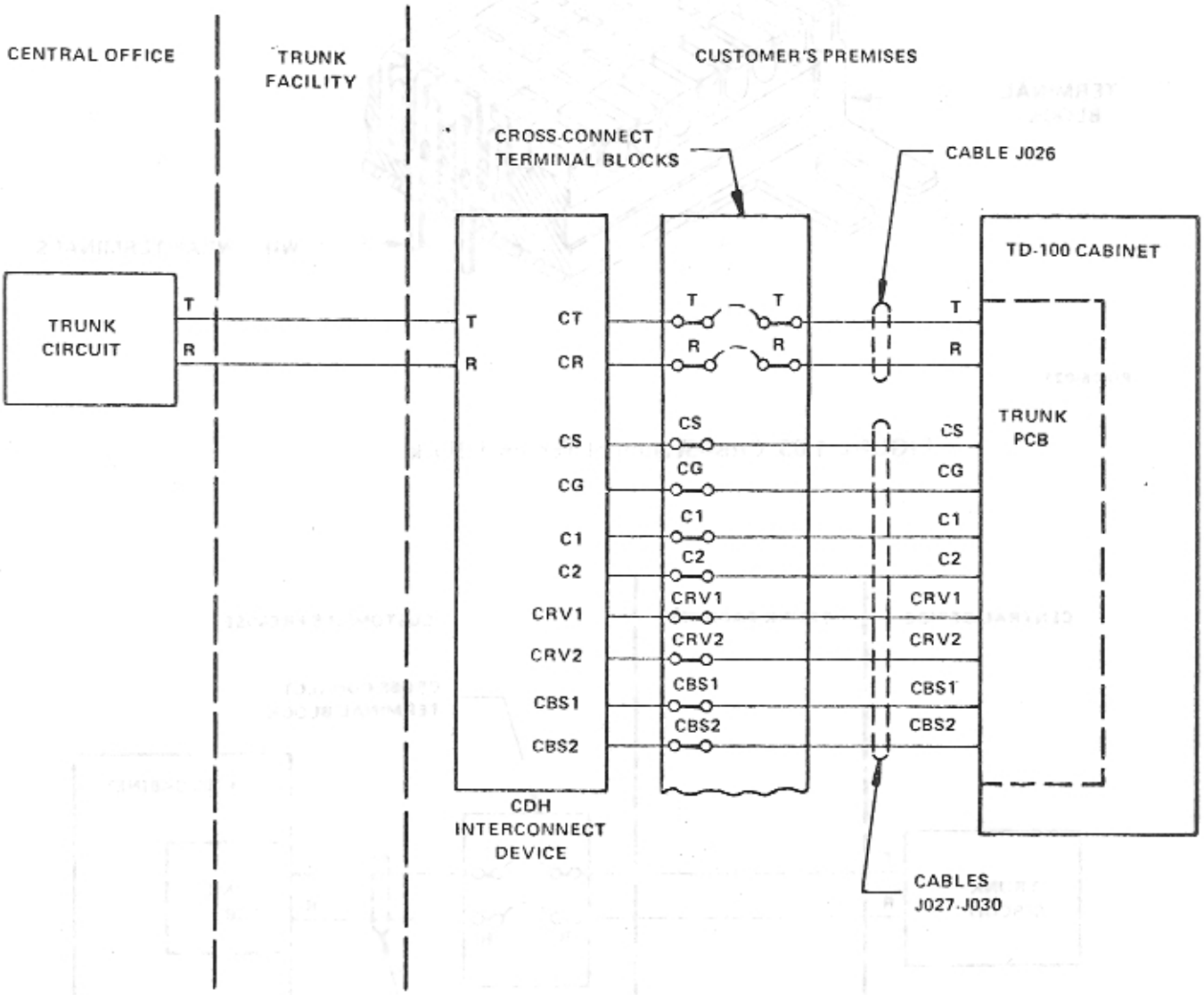
FIGURE 1.03 Cross-Section of Terminal Block



NOTE: DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS

PU-74-035

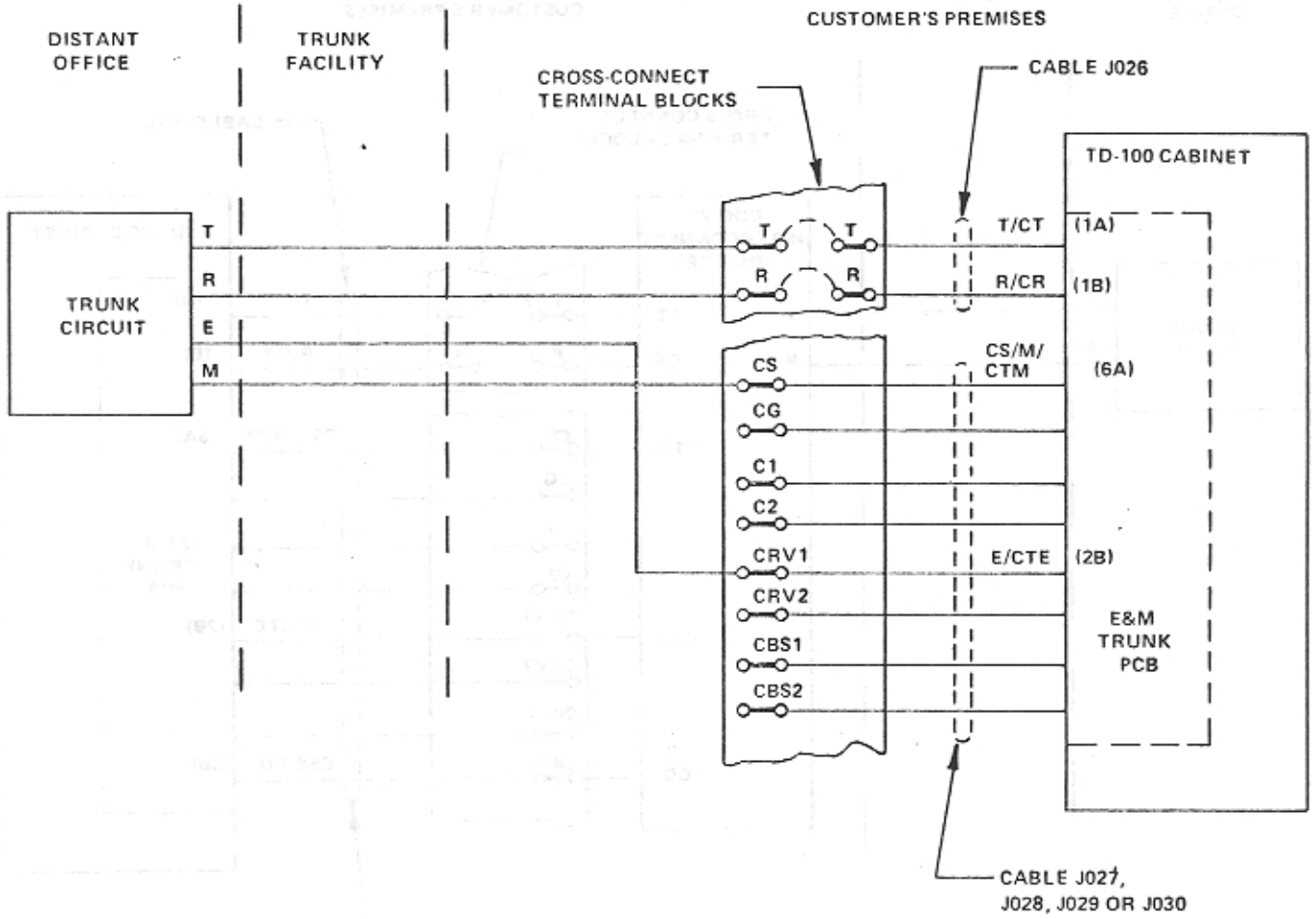
FIGURE 1.04 C.O. DID Trunk Connections



NOTE: DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS

PU-74-036

FIGURE 1.05 CO Trunk Connections with CDH Interconnect Device

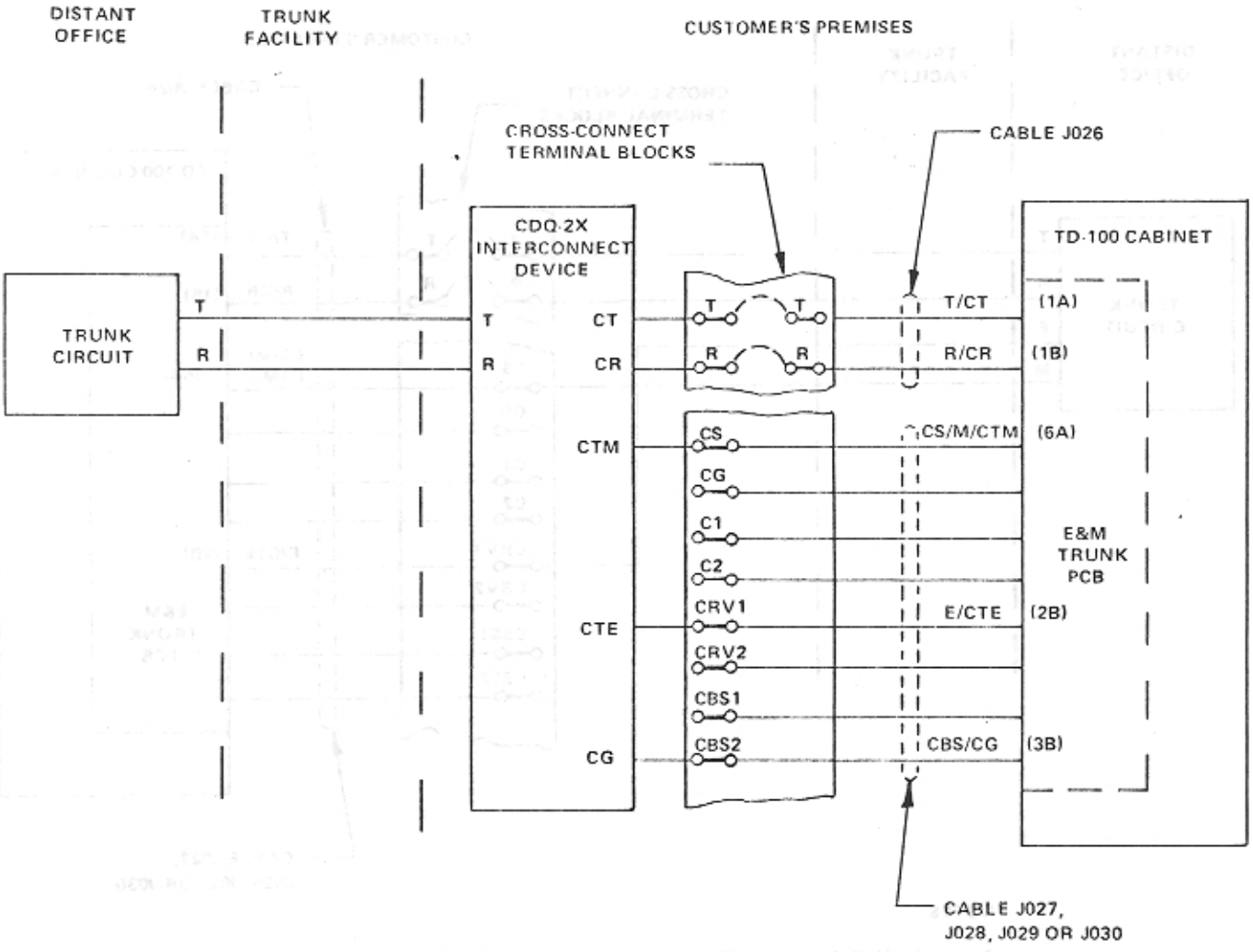


NOTES:

1. DESIGNATIONS ON INTERCONNECT TERMINAL BLOCK CORRESPOND TO THOSE ON CDH INTERCONNECT DEVICE.
2. NOTATIONS ON E&M TRUNK PCB REPRESENT MOTHERBOARD CONNECTOR TERMINALS.

PU-76-026

FIGURE 1.06 E&M Trunk Connections

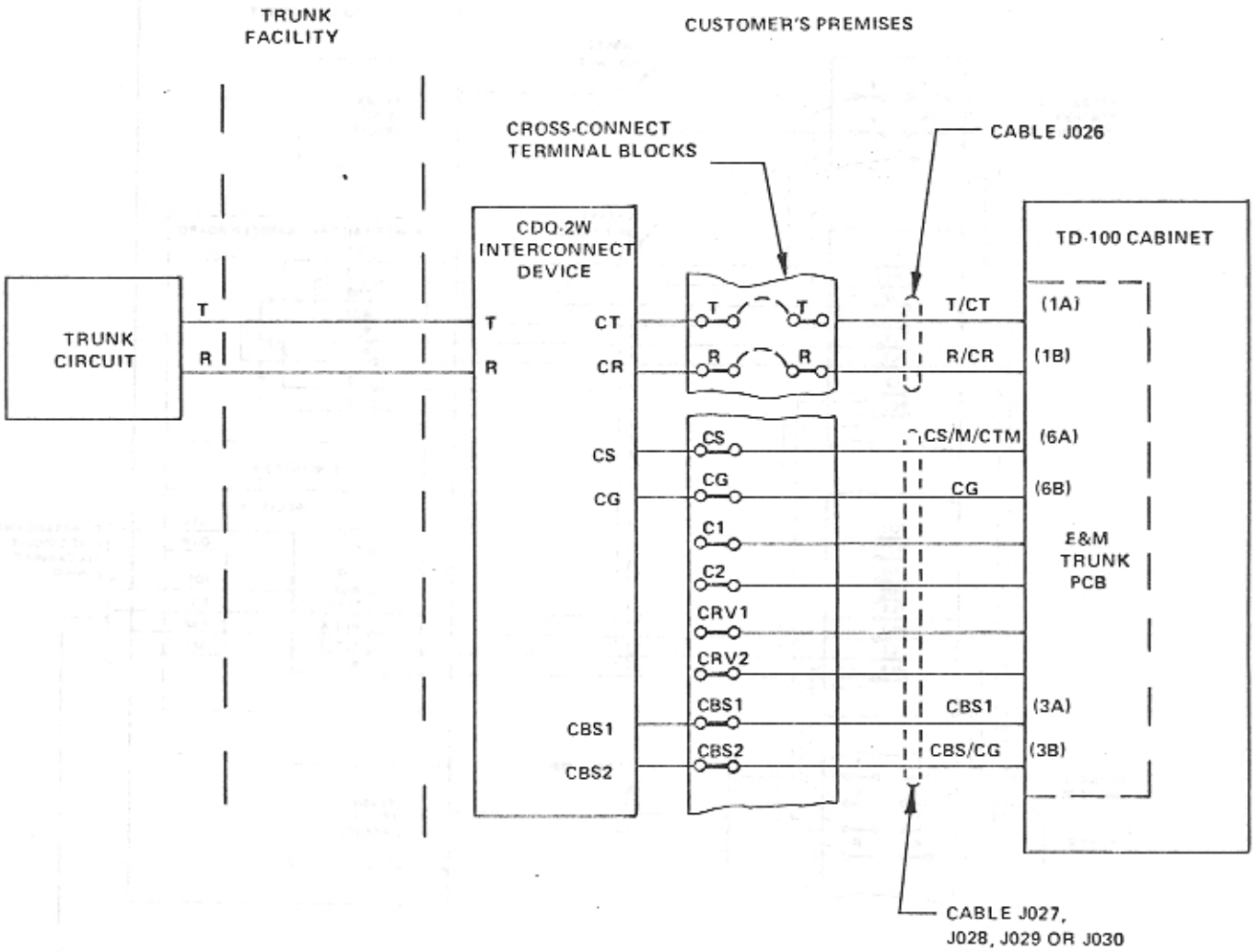


NOTES:

1. DESIGNATIONS ON INTERCONNECT TERMINAL BLOCK CORRESPOND TO THOSE ON CDH INTERCONNECT DEVICE.
2. NOTATIONS ON E&M TRUNK PCB REPRESENT MOTHERBOARD CONNECTOR TERMINALS.

PU-76-027

FIGURE 1.07 E&M Trunk Connections Using CDQ-2X Interconnect Device

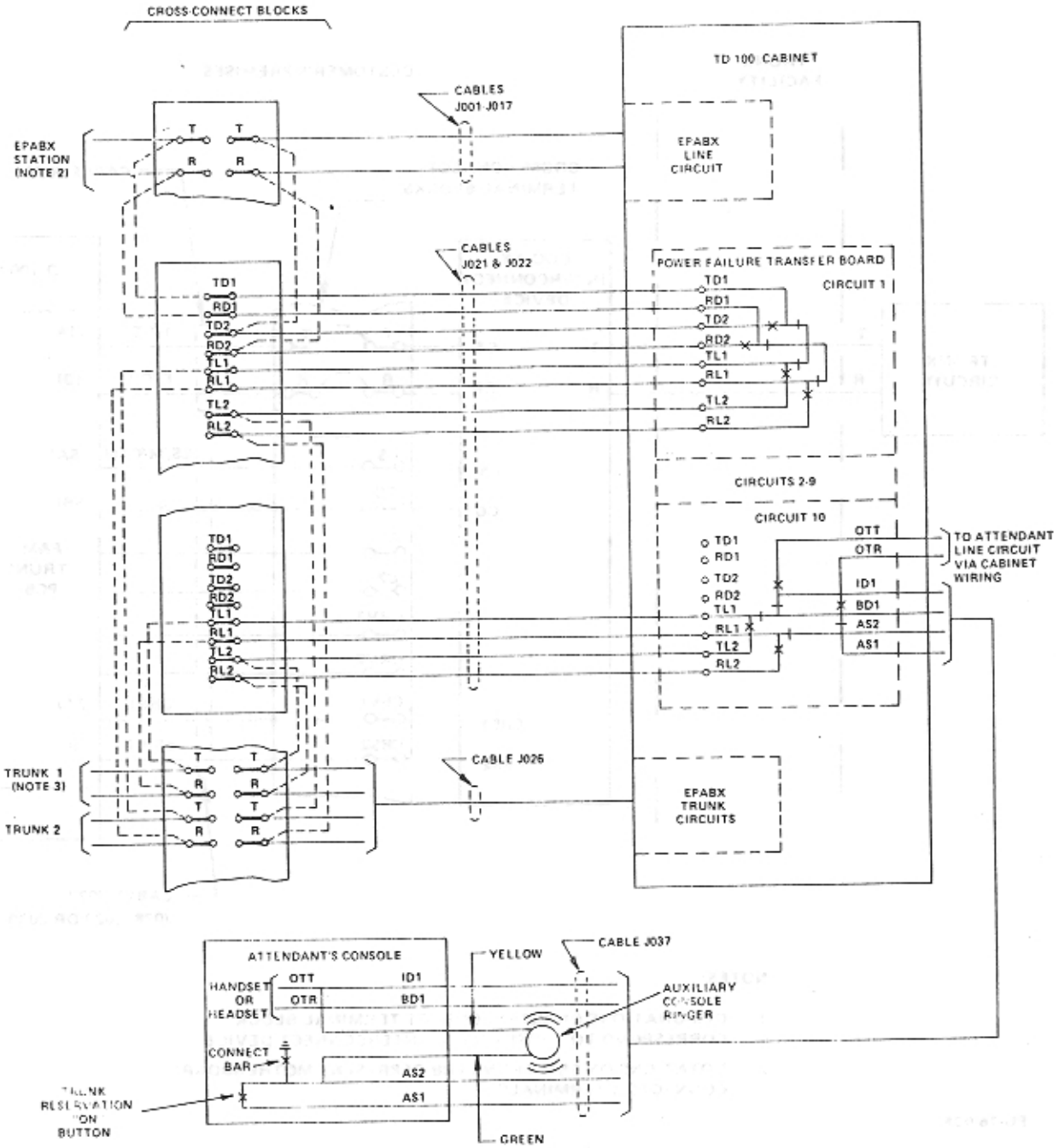


NOTES:

1. DESIGNATIONS ON INTERCONNECT TERMINAL BLOCK CORRESPOND TO THOSE ON CDH INTERCONNECT DEVICE.
2. NOTATIONS ON E&M TRUNK PCB REPRESENT MOTHERBOARD CONNECTOR TERMINALS.

PU-76-028

FIGURE 1.08 E&M Trunk Connections Using CDQ-2W Interconnect Device



NOTES:
1. DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS.
2. STATION TELEPHONE SETS REQUIRE GROUNDING PUSH BUTTON IF GROUND START TRUNKS ARE USED.
3. STRAP FIRST CHOICE TRUNK TO PFT CIRCUIT 10 IF ATTENDANT IS TO RECEIVE MAJORITY OF CALLS.

PU-76-029

FIGURE 1.09 Power Failure Transfer Cross-Connections

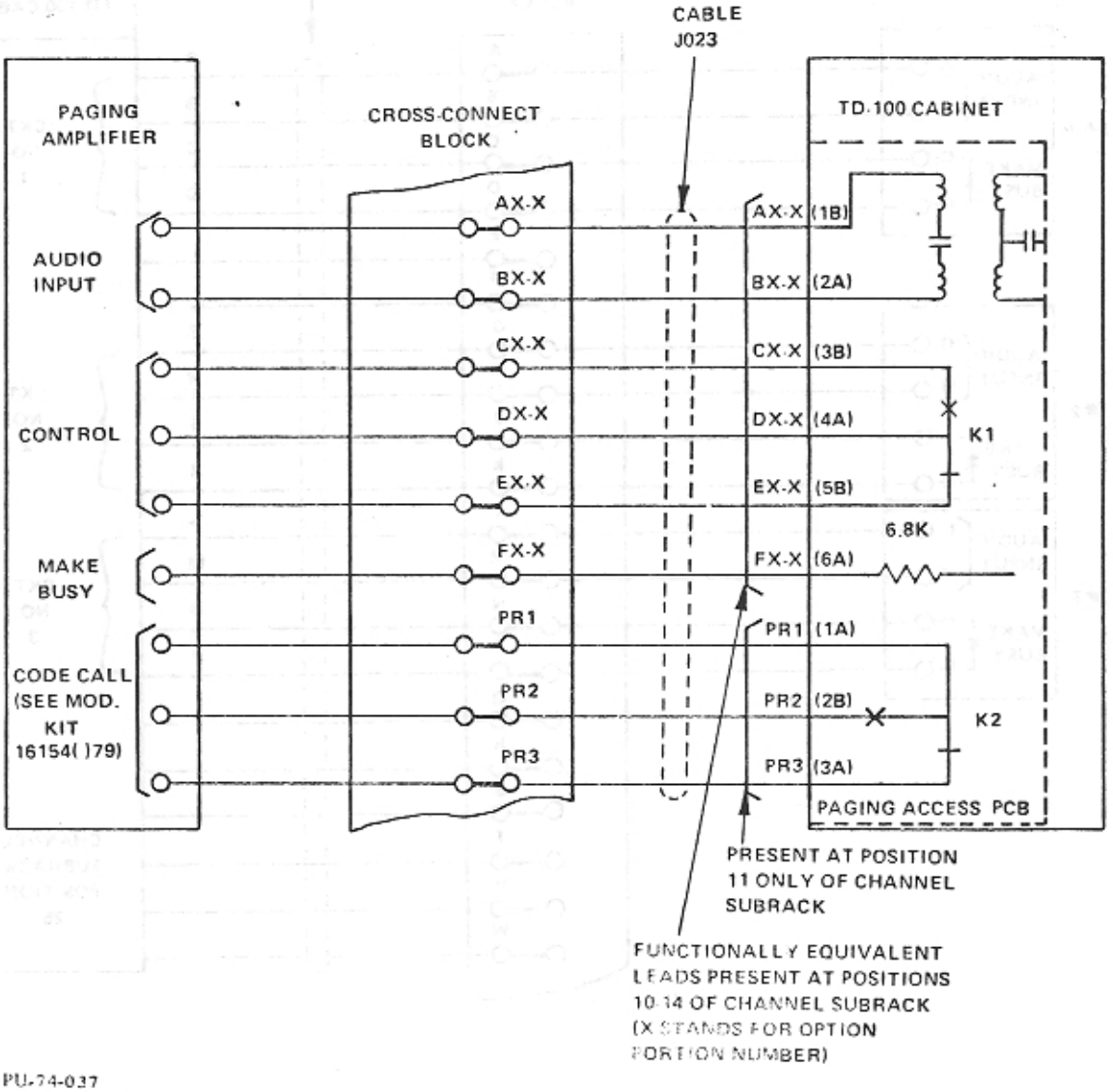


FIGURE 1.10 Paging Access Connections

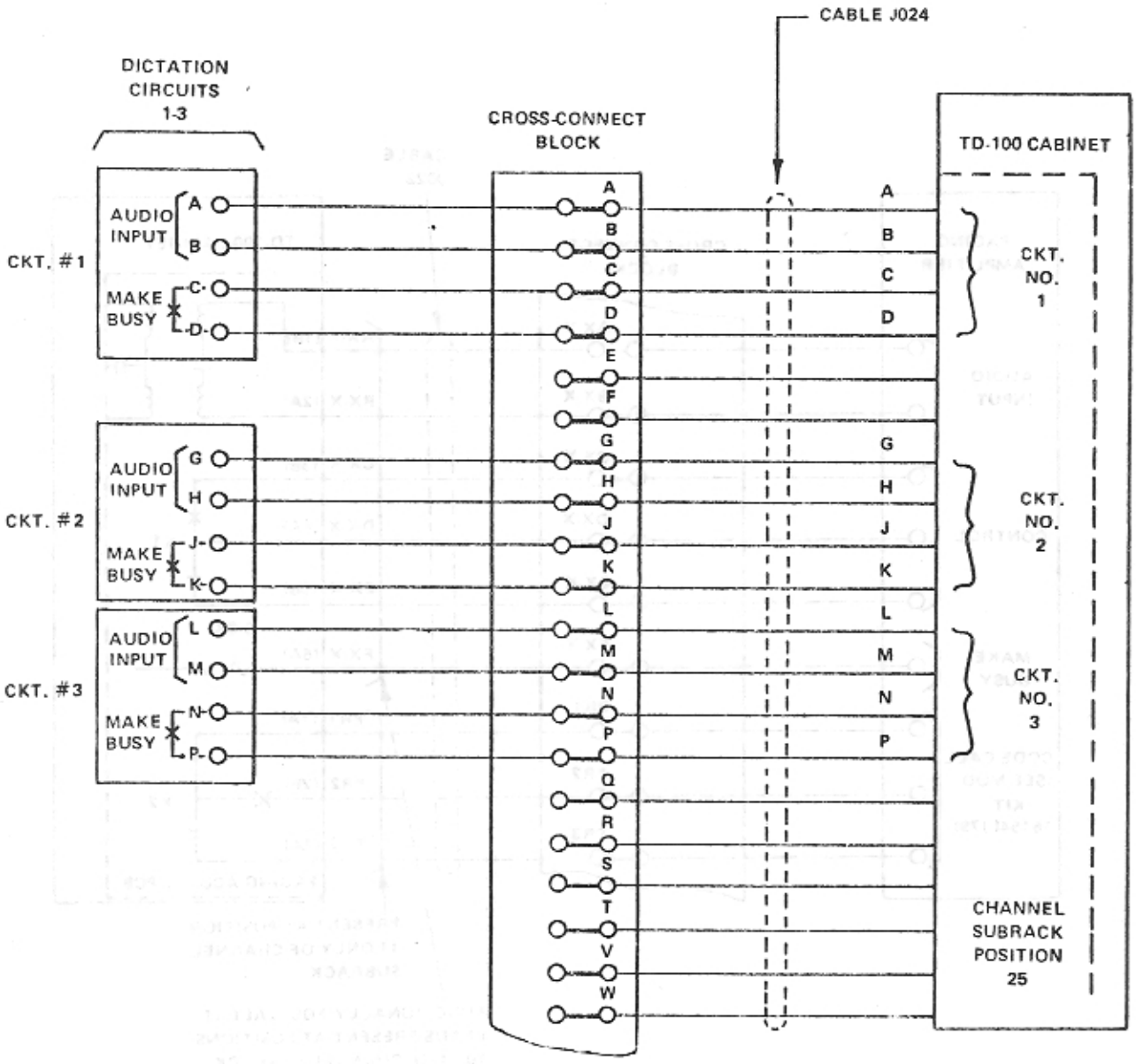


FIGURE 1.11 Dictation Access Connections

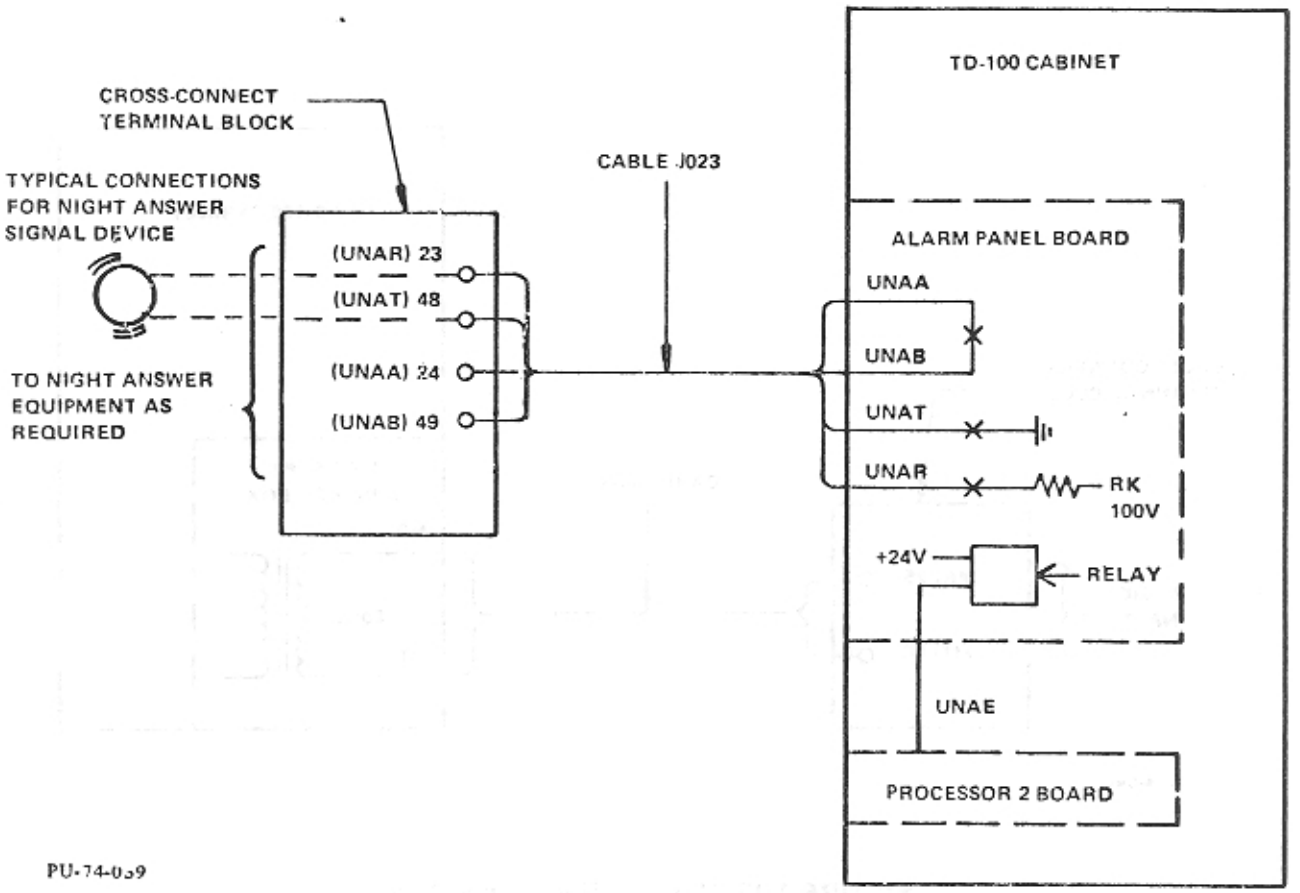


FIGURE 1.12 Unassigned Night Answer Connections

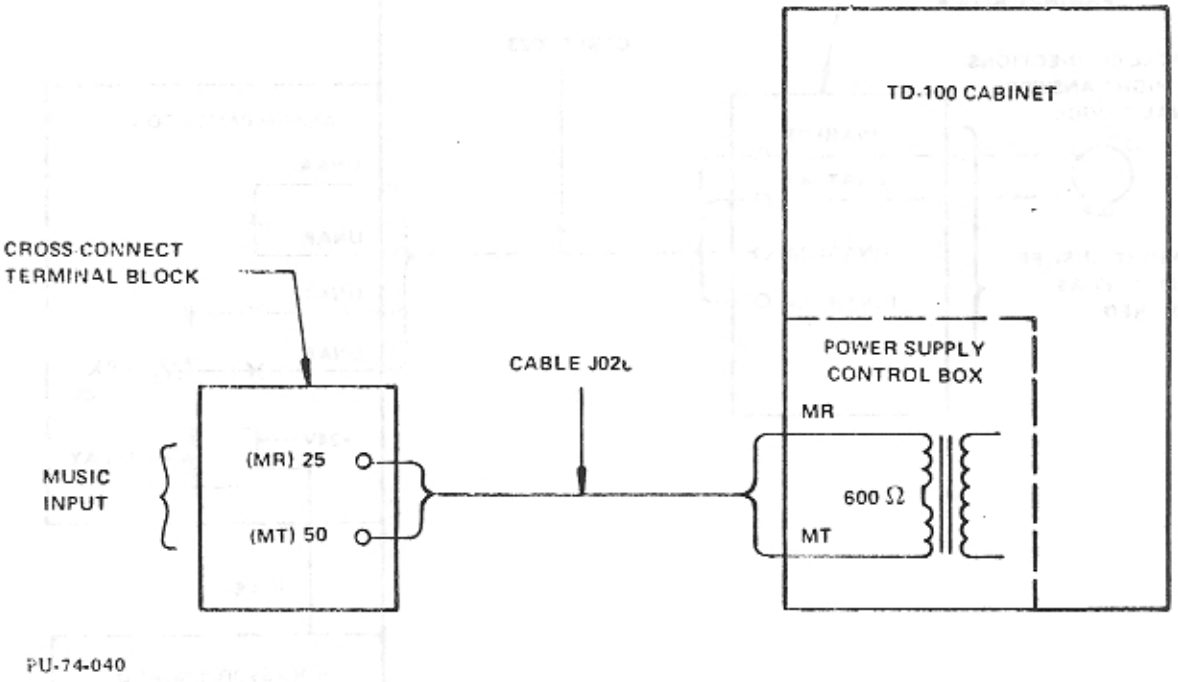
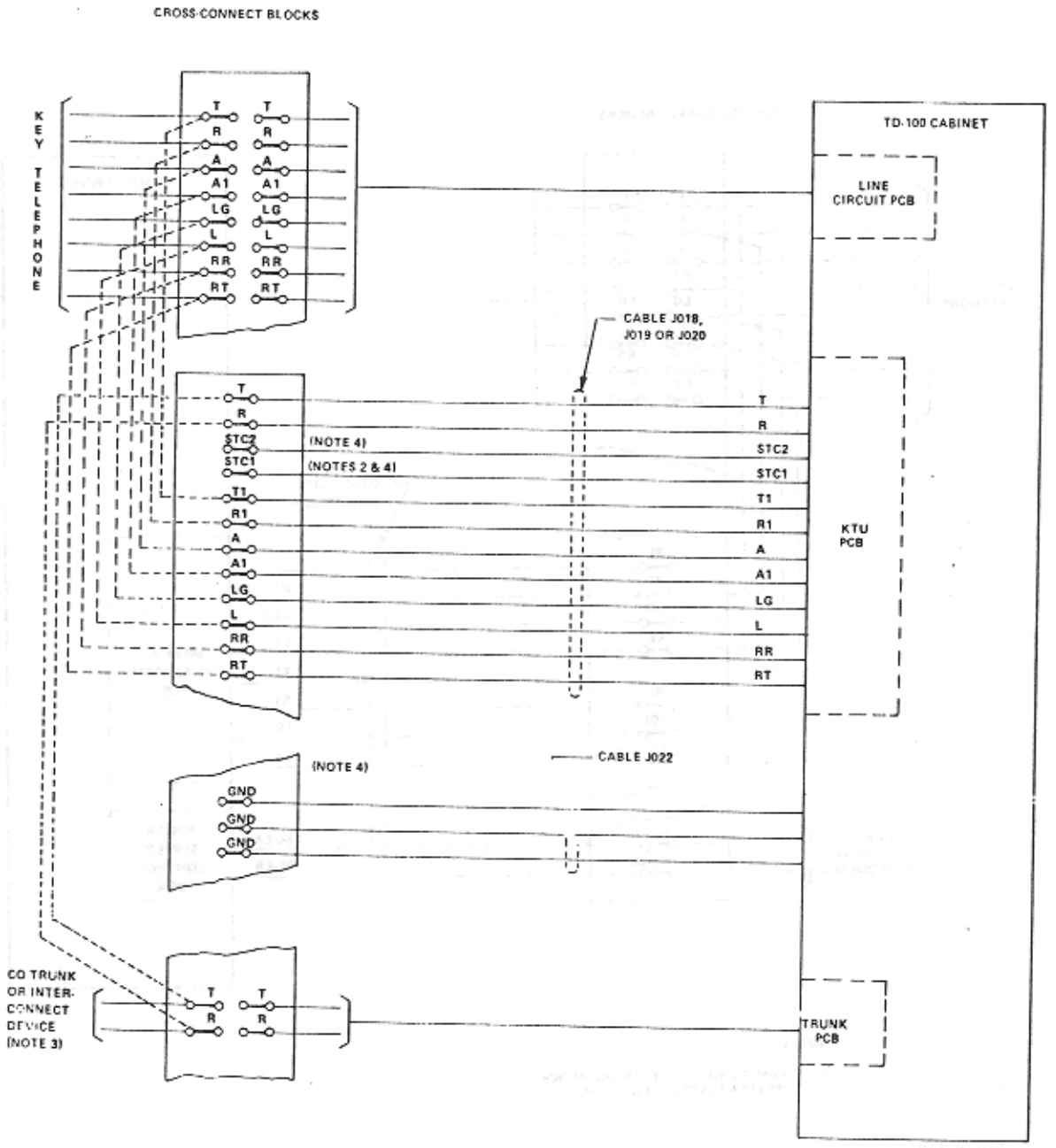


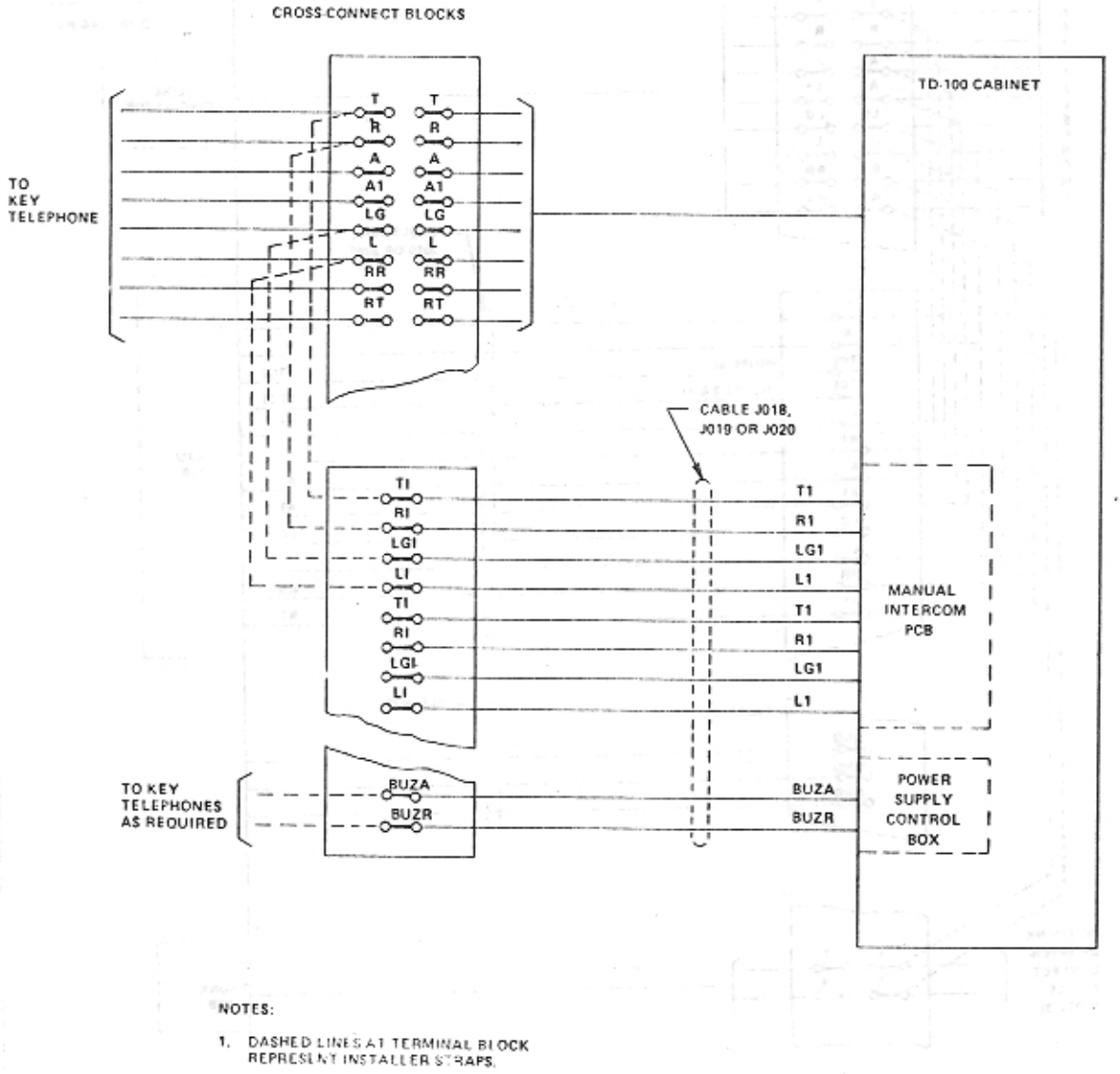
FIGURE 1.13 Music-on-Hold Connections



NOTES:
1. DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS.
2. CONNECT STC1 TO RU1 ON INTERCONNECT DEVICE, IF USED.
3. ONLY SINGLE PARTY SERVICE IS AVAILABLE IF INTERCONNECT DEVICE IS USED.
4. IF TWO PARTY SERVICE IS REQUIRED (NO INTERCONNECT DEVICE),
   CONNECT STC1 TO GND VIA 2[illegible] FOR RING PARTY GROUND.
   CONNECT STC2 TO GND VIA 3[illegible] FOR TIP PARTY GROUND.

PU-76-031

FIGURE 1.14 Private Line (KTU) Connections

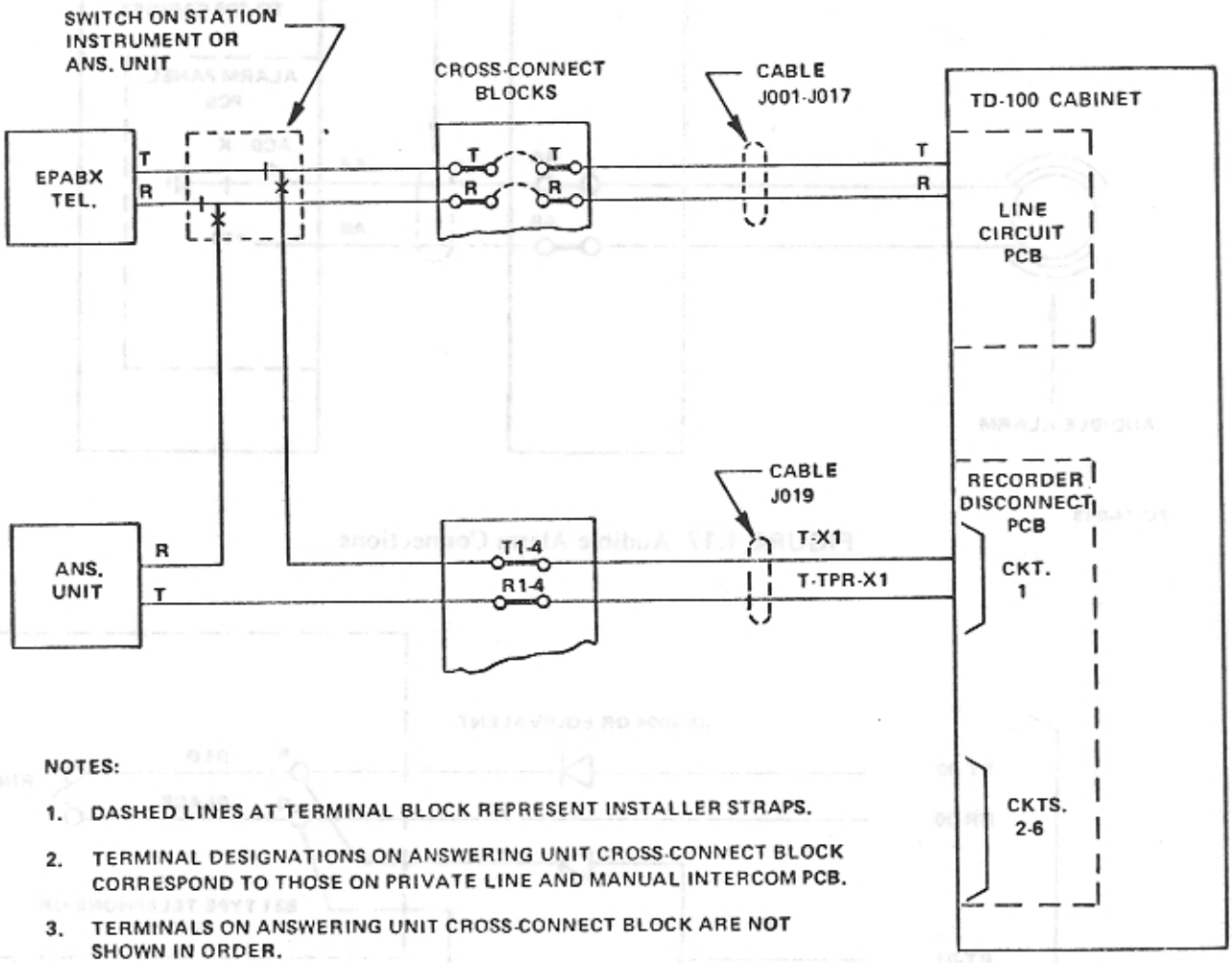


NOTES:

1. DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS.

PU-76-030

FIGURE 1.15 Manual Intercom Connections

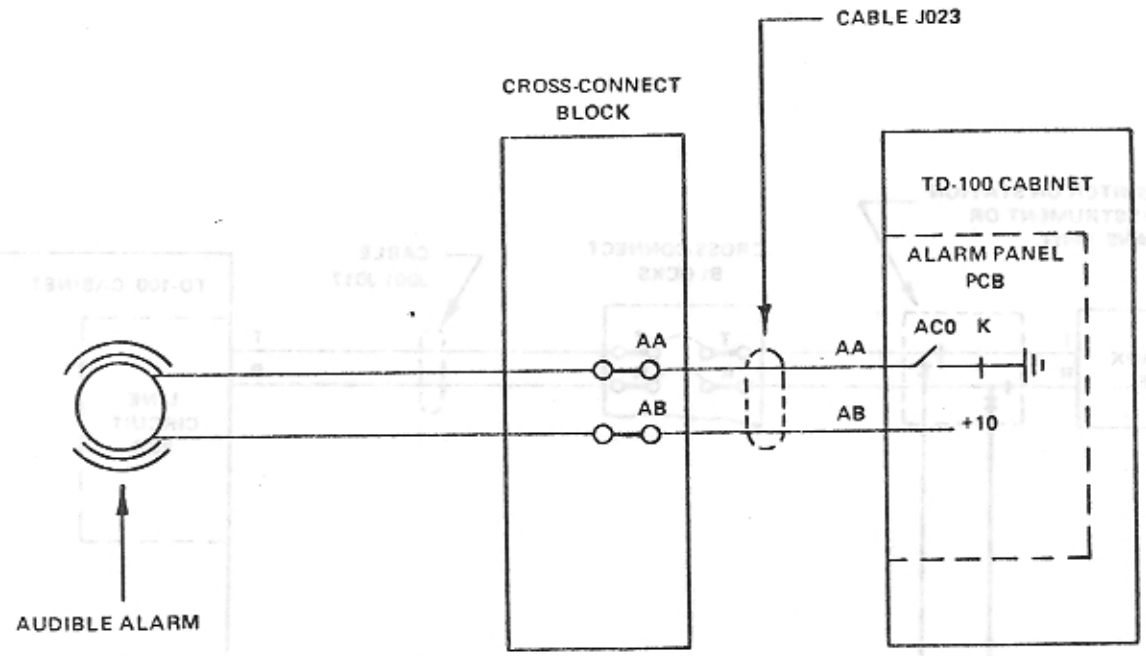


NOTES:

1. DASHED LINES AT TERMINAL BLOCK REPRESENT INSTALLER STRAPS.
2. TERMINAL DESIGNATIONS ON ANSWERING UNIT CROSS-CONNECT BLOCK CORRESPOND TO THOSE ON PRIVATE LINE AND MANUAL INTERCOM PCB.
3. TERMINALS ON ANSWERING UNIT CROSS-CONNECT BLOCK ARE NOT SHOWN IN ORDER.

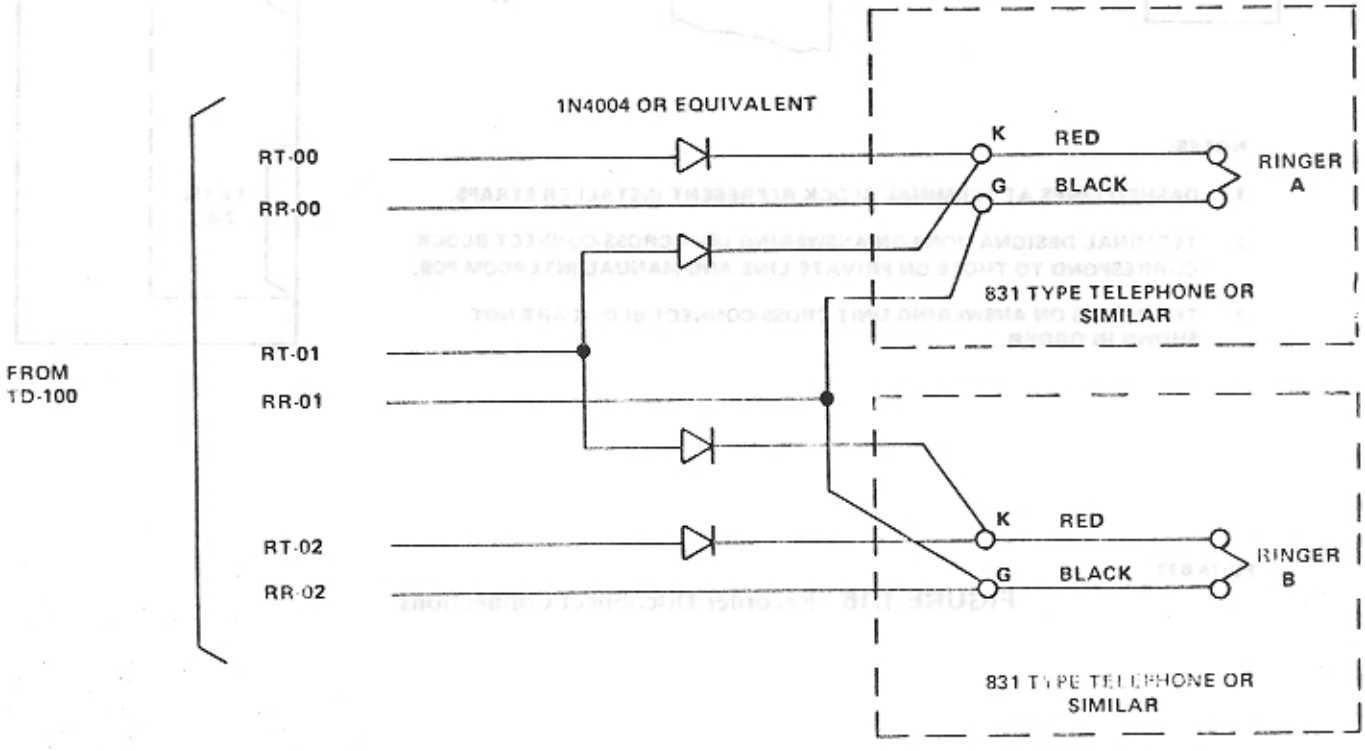
PU-76-032

FIGURE 1.16 Recorder Disconnect Connections



PU-74-043

FIGURE 1.17 Audible Alarm Connections



PU-76-033

FIGURE 1.18 Common Audible Ringer Connections

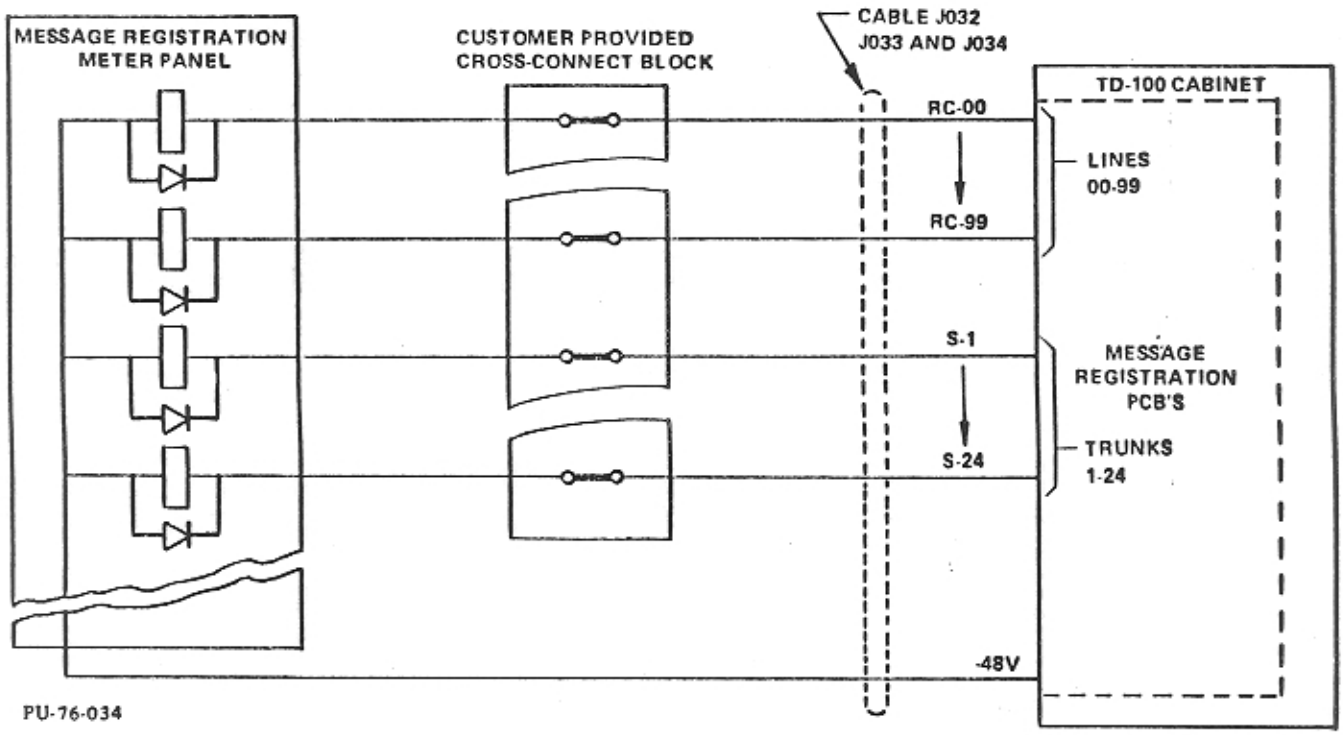


FIGURE 1.19 Message Registration Connections

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J021

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	TD-1				1	F	1	1	R	1	1	GEN MGR
	1	BL-WH	RD-1				2			2	R	1	2	TELEPHONE
2	27	WH-OR	TD-2				3			3	R	1	3	
	2	OR-WH	RD-2	Pwr. Fail, Xfer, Ckt. 1			4			4	R	1	4	
3	28	WH-GN	TL-1				5			5	S	3	1	FROM 1ST GAS
	3	GN-WH	RL-1				6			6	S	3	2	TUBE PROTECTOR
4	29	WH-BN	TL-2				7			7	S	3	3	
	4	BN-WH	RL-2				8			8	S	3	4	
5	30	WH-SL	TD-1				9			9	R	1	5	ASST MGR
	5	SL-WH	RD-1				10			10	R	1	6	TELEPHONE
6	31	RD-BL	TD-2				11		2	1	R	1	7	
	6	BL-RD	RD-2	Pwr. Fail, Xfer, Ckt. 2			12			2	R	1	8	
7	32	RD-OR	TL-1				13			3	S	3	5	FROM 2ND GAS
	7	OR-RD	RL-1				14			4	S	3	6	TUBE PROTECTOR
8	33	RD-GN	TL-2				15			5	S	3	7	
	8	GN-RD	RL-2				16			6	S	3	8	
9	34	RD-BN	TD1-3				17							
	9	BN-RD	RD1-3				18							
10	35	RD-SL	TD2-3											
	10	SL-RD	RD2-3	Pwr. Fail, Xfer, Ckt. 3										
11	36	BK-BL	TL1-3											
							28							
							29							
							30							
	16	BL-Y												
17	42	Y-OR												
	17	OR-Y												
18	43	Y-GN												
	18	GN-Y												
19	44	Y-BN												
	19	BN-Y												
20	45	Y-SL												
	20	SL-Y												
21	46	VI-BL												
	21	BL-VI												
22	47	VI-OR												
	22	OR-VI												
23	48	VI-GN												
	23	GN-VI												
24	49	VI-BN												
	24	BN-VI												
25	50	VI-SL												
	25	SL-VI												

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FIGURE 1.21 Typical Cabinet, Cable and Frame Cross-Connections

TABLE 1.00 Connecting Cables

CABLE	USE
J001	Stations 00-05
J002	Stations 06-11
J003	Stations 12-17
J004	Stations 18-23
J005	Stations 24-29
J006	Stations 30-35
J007	Stations 36-41
J008	Stations 42-47
J009	Stations 48-53
J010	Stations 54-59
J011	Stations 60-65
J012	Stations 66-71
J013	Stations 72-77
J014	Stations 78-83
J015	Stations 84-89
J016	Stations 90-94
J017	Stations 95-99
J018	Line Option 1
J019	Line Option 2
J020	Line Option 3
J021	Power Failure Transfer Lines 1-5
J022	Power Failure Transfer Lines 6-10
J023	Options 1-5; UNA, Major and Minor Alarms
J024	Option 6 - 3 Channel, Option 7 - 2 Channel
J025	AIOD
J026	Trunks 1-24, MOH
J027	Interconnect Devices/E&M Trunks 1-6
J028	Interconnect Devices/E&M Trunks 7-12
J029	Interconnect Devices/E&M Trunks 13-18
J030	Interconnect Devices/E&M Trunks 19-24
J031	Traffic Measuring Equipment
J032	MMR Equipment – Lines 00-49
J033	MMR Equipment – Lines 50-99
J034	MMR Equipment – Trunks 1-24
J035	Future
J036	Future
J037	Console Control Leads
J038	Console Control Leads
J039	Console Control Leads
J040	Console Busy Lamps – Lines 00-39
J041	Console Busy Lamps – Lines 40-79
J042	Console Busy Lamps – Lines 80-99

NOTES:

1. Refer to Table 1.01 for information peculiar to each cable.

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J001

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-00											
	1	BL-WH	R-00											
2	27	WH-OR	A-00											
	2	OR-WH	A1-00	Station Line 00										
3	28	WH-GN	LG-00											
	3	GN-WH	L-00											
4	29	WH-BN	RR-00											
	4	BN-WH	RT-00											
5	30	WH-SL	T-01											
	5	SL-WH	R-01											
6	31	RD-BL	A-01											
	6	BL-RD	A1-01	Station Line 01										
7	32	RD-OR	LG-01											
	7	OR-RD	L-01											
8	33	RD-GN	RR-01											
	8	GN-RD	RT-01											
9	34	RD-BN	T-02											
	9	BN-RD	R-02											
10	35	RD-SL	A-02											
	10	SL-RD	A1-02	Station Line 02										
11	36	BK-BL	LG-02											
	11	BL-BK	L-02											
12	37	BK-OR	RR-02											
	12	OR-BK	RT-02											
13	38	BK-GN	T-03											
	13	GN-BK	R-03											
14	39	BK-BN	A-03											
	14	BN-BK	A1-03	Station Line 03										
15	40	BK-SL	LG-03											
	15	SL-BK	L-03											
16	41	Y-BL	RR-03											
	16	BL-Y	RT-03											
17	42	Y-OR	T-04											
	17	OR-Y	R-04											
18	43	Y-GN	A-04											
	18	GN-Y	A1-04	Station Line 04										
19	44	Y-BN	LG-04											
	19	BN-Y	L-04											
20	45	Y-SL	RR-04											
	20	SL-Y	RT-04											
21	46	VI-BL	T-05											
	21	BL-VI	R-05											
22	47	VI-OR	A-05											
	22	OR-VI	A1-05	Station Line 05										
23	48	VI-GN	LG-05											
	23	GN-VI	L-05											
24	49	VI-BN	RR-05											
	24	BN-VI	RT-05											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J002

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	L-06											
	1	BL-WH	R-06											
2	27	WH-OR	A-06											
	2	OR-WH	A1-06	Station Line 06										
3	28	WH-GN	LG-06											
	3	GN-WH	L-06											
4	29	WH-BN	RR-06											
	4	BN-WH	RT-06											
5	30	WH-SL	T-07											
	5	SL-WH	R-07											
6	31	RD-BL	A-07											
	6	BL-RD	A1-07	Station Line 07										
7	32	RD-OR	LG-07											
	7	OR-RD	L-07											
8	33	RD-GN	RR-07											
	8	GN-RD	RT-07											
9	34	RD-BN	T-08											
	9	BN-RD	R-08											
10	35	RD-SL	A-08											
	10	SL-RD	A1-08	Station Line 08										
11	36	BK-BL	LG-08											
	11	BL-BK	L-08											
12	37	BK-OR	RR-08											
	12	OR-BK	RT-08											
13	38	BK-GN	T-09											
	13	GN-BK	R-09											
14	39	BK-BN	A-09											
	14	BN-BK	A1-09	Station Line 09										
15	40	BK-SL	LG-09											
	15	SL-BK	L-09											
16	41	Y-BL	RR-09											
	16	BL-Y	RT-09											
17	42	Y-OR	T-10											
	17	OR-Y	R-10											
18	43	Y-GN	A-10											
	18	GN-Y	A1-10	Station Line 10										
19	44	Y-BN	LG-10											
	19	BN-Y	L-10											
20	45	Y-SL	RR-10											
	20	SL-Y	RT-10											
21	46	VI-BL	T-11											
	21	BL-VI	R-11											
22	47	VI-OR	A-11											
	22	OR-VI	A1-11	Station Line 11										
23	48	VI-GN	LG-11											
	23	GN-VI	L-11											
24	49	VI-BN	RR-11											
	24	BN-VI	RT-11											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J003

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-12											
	1	BL-WH	R-12											
2	27	WH-OR	A-12											
	2	OR-WH	A1-12	Station Line 12										
3	28	WH-GN	LG-12											
	3	GN-WH	L-12											
4	29	WH-BN	RR-12											
	4	BN-WH	RT-12											
5	30	WH-SL	T-13											
	5	SL-WH	R-13											
6	31	RD-BL	A-13											
	6	BL-RD	A1-13	Station Line 13										
7	32	RD-OR	LG-13											
	7	OR-RD	L-13											
8	33	RD-GN	RR-13											
	8	GN-RD	RT-13											
9	34	RD-BN	T-14											
	9	BN-RD	R-14											
10	35	RD-SL	A-14											
	10	SL-RD	A1-14	Station Line 14										
11	36	BK-BL	LG-14											
	11	BL-BK	L-14											
12	37	BK-OR	RR-14											
	12	OR-BK	RT-14											
13	38	BK-GN	T-15											
	13	GN-BK	R-15											
14	39	BK-BN	A-15											
	14	BN-BK	A1-15	Station Line 15										
15	40	BK-SL	LG-15											
	15	SL-BK	L-15											
16	41	Y-BL	RR-15											
	16	BL-Y	RT-15											
17	42	Y-OR	T-16											
	17	OR-Y	R-16											
18	43	Y-GN	A-16											
	18	GN-Y	A1-16	Station Line 16										
19	44	Y-BN	LG-16											
	19	BN-Y	L-16											
20	45	Y-SL	RR-16											
	20	SL-Y	RT-16											
21	46	VI-BL	T-17											
	21	BL-VI	R-17											
22	47	VI-OR	A-17											
	22	OR-VI	A1-17	Station Line 17										
23	48	VI-GN	LG-17											
	23	GN-VI	L-17											
24	49	VI-BN	RR-17											
	24	BN-VI	RT-17											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J004

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-18											
	1	BL-WH	R-18											
2	27	WH-OR	A-18											
	2	OR-WH	A1-18	Station Line 18										
3	28	WH-GN	LG-18											
	3	GN-WH	L-18											
4	29	WH-BN	RR-18											
	4	BN-WH	RT-18											
5	30	WH-SL	T-19											
	5	SL-WH	R-19											
6	31	RD-BL	A-19											
	6	BL-RD	A1-19	Station Line 19										
7	32	RD-OR	LG-19											
	7	OR-RD	L-19											
8	33	RD-GN	RR-19											
	8	GN-RD	RT-19											
9	34	RD-BN	T-20											
	9	BN-RD	R-20											
10	35	RD-SL	A-20											
	10	SL-RD	A1-20	Station Line 20										
11	36	BK-BL	LG-20											
	11	BL-BK	L-20											
12	37	BK-OR	RR-20											
	12	OR-BK	RT-20											
13	38	BK-GN	T-21											
	13	GN-BK	R-21											
14	39	BK-BN	A-21											
	14	BN-BK	A1-21	Station Line 21										
15	40	BK-SL	LG-21											
	15	SL-BK	L-21											
16	41	Y-BL	RR-21											
	16	BL-Y	RT-21											
17	42	Y-OR	T-22											
	17	OR-Y	R-22											
18	43	Y-GN	A-22											
	18	GN-Y	A1-22	Station Line 22										
19	44	Y-BN	LG-22											
	19	BN-Y	L-22											
20	45	Y-SL	RR-22											
	20	SL-Y	RT-22											
21	46	VI-BL	T-23											
	21	BL-VI	R-23											
22	47	VI-OR	A-23											
	22	OR-VI	A1-23	Station Line 23										
23	48	VI-GN	LG-23											
	23	GN-VI	L-23											
24	49	VI-BN	RR-23											
	24	BN-VI	RT-23											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J005

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-24											
	1	BL-WH	R-24											
2	27	WH-OR	A-24											
	2	OR-WH	A1-24	Station Line 24										
3	28	WH-GN	LG-24											
	3	GN-WH	L-24											
4	29	WH-BN	RR-24											
	4	BN-WH	RT-24											
5	30	WH-SL	T-25											
	5	SL-WH	R-25											
6	31	RD-BL	A-25											
	6	BL-RD	A1-25	Station Line 25										
7	32	RD-OR	LG-25											
	7	OR-RD	L-25											
8	33	RD-GN	RR-25											
	8	GN-RD	RT-25											
9	34	RD-BN	T-26											
	9	BN-RD	R-26											
10	35	RD-SL	A-26											
	10	SL-RD	A1-26	Station Line 26										
11	36	BK-BL	LG-26											
	11	BL-BK	L-26											
12	37	BK-OR	RR-26											
	12	OR-BK	RT-26											
13	38	BK-GN	T-27											
	13	GN-BK	R-27											
14	39	BK-BN	A-27											
	14	BN-BK	A1-27	Station Line 27										
15	40	BK-SL	LG-27											
	15	SL-BK	L-27											
16	41	Y-BL	RR-27											
	16	BL-Y	RT-27											
17	42	Y-OR	T-28											
	17	OR-Y	R-28											
18	43	Y-GN	A-28											
	18	GN-Y	A1-28	Station Line 28										
19	44	Y-BN	LG-28											
	19	BN-Y	L-28											
20	45	Y-SL	RR-28											
	20	SL-Y	RT-28											
21	46	VI-BL	T-29											
	21	BL-VI	R-29											
22	47	VI-OR	A-29											
	22	OR-VI	A1-29	Station Line 29										
23	48	VI-GN	LG-29											
	23	GN-VI	L-29											
24	49	VI-BN	RR-29											
	24	BN-VI	RT-29											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J006

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-30											
	1	BL-WH	R-30											
2	27	WH-OR	A-30											
	2	OR-WH	A1-30	Station Line 30										
3	28	WH-GN	LG-30											
	3	GN-WH	L-30											
4	29	WH-BN	RR-30											
	4	BN-WH	RT-30											
5	30	WH-SL	T-31											
	5	SL-WH	R-31											
6	31	RD-BL	A-31											
	6	BL-RD	A1-31	Station Line 31										
7	32	RD-OR	LG-31											
	7	OR-RD	L-31											
8	33	RD-GN	RR-31											
	8	GN-RD	RT-31											
9	34	RD-BN	T-32											
	9	BN-RD	R-32											
10	35	RD-SL	A-32											
	10	SL-RD	A1-32	Station Line 32										
11	36	BK-BL	LG-32											
	11	BL-BK	L-32											
12	37	BK-OR	RR-32											
	12	OR-BK	RT-32											
13	38	BK-GN	T-33											
	13	GN-BK	R-33											
14	39	BK-BN	A-33											
	14	BN-BK	A1-33	Station Line 33										
15	40	BK-SL	LG-33											
	15	SL-BK	L-33											
16	41	Y-BL	RR-33											
	16	BL-Y	RT-33											
17	42	Y-OR	T-34											
	17	OR-Y	R-34											
18	43	Y-GN	A-34											
	18	GN-Y	A1-34	Station Line 34										
19	44	Y-BN	LG-34											
	19	BN-Y	L-34											
20	45	Y-SL	RR-34											
	20	SL-Y	RT-34											
21	46	VI-BL	T-35											
	21	BL-VI	R-35											
22	47	VI-OR	A-35											
	22	OR-VI	A1-35	Station Line 35										
23	48	VI-GN	LG-35											
	23	GN-VI	L-35											
24	49	VI-BN	RR-35											
	24	BN-VI	RT-35											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J007

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-36											
	1	BL-WH	R-36											
2	27	WH-OR	A-36											
	2	OR-WH	A1-36	Station Line 36										
3	28	WH-GN	LG-36											
	3	GN-WH	L-36											
4	29	WH-BN	RR-36											
	4	BN-WH	RT-36											
5	30	WH-SL	T-37											
	5	SL-WH	R-37											
6	31	RD-BL	A-37											
	6	BL-RD	A1-37	Station Line 37										
7	32	RD-OR	LG-37											
	7	OR-RD	L-37											
8	33	RD-GN	RR-37											
	8	GN-RD	RT-37											
9	34	RD-BN	T-38											
	9	BN-RD	R-38											
10	35	RD-SL	A-38											
	10	SL-RD	A1-38	Station Line 38										
11	36	BK-BL	LG-38											
	11	BL-BK	L-38											
12	37	BK-OR	RR-38											
	12	OR-BK	RT-38											
13	38	BK-GN	T-39											
	13	GN-BK	R-39											
14	39	BK-BN	A-39											
	14	BN-BK	A1-39	Station Line 39										
15	40	BK-SL	LG-39											
	15	SL-BK	L-39											
16	41	Y-BL	RR-39											
	16	BL-Y	RT-39											
17	42	Y-OR	T-40											
	17	OR-Y	R-40											
18	43	Y-GN	A-40											
	18	GN-Y	A1-40	Station Line 40										
19	44	Y-BN	LG-40											
	19	BN-Y	L-40											
20	45	Y-SL	RR-40											
	20	SL-Y	RT-40											
21	46	VI-BL	T-41											
	21	BL-VI	R-41											
22	47	VI-OR	A-41											
	22	OR-VI	A1-41	Station Line 41										
23	48	VI-GN	LG-41											
	23	GN-VI	L-41											
24	49	VI-BN	RR-41											
	24	BN-VI	RT-41											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, 3008

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-42											
	1	BL-WH	R-42											
2	27	WH-OR	A-42											
	2	OR-WH	A1-42	Station Line 42										
3	28	WH-GN	LG-42											
	3	GN-WH	L-42											
4	29	WH-BN	RR-42											
	4	BN-WH	RT-42											
5	30	WH-SL	L-43											
	5	SL-WH	R-43											
6	31	RD-BL	A-43											
	6	BL-RD	A1-43	Station Line 43										
7	32	RD-OR	LG-43											
	7	OR-RD	L-43											
8	33	RD-GN	RR-43											
	8	GN-RD	RT-43											
9	34	RD-BN	T-44											
	9	BN-RD	R-44											
10	35	RD-SL	A-44											
	10	SL-RD	A1-44	Station Line 44										
11	36	BK-BL	LG-44											
	11	BL-BK	L-44											
12	37	BK-OR	RR-44											
	12	OR-BK	RT-44											
13	38	BK-GN	T-45											
	13	GN-BK	R-45											
14	39	BK-BN	A-45											
	14	BN-BK	A1-45	Station Line 45										
15	40	BK-SL	LG-45											
	15	SL-BK	L-45											
16	41	Y-BL	RR-45											
	16	BL-Y	RT-45											
17	42	Y-OR	T-46											
	17	OR-Y	R-46											
18	43	Y-GN	A-46											
	18	GN-Y	A1-46	Station Line 46										
19	44	Y-BN	LG-46											
	19	BN-Y	L-46											
20	45	Y-SL	RR-46											
	20	SL-Y	RT-46											
21	46	VI-BL	T-47											
	21	BL-VI	R-47											
22	47	VI-OR	A-47											
	22	OR-VI	A1-47	Station Line 47										
23	48	VI-GN	LG-47											
	23	GN-VI	L-47											
24	49	VI-BN	RR-47											
	24	BN-VI	RT-47											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J009

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-48											
	1	BL-WH	R-48											
2	27	WH-OR	A-48											
	2	OR-WH	A1-48	Station Line 48										
3	28	WH-GN	LG-48											
	3	GN-WH	L-48											
4	29	WH-BN	RR-48											
	4	BN-WH	RT-48											
5	30	WH-SL	T-49											
	5	SL-WH	R-49											
6	31	RD-BL	A-49											
	6	BL-RD	A1-49	Station Line 49										
7	32	RD-OR	LG-49											
	7	OR-RD	L-49											
8	33	RD-GN	RR-49											
	8	GN-RD	RT-49											
9	34	RD-BN	T-50											
	9	BN-RD	R-50											
10	35	RD-SL	A-50											
	10	SL-RD	A1-50	Station Line 50										
11	36	BK-BL	LG-50											
	11	BL-BK	L-50											
12	37	BK-OR	RR-50											
	12	OR-BK	RT-50											
13	38	BK-GN	T-51											
	13	GN-BK	R-51											
14	39	BK-BN	A-51											
	14	BN-BK	A1-51	Station Line 51										
15	40	BK-SL	LG-51											
	15	SL-BK	L-51											
16	41	Y-BL	RR-51											
	16	BL-Y	RT-51											
17	42	Y-OR	T-52											
	17	OR-Y	R-52											
18	43	Y-GN	A-52											
	18	GN-Y	A1-52	Station Line 52										
19	44	Y-BN	LG-52											
	19	BN-Y	L-52											
20	45	Y-SL	RR-52											
	20	SL-Y	RT-52											
21	46	VI-BL	T-53											
	21	BL-VI	R-53											
22	47	VI-OR	A-53											
	22	OR-VI	A1-53	Station Line 53										
23	48	VI-GN	LG-53											
	23	GN-VI	L-53											
24	49	VI-BN	RR-53											
	24	BN-VI	RT-53											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J010

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-54											
	1	BL-WH	R-54											
2	27	WH-OR	A-54											
	2	OR-WH	A1-54	Station Line 54										
3	28	WH-GN	LG-54											
	3	GN-WH	L-54											
4	29	WH-BN	RR-54											
	4	BN-WH	RT-54											
5	30	WH-SL	T-55											
	5	SL-WH	R-55											
6	31	RD-BL	A-55											
	6	BL-RD	A1-55	Station Line 55										
7	32	RD-OR	LG-55											
	7	OR-RD	L-55											
8	33	RD-GN	RR-55											
	8	GN-RD	RT-55											
9	34	RD-BN	T-56											
	9	BN-RD	R-56											
10	35	RD-SL	A-56											
	10	SL-RD	A1-56	Station Line 56										
11	36	BK-BL	LG-56											
	11	BL-BK	L-56											
12	37	BK-OR	RR-56											
	12	OR-BK	RT-56											
13	38	BK-GN	T-57											
	13	GN-BK	R-57											
14	39	BK-BN	A-57											
	14	BN-BK	A1-57	Station Line 57										
15	40	BK-SL	LG-57											
	15	SL-BK	L-57											
16	41	Y-BL	RR-57											
	16	BL-Y	RT-57											
17	42	Y-OR	T-58											
	17	OR-Y	R-58											
18	43	Y-GN	A-58											
	18	GN-Y	A1-58	Station Line 58										
19	44	Y-BN	LG-58											
	19	BN-Y	L-58											
20	45	Y-SL	RR-58											
	20	SL-Y	RT-58											
21	46	VI-BL	T-59											
	21	BL-VI	R-59											
22	47	VI-OR	A-59											
	22	OR-VI	A1-59	Station Line 59										
23	48	VI-GN	LG-59											
	23	GN-VI	L-59											
24	49	VI-BN	RR-59											
	24	BN-VI	RT-59											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J011

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-60											
	1	BL-WH	R-60											
2	27	WH-OR	A-60											
	2	OR-WH	A1-60	Station Line 60										
3	28	WH-GN	LG-60											
	3	GN-WH	L-60											
4	29	WH-BN	RR-60											
	4	BN-WH	RT-60											
5	30	WH-SL	T-61											
	5	SL-WH	R-61											
6	31	RD-BL	A-61											
	6	BL-RD	A1-61	Station Line 61										
7	32	RD-OR	LG-61											
	7	OR-RD	L-61											
8	33	RD-GN	RR-61											
	8	GN-RD	RT-61											
9	34	RD-BN	T-62											
	9	BN-RD	R-62											
10	35	RD-SL	A-62											
	10	SL-RD	A1-62	Station Line 62										
11	36	BK-BL	LG-62											
	11	BL-BK	L-62											
12	37	BK-OR	RR-62											
	12	OR-BK	RT-62											
13	38	BK-GN	T-63											
	13	GN-BK	R-63											
14	39	BK-BN	A-63											
	14	BN-BK	A1-63	Station Line 63										
15	40	BK-SL	LG-63											
	15	SL-BK	L-63											
16	41	Y-BL	RR-63											
	16	BL-Y	RT-63											
17	42	Y-OR	T-64											
	17	OR-Y	R-64											
18	43	Y-GN	A-64											
	18	GN-Y	A1-64	Station Line 64										
19	44	Y-BN	LG-64											
	19	BN-Y	L-64											
20	45	Y-SL	RR-64											
	20	SL-Y	RT-64											
21	46	VI-BL	T-65											
	21	BL-VI	R-65											
22	47	VI-OR	A-65											
	22	OR-VI	A1-65	Station Line 65										
23	48	VI-GN	LG-65											
	23	GN-VI	L-65											
24	49	VI-BN	RR-65											
	24	BN-VI	RT-65											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J012

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-66											
	1	BL-WH	R-66											
2	27	WH-OR	A-66											
	2	OR-WH	A1-66	Station Line 66										
3	28	WH-GN	LG-66											
	3	GN-WH	L-66											
4	29	WH-BN	RR-66											
	4	BN-WH	RT-66											
5	30	WH-SL	T-67											
	5	SL-WH	R-67											
6	31	RD-BL	A-67											
	6	BL-RD	A1-67	Station Line 67										
7	32	RD-OR	LG-67											
	7	OR-RD	L-67											
8	33	RD-GN	RR-67											
	8	GN-RD	RT-67											
9	34	RD-BN	T-68											
	9	BN-RD	R-68											
10	35	RD-SL	A-68											
	10	SL-RD	A1-68	Station Line 68										
11	36	BK-BL	LG-68											
	11	BL-BK	L-68											
12	37	BK-OR	RR-68											
	12	OR-BK	RT-68											
13	38	BK-GN	T-69											
	13	GN-BK	R-69											
14	39	BK-BN	A-69											
	14	BN-BK	A1-69	Station Line 69										
15	40	BK-SL	LG-69											
	15	SL-BK	L-69											
16	41	Y-BL	RR-69											
	16	BL-Y	RT-69											
17	42	Y-OR	T-70											
	17	OR-Y	R-70											
18	43	Y-GN	A-70											
	18	GN-Y	A1-70	Station Line 70										
19	44	Y-BN	LG-70											
	19	BN-Y	L-70											
20	45	Y-SL	RR-70											
	20	SL-Y	RT-70											
21	46	VI-BL	T-71											
	21	BL-VI	R-71											
22	47	VI-OR	A-71											
	22	OR-VI	A1-71	Station Line 71										
23	48	VI-GN	LG-71											
	23	GN-VI	L-71											
24	49	VI-BN	RR-71											
	24	BN-VI	RT-71											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections. J013

PAIR	PIN	COLOR	CEVO DESIG. NATION	USAGE 1	CEVO DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							MT TER.	EXTERNAL BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-72											
	1	BL-WH	R-72											
2	27	WH-OR	A-72											
	2	OR-WH	A1-72	Station Line 72										
3	28	WH-GN	LG-72											
	3	GN-WH	L-72											
4	29	WH-BN	RR-72											
	4	BN-WH	RT-72											
5	30	WH-SL	T-73											
	5	SL-WH	R-73											
6	31	RD-BL	A-73											
	6	BL-RD	A1-73	Station Line 73										
7	32	RD-OR	LG-73											
	7	OR-RD	L-73											
8	33	RD-GN	RR-73											
	8	GN-RD	RT-73											
9	34	RD-BN	T-74											
	9	BN-RD	R-74											
10	35	RD-SL	A-74											
	10	SL-RD	A1-74	Station Line 74										
11	36	BK-BL	LG-74											
	11	BL-BK	L-74											
12	37	BK-OR	RR-74											
	12	OR-BK	RT-74											
13	38	BK-GN	T-75											
	13	GN-BK	R-75											
14	39	BK-BN	A-75											
	14	BN-BK	A1-75	Station Line 75										
15	40	BK-SL	LG-75											
	15	SL-BK	L-75											
16	41	Y-BL	RR-75											
	16	BL-Y	RT-75											
17	42	Y-OR	T-76											
	17	OR-Y	R-76											
18	43	Y-GN	A-76											
	18	GN-Y	A1-76	Station Line 76										
19	44	Y-BN	LG-76											
	19	BN-Y	L-76											
20	45	Y-SL	RR-76											
	20	SL-Y	RT-76											
21	46	VI-BL	T-77											
	21	BL-VI	R-77											
22	47	VI-OR	A-77											
	22	OR-VI	A1-77	Station Line 77										
23	48	VI-GN	LG-77											
	23	GN-VI	L-77											
24	49	VI-BN	R-77											
	24	BN-VI	RT-77											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J014

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-78											
	1	BL-WH	R-78											
2	27	WH-OR	A-78											
	2	OR-WH	A1-78	Station Line 78										
3	28	WH-GN	LG-78											
	3	GN-WH	L-78											
4	29	WH-BN	RR-78											
	4	BN-WH	RT-78											
5	30	WH-SL	T-79											
	5	SL-WH	R-79											
6	31	RD-BL	A-79											
	6	BL-RD	A1-79	Station Line 79										
7	32	RD-OR	LG-79											
	7	OR-RD	L-79											
8	33	RD-GN	RR-79											
	8	GN-RD	RT-79											
9	34	RD-BN	T-80											
	9	BN-RD	R-80											
10	35	RD-SL	A-80											
	10	SL-RD	A1-80	Station Line 80										
11	36	BK-BL	LG-80											
	11	BL-BK	L-80											
12	37	BK-OR	RR-80											
	12	OR-BK	RT-80											
13	38	BK-GN	T-81											
	13	GN-BK	R-81											
14	39	BK-BN	A-81											
	14	BN-BK	A1-81	Station Line 81										
15	40	BK-SL	LG-81											
	15	SL-BK	L-81											
16	41	Y-BL	RR-81											
	16	BL-Y	RT-81											
17	42	Y-OR	T-82											
	17	OR-Y	R-82											
18	43	Y-GN	A-82											
	18	GN-Y	A1-82	Station Line 82										
19	44	Y-BN	LG-82											
	19	BN-Y	L-82											
20	45	Y-SL	RR-82											
	20	SL-Y	RT-82											
21	46	VI-BL	T-83											
	21	BL-VI	R-83											
22	47	VI-OR	A-83											
	22	OR-VI	A1-83	Station Line 83										
23	48	VI-GN	LG-83											
	23	GN-VI	L-83											
24	49	VI-BN	RR-83											
	24	BN-VI	RT-83											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J015

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME						NOTES
							INT.	EXTERNAL					
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-84											
	1	BL-WH	R-84											
2	27	WH-OR	A-84											
	2	OR-WH	A1-84	Station Line 84										
3	28	WH-GN	LG-84											
	3	GN-WH	L-84											
4	29	WH-BN	RR-84											
	4	BN-WH	RT-84											
5	30	WH-SL	T-85											
	5	SL-WH	R-85											
6	31	RD-BL	A-85											
	6	BL-RD	A1-85	Station Line 85										
7	32	RD-OR	LG-85											
	7	OR-RD	L-85											
8	33	RD-GN	RR-85											
	8	GN-RD	RT-85											
9	34	RD-BN	T-86											
	9	BN-RD	R-86											
10	35	RD-SL	A-86											
	10	SL-RD	A1-86	Station Line 86										
11	36	BK-BL	LG-86											
	11	BL-BK	L-86											
12	37	BK-OR	RR-86											
	12	OR-BK	RT-86											
13	38	BK-GN	T-87											
	13	GN-BK	R-87											
14	39	BK-BN	A-87											
	14	BN-BK	A1-87	Station Line 87										
15	40	BK-SL	LG-87											
	15	SL-BK	L-87											
16	41	Y-BL	RR-87											
	16	BL-Y	RT-87											
17	42	Y-OR	T-88											
	17	OR-Y	R-88											
18	43	Y-GN	A-88											
	18	GN-Y	A1-88	Station Line 88										
19	44	Y-BN	LG-88											
	19	BN-Y	L-88											
20	45	Y-SL	RR-88											
	20	SL-Y	RT-88											
21	46	VI-BL	T-89											
	21	BL-VI	R-89											
22	47	VI-OR	A-89											
	22	OR-VI	A1-89	Station Line 89										
23	48	VI-GN	LG-89											
	23	GN-VI	L-89											
24	49	VI-BN	RR-89											
	24	BN-VI	RT-89											
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J016

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-90											
	1	BL-WH	R-90											
2	27	WH-OR	A-90											
	2	OR-WH	A1-90	Station Line 90										
3	28	WH-GN	LG-90											
	3	GN-WH	L-90											
4	29	WH-BN	RR-90											
	4	BN-WH	RT-90											
5	30	WH-SL	T-91											
	5	SL-WH	R-91											
6	31	RD-BL	A-91											
	6	BL-RD	A1-91	Station Line 91										
7	32	RD-OR	LG-91											
	7	OR-RD	L-91											
8	33	RD-GN	RR-91											
	8	GN-RD	RT-91											
9	34	RD-BN	T-92											
	9	BN-RD	R-92											
10	35	RD-SL	A-92											
	10	SL-RD	A1-92	Station Line 92										
11	36	BK-BL	LG-92											
	11	BL-BK	L-92											
12	37	BK-OR	RR-92											
	12	OR-BK	RT-92											
13	38	BK-GN	T-93											
	13	GN-BK	R-93											
14	39	BK-BN	A-93											
	14	BN-BK	A1-93	Station Line 93										
15	40	BK-SL	LG-93											
	15	SL-BK	L-93											
16	41	Y-BL	RR-93											
	16	BL-Y	RT-93											
17	42	Y-OR	T-94											
	17	OR-Y	R-94											
18	43	Y-GN	A-94											
	18	GN-Y	A1-94	Station Line 94										
19	44	Y-BN	LG-94											
	19	BN-Y	L-94											
20	45	Y-SL	RR-94											
	20	SL-Y	RT-94											
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J017

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-95											
	1	BL-WH	R-95											
2	27	WH-OR	A-95											
	2	OR-WH	A1-95	Station Line 95										
3	28	WH-GN	LG-95											
	3	GN-WH	L-95											
4	29	WH-BN	RR-95											
	4	BN-WH	RT-95											
5	30	WH-SL	T-96											
	5	SL-WH	R-96											
6	31	RD-BL	A-96											
	6	BL-RD	A1-96	Station Line 96										
7	32	RD-OR	LG-96											
	7	OR-RD	L-96											
8	33	RD-GN	RR-96											
	8	GN-RD	RT-96											
9	34	RD-BN	T-97											
	9	BN-RD	R-97											
10	35	RD-SL	A-97											
	10	SL-RD	A1-97	Station Line 97										
11	36	BK-BL	LG-97											
	11	BL-BK	L-97											
12	37	BK-OR	RR-97											
	12	OR-BK	RT-97											
13	38	BK-GN	T-98											
	13	GN-BK	R-98											
14	39	BK-BN	A-98											
	14	BN-BK	A1-98	Station Line 98										
15	40	BK-SL	LG-98											
	15	SL-BK	L-98											
16	41	Y-BL	RR-98											
	16	BL-Y	RT-98											
17	42	Y-OR	T-99											
	17	OR-Y	R-99											
18	43	Y-GN	A-99											
	18	GN-Y	A1-99	Station Line 99										
19	44	Y-BN	LG-99											
	19	BN-Y	L-99											
20	45	Y-SL	RR-99											
	20	SL-Y	RT-99											
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J018

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-1											
	1	BL-WH	R-1											
2	27	WH-OR	STC2-1											
	2	OR-WH	STC1-1											
3	28	WH-GN	T1-1											
	3	GN-WH	R1-1	Private Line 1										
4	29	WH-BN	A-1											
	4	BN-WH	A1-1											
5	30	WH-SL	LG-1											
	5	SL-WH	L-1											
6	31	RD-BL	RR-1											
	6	BL-RD	RT-1											
7	32	RD-OR	T-2											
	7	OR-RD	R-2											
8	33	RD-GN	STC2-2											
	8	GN-RD	STC1-2											
9	34	RD-BN	T1-2											
	9	BN-RD	R1-2	Private Line 2										
10	35	RD-SL	A-2											
	10	SL-RD	A1-2											
11	36	BK-BL	LG-2											
	11	BL-BK	L-2											
12	37	BK-OR	RR-2											
	12	OR-BK	RT-2											
13	38	BK-GN	T1-1											
	13	GN-BK	R1-1	Manual Intercom 1										
14	39	BK-BN	LG1-1											
	14	BN-BK	L1-1											
15	40	BK-SL	T1-2											
	15	SL-BK	R1-2	Manual Intercom 2										
16	41	Y-BL	LG1-2											
	16	BL-Y	L1-2											
17	42	Y-OR	T1-3											
	17	OR-Y	R1-3	Manual Intercom 3										
18	43	Y-GN	LG1-3											
	18	GN-Y	L1-3											
19	44	Y-BN		Spare										
	19	BN-Y		Spare										
20	45	Y-SL		Spare										
	20	SL-Y		Spare										
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL	BUZR	Buzzer Connections										
	25	SL-VI	BUZA	for Man, Inter, Lines										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J019

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-3		T-TPR-X6	Rec, Discon, 6								
	1	BL-WH	R-3			Not Used								
2	27	WH-OR	STC2-3			Not Used								
	2	OR-WH	STC1-3		T-TPR-X5	Rec, Discon, 5								
3	28	WH-GN	T1-3		T-X3	Rec, Discon, 3								
	3	GN-WH	R1-3	Private Line 3		Not Used								
4	29	WH-BN	A-3		T-TPR-X3	Rec, Discon, 3								
	4	BN-WH	A1-3			Not Used								
5	30	WH-SL	LG-3			Not Used								
	5	SL-WH	L-3			Not Used								
6	31	RD-BL	RR-3			Not Used								
	6	BL-RD	RT-3			Not Used								
7	32	RD-OR	T-4			Not Used								
	7	OR-RD	R-4		T-X6	Rec, Discon, 6								
8	33	RD-GN	STC2-4			Not Used								
	8	GN-RD	STC1-4			Not Used								
9	34	RD-BN	T1-4		T-TPR-X2	Rec, Discon, 2								
	9	BN-RD	R1-4	Private Line 4	T-TPR-X1	Rec, Discon, 1								
10	35	RD-SL	A-4		T-X5	Rec, Discon, 5								
	10	SL-RD	A1-4			Not Used								
11	36	BK-BL	LG-4			Not Used								
	11	BL-BK	L-4			Not Used								
12	37	BK-OR	RR-4			Not Used								
	12	OR-BK	RT-4			Not Used								
13	38	BK-GN	T1-4		T-X1	Rec, Discon, 1								
	13	GN-BK	R1-4	Manual Intercom 4		Not Used								
14	39	BK-BN	LG1-4			Not Used								
	14	BN-BK	L1-4			Not Used								
15	40	BK-SL	T1-5		T-X2	Rec, Discon, 2								
	15	SL-BK	R1-5	Manual Intercom 5		Not Used								
16	41	Y-BL	LG1-5			Not Used								
	16	BL-Y	L1-5		T-X4	Rec, Discon, 4								
17	42	Y-OR	T1-6			Not Used								
	17	OR-Y	R1-6	Manual Intercom 6		Not Used								
18	43	Y-GN	LG1-6			Not Used								
	18	GN-Y	L1-6		T-TPR-X4	Rec, Discon, 4								
19	44	Y-BN		Spare		Spare								
	19	BN-Y		Spare		Spare								
20	45	Y-SL		Spare		Spare								
	20	SL-Y		Spare		Spare								
21	46	VI-BL		Spare		Spare								
	21	BL-VI		Spare		Spare								
22	47	VI-OR		Spare		Spare								
	22	OR-VI		Spare		Spare								
23	48	VI-GN		Spare		Spare								
	23	GN-VI		Spare		Spare								
24	49	VI-BN		Spare		Spare								
	24	BN-VI		Spare		Spare								
25	50	VI-SL	BUZR	Buzzer Connections		Spare								
	25	SL-VI	BUZA	for Man. Intercom		Spare								

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J020

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T-5											
	1	BL-WH	R-5											
2	27	WH-OR	STC2-5											
	2	OR-WH	STC1-5											
3	28	WH-GN	T1-5											
	3	GN-WH	R1-5	Private Line 5										
4	29	WH-BN	A-5											
	4	BN-WH	A1-5											
5	30	WH-SL	LG-5											
	5	SL-WH	L-5											
6	31	RD-BL	RR-5											
	6	BL-RD	RT-5											
7	32	RD-OR	T-6											
	7	OR-RD	R-6											
8	33	RD-GN	STC2-6											
	8	GN-RD	STC1-6											
9	34	RD-BN	T1-6											
	9	BN-RD	R1-6	Private Line 6										
10	35	RD-SL	A-6											
	10	SL-RD	A1-6											
11	36	BK-BL	LG-6											
	11	BL-BK	L-6											
12	37	BK-OR	RR-6											
	12	OR-BK	RT-6											
13	38	BK-GN	T1-7											
	13	GN-BK	R1-7	Manual Intercom 7										
14	39	BK-BN	LG1-7											
	14	BN-BK	L1-7											
15	40	BK-SL	T1-8											
	15	SL-BK	R1-8	Manual Intercom 8										
16	41	Y-BL	LG1-8											
	16	BL-Y	L1-8											
17	42	Y-OR	T1-9											
	17	OR-Y	R1-9	Manual Intercom 9										
18	43	Y-GN	LG1-9											
	18	GN-Y	L1-9											
19	44	Y-BN		Spare										
	19	BN-Y		Spare										
20	45	Y-SL		Spare										
	20	SL-Y		Spare										
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL	BUZR	Buzzer Connections										
	25	SL-VI	BUZA	for Man. Intercom										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J021

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	TD1-1											
	1	BL-WH	RD1-1											
2	27	WH-OR	TD2-1											
	2	OR-WH	RD2-1	Pwr.Fail.Xfer.Ckt. 1										
3	28	WH-GN	TL1-1											
	3	GN-WH	RL1-1											
4	29	WH-BN	TL2-1											
	4	BN-WH	RL2-1											
5	30	WH-SL	TD1-2											
	5	SL-WH	RD1-2											
6	31	RD-BL	TD2-2											
	6	BL-RD	RD2-2	Pwr.Fail.Xfer.Ckt. 2										
7	32	RD-OR	TL1-2											
	7	OR-RD	RL1-2											
8	33	RD-GN	TL2-2											
	8	GN-RD	RL2-2											
9	34	RD-BN	TD1-3											
	9	BN-RD	RD1-3											
10	35	RD-SL	TD2-3											
	10	SL-RD	RD2-3	Pwr.Fail.Xfer.Ckt. 3										
11	36	BK-BL	TL1-3											
	11	BL-BK	RL1-3											
12	37	BK-OR	TL2-3											
	12	OR-BK	RL2-3											
13	38	BK-GN	TD1-4											
	13	GN-BK	RD1-4											
14	39	BK-BN	TD2-4											
	14	BN-BK	RD2-4	Pwr.Fail.Xfer.Ckt. 4										
15	40	BK-SL	TL1-4											
	15	SL-BK	RL1-4											
16	41	Y-BL	TL2-4											
	16	BL-Y	RL2-4											
17	42	Y-OR	TD1-5											
	17	OR-Y	RD2-5											
18	43	Y-GN	TD2-5											
	18	GN-Y	RD2-5	Pwr.Fail.Xfer.Ckt. 5										
19	44	Y-BN	TL1-5											
	19	BN-Y	RL1-5											
20	45	Y-SL	TL2-5											
	20	SL-Y	RL2-5											
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J022

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	TD1-6											
	1	BL-WH	RD1-6											
2	27	WH-OR	TD2-6											
	2	OR-WH	RD2-6	Pwr.Fail.Xfer.Ckt. 6										
3	28	WH-GN	TL1-6											
	3	GN-WH	RL1-6											
4	29	WH-BN	TL2-6											
	4	BN-WH	RL2-6											
5	30	WH-SL	TD1-7											
	5	SL-WH	RD1-7											
6	31	RD-BL	TD2-7											
	6	BL-RD	RD2-7	Pwr.Fail.Xfer.Ckt. 7										
7	32	RD-OR	TL1-7											
	7	OR-RD	RL1-7											
8	33	RD-GN	TL2-7											
	8	GN-RD	RL2-7											
9	34	RD-BN	TD1-8											
	9	BN-RD	RD1-8											
10	35	RD-SL	TD2-8											
	10	SL-RD	RD2-8	Pwr.Fail.Xfer.Ckt. 8										
11	36	BK-BL	TL1-8											
	11	BL-BK	RL2-8											
12	37	BK-OR	TL2-8											
	12	OR-BK	RL2-8											
13	38	BK-GN	TD1-9											
	13	GN-BK	RD1-9											
14	39	BK-BN	TD2-9											
	14	BN-BK	RD2-9	Pwr.Fail.Xfer.Ckt. 9										
15	40	BK-SL	TL1-9											
	15	SL-BK	RL1-9											
16	41	Y-BL	TL2-9											
	16	BL-Y	RL2-9											
17	42	Y-OR	TD1-10											
	17	OR-Y	RD1-10											
18	43	Y-GN	TD2-10											
	18	GN-Y	RD2-10	Att.Pwr.Fail.Xfer.Ckt. 10										
19	44	Y-BN	TL1-10											
	19	BN-Y	RL1-10											
20	45	Y-SL	TL2-10											
	20	SL-Y	RL2-10											
21	46	VI-BL	OL	Overflow Att.										
	21	BL-VI	AAR											
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN	GND	Ground										
	24	BN-VI	GND	Ground										
25	50	VI-SL	GND	Ground										
	25	SL-VI	GND	Ground										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J023

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	A1-1											
	1	BL-WH	B1-1											
2	27	WH-OR	C1-1	Chan. Motherboard										
	2	OR-WH	D1-1	Opt. 1 (Card Pos. 10)										
3	28	WH-GN	E1-1											
	3	GN-WH	F1-1											
4	29	WH-BN	A2-2											
	4	BN-WH	B2-2											
5	30	WH-SL	C2-2	Chan. Motherboard										
	5	SL-WH	D2-2	Opt. 2 (Card Pos. 11)										
6	31	RD-BL	E2-2											
	6	BL-RD	F2-2											
7	32	RD-OR	A3-3											
	7	OR-RD	B3-3											
8	33	RD-GN	C3-3	Chan. Motherboard										
	8	GN-RD	D3-3	Opt. 3 (Card Pos. 12)										
9	34	RD-BN	E3-3											
	9	BN-RD	F3-3											
10	35	RD-SL	A4-4											
	10	SL-RD	B4-4											
11	36	BK-BL	C4-4	Chan. Motherboard										
	11	BL-BK	D4-4	Opt. 4 (Card Pos. 13)										
12	37	BK-OR	E4-4											
	12	OR-BK	F4-4											
13	38	BK-GN	A5-5											
	13	GN-BK	B5-5											
14	39	BK-BN	C5-5	Chan. Motherboard										
	14	BN-BK	D5-5	Opt. 5 (Card Pos. 14)										
15	40	BK-SL	E5-5											
	15	SL-BK	F5-5											
16	41	Y-BL		Spare										
	16	BL-Y		Spare										
17	42	Y-OR		Spare										
	17	OR-Y		Spare										
18	43	Y-GN		Spare										
	18	GN-Y		Spare										
19	44	Y-BN		Spare										
	19	BN-Y	PR3											
20	45	Y-SL	PR2	Code Call										
	20	SL-Y	PR1											
21	46	VI-BL	AB	Audible										
	21	BL-VI	AA											
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN	UNAT											
	23	GN-VI	UNAR	Unassigned Night										
24	49	VI-BN	UNAB	Answer										
	24	BN-VI	UNAA											
25	50	VI-SL	CO Minor	Minor Alarm to CO										
	25	SL-VI	CO Major	Major Alarm to CO										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J024

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	A-6											
	1	BL-WH	B-6											
2	27	WH-OR	C-6											
	2	OR-WH	D-6											
3	28	WH-GN	E-6											
	3	GN-WH	F-6											
4	29	WH-BN	G-6											
	4	BN-WH	H-6	(Chan. Motherboard										
5	30	WH-SL	J-6	Pos. 25)										
	5	SL-WH	K-6											
6	31	RD-BL	L-6											
	6	BL-RD	M-6											
7	32	RD-OR	N-6											
	7	OR-RD	P-6											
8	33	RD-GN	Q-6											
	8	GN-RD	R-6											
9	34	RD-BN	S-6											
	9	BN-RD	T-6											
10	35	RD-SL	V-6											
	10	SL-RD	W-6											
11	36	BK-BL	A-7											
	11	BL-BK	B-7											
12	37	BK-OR	C-7											
	12	OR-BK	D-7											
13	38	BK-GN	E-7											
	13	GN-BK	F-7											
14	39	BK-BN	G-7											
	14	BN-BK	H-7	(Chan. Motherboard										
15	40	BK-SL	J-7	Pos. 26)										
	15	SL-BK	K-7											
16	41	Y-BL	L-7											
	16	BL-Y	M-7											
17	42	Y-OR	N-7											
	17	OR-Y	P-7											
18	43	Y-GN	Q-7											
	18	GN-Y	R-7											
19	44	Y-BN	S-7											
	19	BN-Y	T-7											
20	45	Y-SL	V-7											
	20	SL-Y	W-7											
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J025

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	CBS1											
	1	BL-WH	CBS2											
2	27	WH-OR	CDT-1											
	2	OR-WH	CCK-1											
3	28	WH-GN	CDT-2	AIOD										
	3	GN-WH	CCK-2											
4	29	WH-BN	CS1											
	4	BN-WH	CS2											
5	30	WH-SL	CG											
	5	SL-WH												
6	31	RD-BL												
	6	BL-RD												
7	32	RD-OR												
	7	OR-RD												
8	33	RD-GN												
	8	GN-RD												
9	34	RD-BN												
	9	BN-RD												
10	35	RD-SL												
	10	SL-RD												
11	36	BK-BL												
	11	BL-BK												
12	37	BK-OR												
	12	OR-BK												
13	38	BK-GN												
	13	GN-BK												
14	39	BK-BN												
	14	BN-BK												
15	40	BK-SL												
	15	SL-BK												
16	41	Y-BL												
	16	BL-Y												
17	42	Y-OR												
	17	OR-Y												
18	43	Y-GN												
	18	GN-Y												
19	44	Y-BN												
	19	BN-Y												
20	45	Y-SL												
	20	SL-Y												
21	46	VI-BL												
	21	BL-VI												
22	47	VI-OR												
	22	OR-VI												
23	48	VI-GN												
	23	GN-VI												
24	49	VI-BN												
	24	BN-VI												
25	50	VI-SL												
	25	SL-VI												

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J026

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD * DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	T1	Trunk 1	CT1	Trunk 1								
	1	BL-WH	R1		CR1									
2	27	WH-OR	T2	Trunk 2	CT2	Trunk 2								
	2	OR-WH	R2		CR2									
3	28	WH-GN	T3	Trunk 3	CT3	Trunk 3								
	3	GN-WH	R3		CR3									
4	29	WH-BN	T4	Trunk 4	CT4	Trunk 4								
	4	BN-WH	R4		CR4									
5	30	WH-SL	T5	Trunk 5	CT5	Trunk 5								
	5	SL-WH	R5		CR5									
6	31	RD-BL	T6	Trunk 6	CT6	Trunk 6								
	6	BL-RD	R6		CR6									
7	32	RD-OR	T7	Trunk 7	CT7	Trunk 7								
	7	OR-RD	R7		CR7									
8	33	RD-GN	T8	Trunk 8	CT8	Trunk 8								
	8	GN-RD	R8		CR8									
9	34	RD-BN	T9	Trunk 9	CT9	Trunk 9								
	9	BN-RD	R9		CR9									
10	35	RD-SL	T10	Trunk 10	CT10	Trunk 10								
	10	SL-RD	R10		CR10									
11	36	BK-BL	T11	Trunk 11	CT11	Trunk 11								
	11	BL-BK	R11		CR11									
12	37	BK-OR	T12	Trunk 12	CT12	Trunk 12								
	12	OR-BK	R12		CR12									
13	38	BK-GN	T13	Trunk 13	CT13	Trunk 13								
	13	GN-BK	R13		CR13									
14	39	BK-BN	T14	Trunk 14	CT14	Trunk 14								
	14	BN-BK	R14		CR14									
15	40	BK-SL	T15	Trunk 15	CT15	Trunk 15								
	15	SL-BK	R15		CR15									
16	41	Y-BL	T16	Trunk 16	CT16	Trunk 16								
	16	BL-Y	R16		CR16									
17	42	Y-OR	T17	Trunk 17	CT17	Trunk 17								
	17	OR-Y	R17		CR17									
18	43	Y-GN	T18	Trunk 18	CT18	Trunk 18								
	18	GN-Y	R18		CR18									
19	44	Y-BN	T19	Trunk 19	CT19	Trunk 19								
	19	BN-Y	R19		CR19									
20	45	Y-SL	T20	Trunk 20	CT20	Trunk 20								
	20	SL-Y	R20		CR20									
21	46	VI-BL	T21	Trunk 21	CT21	Trunk 21								
	21	BL-VI	R21		CR21									
22	47	VI-OR	T22	Trunk 22	CT22	Trunk 22								
	22	OR-VI	R22		CR22									
23	48	VI-GN	T23	Trunk 23	CT23	Trunk 23								
	23	GN-VI	R23		CR23									
24	49	VI-BN	T24	Trunk 24	CT24	Trunk 24								
	24	BN-VI	R24		CR24									
25	50	VI-SL	MT	Music on Hold										
	25	SL-VI	MR											

*Lead designations when interconnect device is used.

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J027

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD * DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	CS-1		(M-1) [CTM-1] ⟨CS-1⟩									
	1	BL-WH	CG-1		⟨CG-1⟩									
2	27	WH-OR	C1-1											
	2	OR-WH	C2-1	Trunk 1		Trunk 1								
3	28	WH-GN	CRV1-1		(E-1) [CTE-1]									
	3	GN-WH	CRV2-1											
4	29	WH-BN	CBS1-1		⟨CBS1-1⟩									
	4	BN-WH	CBS2-1		[CG-1] ⟨CBS-1⟩									
5	30	WH-SL	CS-2		(M-2) [CTM-2] ⟨CS-2⟩									
	5	SL-WH	CG-2		⟨CG-2⟩									
6	31	RD-BL	C1-2											
	6	BL-RD	C2-2	Trunk 2		Trunk 2								
7	32	RD-OR	CRV1-2											
	7	OR-RD	CRV2-2											
8	33	RD-GN	CBS1-2		⟨CBS1-2⟩									
	8	GN-RD	CBS2-2		[CG-2] ⟨CBS-2⟩									
9	34	RD-BN	CS-3		(M-3) [CTM-3] ⟨CS-3⟩									
	9	BN-RD	CG-3		⟨CG-3⟩									
10	35	RD-SL	C1-3											
	10	SL-RD	C2-3	Trunk 3		Trunk 3								
11	36	BK-BL	CRV1-3		(E-3) [CTE-3]									
	11	BL-BK	CRV2-3											
12	37	BK-OR	CBS1-3		⟨CBS1-3⟩									
	12	OR-BK	CBS2-3		[CG-3] ⟨CBS-3⟩									
13	38	BK-GN	CS-4		(M-4) [CTM-4] ⟨CS-4⟩									
	13	GN-BK	CG-4		⟨CG-4⟩									
14	39	BK-BN	C1-4	Trunk 4		Trunk 4								
	14	BN-BK	C2-4											
15	40	BK-SL	CRV1-4		(E-4) [CTE-4]									
	15	SL-BK	CRV2-4											
16	41	Y-BL	CBS1-4		⟨CBS1-4⟩									
	16	BL-Y	CBS2-4		[CG-4] ⟨CBS-4⟩									
17	42	Y-OR	CS-5		(M-5) [CTM-5] ⟨CS-5⟩									
	17	OR-Y	CG-5		⟨CG-5⟩									
18	43	Y-GN	C1-5											
	18	GN-Y	C2-5	Trunk 5		Trunk 5								
19	44	Y-BN	CRV1-5		(E-5) [CTE-5]									
	19	BN-Y	CRV2-5											
20	45	Y-SL	CBS1-5		⟨CBS1-5⟩									
	20	SL-Y	CBS2-5		[CG-5] ⟨CBS-5⟩									
21	46	VI-BL	CS-6		(M-6) [CTM-6] ⟨CS-6⟩									
	21	BL-VI	CG-6		⟨CG-6⟩									
22	47	VI-OR	C1-6											
	22	OR-VI	C2-6	Trunk 6		Trunk 6								
23	48	VI-GN	CRV1-6		(E-6) [CTE-6]									
	23	GN-VI	CRV2-6											
24	49	VI-BN	CBS1-6		⟨CBS1-6⟩									
	24	BN-VI	CBS2-6		[CG-6] ⟨CBS-6⟩									
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

*Designations in ( ) for E&M Trunks – No Interconnect Device
Designations in [ ] for E&M Trunks – CDQ-2X Interconnect Device
Designations in ⟨ ⟩ for E&M Trunks – CDQ-2W Interconnect Device

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J028

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD * DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	CS-7		(M-7) [CTM-7] ⟨CS-7⟩									
	1	BL-WH	CG-7		⟨CG-7⟩									
2	27	WH-OR	C1-7											
	2	OR-WH	C2-7	Trunk 7		Trunk 7								
3	28	WH-GN	CRV1-7		(E-7) [CTE-7]									
	3	GN-WH	CRV2-7											
4	29	WH-BN	CBS1-7		⟨CBS1-7⟩									
	4	BN-WH	CBS2-7		[CG-7] ⟨CBS-7⟩									
5	30	WH-SL	CS-8		(M-8) [CTM-8] ⟨CS-8⟩									
	5	SL-WH	CG-8		⟨CG-8⟩									
6	31	RD-BL	C1-8											
	6	BL-RD	C2-8	Trunk 8		Trunk 8								
7	32	RD-OR	CRV1-8		(E-8) [CTE-8]									
	7	OR-RD	CRV2-8											
8	33	RD-GN	CBS1-8		⟨CBS1-8⟩									
	8	GN-RD	CBS2-8		[CG-8] ⟨CBS-8⟩									
9	34	RD-BN	CS-9		(M-9) [CTM-9] ⟨CS-9⟩									
	9	BN-RD	CG-9		⟨CG-9⟩									
10	35	RD-SL	C1-9											
	10	SL-RD	C2-9	Trunk 9		Trunk 9								
11	36	BK-BL	CRV1-9		(E-9) [CTE-9]									
	11	BL-BK	CRV2-9											
12	37	BK-OR	CBS1-9		⟨CBS1-9⟩									
	12	OR-BK	CBS2-9		[CG-9] ⟨CBS-9⟩									
13	38	BK-GN	CS-10		(M-10) [CTM-10] ⟨CS-10⟩									
	13	GN-BK	CG-10		⟨CG-10⟩									
14	39	BK-BN	C1-10											
	14	BN-BK	C2-10	Trunk 10		Trunk 10								
15	40	BK-SL	CRV1-10		(E-10) [CTE-10]									
	15	SL-BK	CRV2-10											
16	41	Y-BL	CBS1-10											
	16	BL-Y	CBS2-10		[CG-10] ⟨CBS-10⟩									
17	42	Y-OR	CS-11		(M-11) [CTM-11] ⟨CS-11⟩									
	17	OR-Y	CG-11		⟨CG-11⟩									
18	43	Y-GN	C1-11											
	18	GN-Y	C2-11	Trunk 11		Trunk 11								
19	44	Y-BN	CRV1-11		(E-11) [CTE-11]									
	19	BN-Y	CRV2-11											
20	45	Y-SL	CBS1-11		⟨CBS1-11⟩									
	20	SL-Y	CBS2-11		[CG-11] ⟨CBS-11⟩									
21	46	VI-BL	CS-12		(M-12) [CTM-12] ⟨CS-12⟩									
	21	BL-VI	CG-12		⟨CG-12⟩									
22	47	VI-OR	C1-12											
	22	OR-VI	C2-12	Trunk 12		Trunk 12								
23	48	VI-GN	CRV1-12		(E-12) [CTE-12]									
	23	GN-VI	CRV2-12											
24	49	VI-BN	CBS1-12											
	24	BN-VI	CBS2-12		[CG-12] ⟨CBS-12⟩									
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

*Designations in ( ) for E&M Trunks – No Interconnect Device
Designations in [ ] for E&M Trunks – CDQ-2X Interconnect Device
Designations in ⟨ ⟩ for E&M Trunks – CDQ-2W Interconnect Device

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J029

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD* DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	CS-13		(M-13) [CTM-13] ⟨CS-13⟩									
	1	BL-WH	CG-13		⟨CG-13⟩									
2	27	WH-OR	C1-13											
	2	OR-WH	C2-13	Trunk 13		Trunk 13								
3	28	WH-GN	CRV1-13		(E-13) [CTE-13]									
	3	GN-WH	CRV2-13											
4	29	WH-BN	CBS1-13		⟨CBS1-13⟩									
	4	BN-WH	CBS2-13		[CG-13] ⟨CBS-13⟩									
5	30	WH-SL	CS-14		(M-14) [CTM-14] ⟨CS-14⟩									
	5	SL-WH	CG-14		⟨CG-14⟩									
6	31	RD-BL	C1-14											
	6	BL-RD	C2-14	Trunk 14		Trunk 14								
7	32	RD-OR	CRV1-14		(E-14) [CTE-14]									
	7	OR-RD	CRV2-14											
8	33	RD-GN	CBS1-14		⟨CBS1-14⟩									
	8	GN-RD	CBS2-14		[CG-14] ⟨CBS-14⟩									
9	34	RD-BN	CS-15		(M-15) [CTM-15] ⟨CS-15⟩									
	9	BN-RD	CG-15		⟨CG-15⟩									
10	35	RD-SL	C1-15											
	10	SL-RD	C2-15	Trunk 15		Trunk 15								
11	36	BK-BL	CRV1-15		(E-15) [CTE-15]									
	11	BL-BK	CRV2-15											
12	37	BK-OR	CBS1-15		⟨CBS1-15⟩									
	12	OR-BK	CBS2-15		[CG-15] ⟨CBS1-16⟩									
13	38	BK-GN	CS-16		(M-16) [CTM-16] ⟨CS-16⟩									
	13	GN-BK	CG-16		⟨CG-16⟩									
14	39	BK-BN	C1-16											
	14	BN-BK	C2-16	Trunk 16		Trunk 16								
15	40	BK-SL	CRV1-16		(E-16) [CTE-16]									
	15	SL-BK	CRV2-16											
16	41	Y-BL	CBS1-16		⟨CBS1-16⟩									
	16	BL-Y	CBS2-16		[CG-16] ⟨CBS-16⟩									
17	42	Y-OR	CS-17		(M-17) [CTM-17] ⟨CS-17⟩									
	17	OR-Y	CG-17		⟨CG-17⟩									
18	43	Y-GN	C1-17											
	18	GN-Y	C2-17	Trunk 17		Trunk 17								
19	44	Y-BN	CRV1-17		(E-17) [CTE-17]									
	19	BN-Y	CRV2-17											
20	45	Y-SL	CBS1-17		⟨CBS1-17⟩									
	20	SL-Y	CBS2-17		[CG-17] ⟨CBS-17⟩									
21	46	VI-BL	CS-18		(M-18) [CTM-18] ⟨CS-18⟩									
	21	BL-VI	CG-18		⟨CG-18⟩									
22	47	VI-OR	C1-18											
	22	OR-VI	C2-18	Trunk 18		Trunk 18								
23	48	VI-GN	CRV1-18		(E-18) [CTE-18]									
	23	GN-VI	CRV2-18											
24	49	VI-BN	CBS1-18		⟨CBS1-18⟩									
	24	BN-VI	CBS2-18		[CG-18] ⟨CBS-18⟩									
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

*Designations in ( ) for E&M Trunks – No Interconnect Device
Designations in [ ] for E&M Trunks – CDQ-2X Interconnect Device
Designations in ⟨ ⟩ for E&M Trunks – CDQ-2W Interconnect Device

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J030

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD * DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	CS-19		(M-19) [CTM-19] ⟨CS-19⟩									
	1	BL-WH	CG-19		⟨CG-19⟩									
2	27	WH-OR	C1-19											
	2	OR-WH	C2-19	Trunk 19		Trunk 19								
3	28	WH-GN	CRV1-19		(E-19) [CTE-19]									
	3	GN-WH	CRV2-19											
4	29	WH-BN	CBS1-19		⟨CBS1-19⟩									
	4	BN-WH	CBS2-19		[CG-19] ⟨CBS-19⟩									
5	30	WH-SL	CS-20		(M-20) [CTM-20] ⟨CS-20⟩									
	5	SL-WH	CG-20		⟨CG-20⟩									
6	31	RD-BL	C1-20											
	6	BL-RD	C2-20	Trunk 20		Trunk 20								
7	32	RD-OR	CRV1-20		(E-20) [CTE-20]									
	7	OR-RD	CRV2-20											
8	33	RD-GN	CBS1-20		⟨CBS1-20⟩									
	8	GN-RD	CBS2-20		[CG-20] ⟨CBS-20⟩									
9	34	RD-BN	CS-21		(M-21) [CTM-21] ⟨CS-21⟩									
	9	BN-RD	CG-21		⟨CG-21⟩									
10	35	RD-SL	C1-21											
	10	SL-RD	C2-21	Trunk 21		Trunk 21								
11	36	BK-BL	CRV1-21		(E-21) [CTE-21]									
	11	BL-BK	CRV2-21											
12	37	BK-OR	CBS1-21		⟨CBS1-21⟩									
	12	OR-BK	CBS2-21		[CG-21] ⟨CBS-21⟩									
13	38	BK-GN	CS-22		(M-22) [CTM-22] ⟨CS-22⟩									
	13	GN-BK	CG-22		⟨CG-22⟩									
14	39	BK-BN	C1-22											
	14	BN-BK	C2-22	Trunk 22		Trunk 22								
15	40	BK-SL	CRV1-22		(E-22) [CTE-22]									
	15	SL-BK	CRV2-22											
16	41	Y-BL	CBS1-22		⟨CBS1-22⟩									
	16	BL-Y	CBS2-22		[CG-22] ⟨CBS-22⟩									
17	42	Y-OR	CS-23		(M-23) [CTM-23] ⟨CS-23⟩									
	17	OR-Y	CG-23		⟨CG-23⟩									
18	43	Y-GN	C1-23											
	18	GN-Y	C2-23	Trunk 23		Trunk 23								
19	44	Y-BN	CRV1-23		(E-23) [CTE-23]									
	19	BN-Y	CRV2-23											
20	45	Y-SL	CBS1-23		⟨CBS1-23⟩									
	20	SL-Y	CBS2-23		[CG-23] ⟨CBS-23⟩									
21	46	VI-BL	CS-24		(M-24) [CTM-24] ⟨CS-24⟩									
	21	BL-VI	CG-24		⟨CG-24⟩									
22	47	VI-OR	C1-24											
	22	OR-VI	C2-24	Trunk 24		Trunk 24								
23	48	VI-GN	CRV1-24		(E-24) [CTE-24]									
	23	GN-VI	CRV2-24											
24	49	VI-BN	CBS1-24		⟨CBS1-24⟩									
	24	BN-VI	CBS2-24		[CG-24] ⟨CBS-24⟩									
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

*Designations in ( ) for E&M Trunks — No Interconnect Device
Designations in [ ] for E&M Trunks — CDQ-2X Interconnect Device
Designations in ⟨ ⟩ for E&M Trunks — CDQ-2W Interconnect Device

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J031

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	I-2A											
	1	BL-WH	TM1											
2	27	WH-OR	I-3A											
	2	OR-WH	TM2											
3	28	WH-GN	I-4A											
	3	GN-WH	TM3											
4	29	WH-BN	SO-1A											
	4	BN-WH	TM4											
5	30	WH-SL	SO-2A											
	5	SL-WH	TM5	Traffic Usage Recorder										
6	31	RD-BL	SO-3A											
	6	BL-RD	TM6											
7	32	RD-OR	SO-4A											
	7	OR-RD	TM7											
8	33	RD-GN	PC											
	8	GN-RD	TM8											
9	34	RD-BN	OVFL											
	9	BN-RD	TM9											
10	35	RD-SL	CS-2A											
	10	SL-RD	TM10											
11	36	BK-BL	PC22											
	11	BL-BK	TM11											
12	37	BK-OR	PC23											
	12	OR-BK	TM12											
13	38	BK-GN	S-1											
	13	GN-BK	TM13											
14	39	BK-BN	50ms,SC61											
	14	BN-BK	TM14											
15	40	BK-SL	GP11											
	15	SL-BK	TM15											
16	41	Y-BL	+5V											
	16	BL-Y	TM16											
17	42	Y-OR	+5V											
	17	OR-Y	TM17											
18	43	Y-GN	GND A											
	18	GN-Y	TM18											
19	44	Y-BN	GND A											
	19	BN-Y	TM19											
20	45	Y-SL	-48V											
	20	SL-Y	TM20											
21	46	VI-BL	-48V											
	21	BL-VI	TM21											
22	47	VI-OR	GND C											
	22	OR-VI	TM32											
23	48	VI-GN	GND C											
	23	GN-VI	TM23											
24	49	VI-BN	SC32											
	24	BN-VI	TM24											
25	50	VI-SL	50 ms											
	25	SL-VI	I-1A											

TABLE 5.31 [illegible]

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	RC 00	Station 00										
	1	BL-WH	RC 01	Station 01										
2	27	WH-OR	RC 02	Station 02										
	2	OR-WH	RC 03	Station 03										
3	28	WH-GN	RC 04	Station 04										
	3	GN-WH	RC 05	Station 05										
4	29	WH-BN	RC 06	Station 06										
	4	BN-WH	RC 07	Station 07										
5	30	WH-SL	RC 08	Station 08										
	5	SL-WH	RC 09	Station 09										
6	31	RD-BL	RC 10	Station 10										
	6	BL-RD	RC 11	Station 11										
7	32	RD-OR	RC 12	Station 12										
	7	OR-RD	RC 13	Station 13										
8	33	RD-GN	RC 14	Station 14										
	8	GN-RD	RC 15	Station 15										
9	34	RD-BN	RC 16	Station 16										
	9	BN-RD	RC 17	Station 17										
10	35	RD-SL	RC 18	Station 18										
	10	SL-RD	RC 19	Station 19										
11	36	BK-BL	RC 20	Station 20										
	11	BL-BK	RC 21	Station 21										
12	37	BK-OR	RC 22	Station 22										
	12	OR-BK	RC 23	Station 23										
13	38	BK-GN	RC 24	Station 24										
	13	GN-BK	RC 25	Station 25										
14	39	BK-BN	RC 26	Station 26										
	14	BN-BK	RC 27	Station 27										
15	40	BK-SL	RC 28	Station 28										
	15	SL-BK	RC 29	Station 29										
16	41	Y-BL	RC 30	Station 30										
	16	BL-Y	RC 31	Station 31										
17	42	Y-OR	RC 32	Station 32										
	17	OR-Y	RC 33	Station 33										
18	43	Y-GN	RC 34	Station 34										
	18	GN-Y	RC 35	Station 35										
19	44	Y-BN	RC 36	Station 36										
	19	BN-Y	RC 37	Station 37										
20	45	Y-SL	RC 38	Station 38										
	20	SL-Y	RC 39	Station 39										
21	46	VI-BL	RC 40	Station 40										
	21	BL-VI	RC 41	Station 41										
22	47	VI-OR	RC 42	Station 42										
	22	OR-VI	RC 43	Station 43										
23	48	VI-GN	RC 44	Station 44										
	23	GN-VI	RC 45	Station 45										
24	49	VI-BN	RC 46	Station 46										
	24	BN-VI	RC 47	Station 47										
25	50	VI-SL	RC 48	Station 48										
	25	SL-VI	RC 49	Station 49										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J033

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	RC 50	Station 50										
	1	BL-WH	RC 51	Station 51										
2	27	WH-OR	RC 52	Station 52										
	2	OR-WH	RC 53	Station 53										
3	28	WH-GN	RC 54	Station 54										
	3	GN-WH	RC 55	Station 55										
4	29	WH-BN	RC 56	Station 56										
	4	BN-WH	RC 57	Station 57										
5	30	WH-SL	RC 58	Station 58										
	5	SL-WH	RC 59	Station 59										
6	31	RD-BL	RC 60	Station 60										
	6	BL-RD	RC 61	Station 61										
7	32	RD-OR	RC 62	Station 62										
	7	OR-RD	RC 63	Station 63										
8	33	RD-GN	RC 64	Station 64										
	8	GN-RD	RC 65	Station 65										
9	34	RD-BN	RC 66	Station 66										
	9	BN-RD	RC 67	Station 67										
10	35	RD-SL	RC 68	Station 68										
	10	SL-RD	RC 69	Station 69										
11	36	BK-BL	RC 70	Station 70										
	11	BL-BK	RC 71	Station 71										
12	37	BK-OR	RC 72	Station 72										
	12	OR-BK	RC 73	Station 73										
13	38	BK-GN	RC 74	Station 74										
	13	GN-BK	RC 75	Station 75										
14	39	BK-BN	RC 76	Station 76										
	14	BN-BK	RC 77	Station 77										
15	40	BK-SL	RC 78	Station 78										
	15	SL-BK	RC 79	Station 79										
16	41	Y-BL	RC 80	Station 80										
	16	BL-Y	RC 81	Station 81										
17	42	Y-OR	RC 82	Station 82										
	17	OR-Y	RC 83	Station 83										
18	43	Y-GN	RC 84	Station 84										
	18	GN-Y	RC 85	Station 85										
19	44	Y-BN	RC 86	Station 86										
	19	BN-Y	RC 87	Station 87										
20	45	Y-SL	RC 88	Station 88										
	20	SL-Y	RC 89	Station 89										
21	46	VI-BL	RC 90	Station 90										
	21	BL-VI	RC 91	Station 91										
22	47	VI-OR	RC 92	Station 92										
	22	OR-VI	RC 93	Station 93										
23	48	VI-GN	RC 94	Station 94										
	23	GN-VI	RC 95	Station 95										
24	49	VI-BN	RC 96	Station 96										
	24	BN-VI	RC 97	Station 97										
25	50	VI-SL	RC 98	Station 98										
	25	SL-VI	RC 99	Station 99										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J034

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	S1	Trunk 1										
	1	BL-WH	S2	Trunk 2										
2	27	WH-OR	S3	Trunk 3										
	2	OR-WH	S4	Trunk 4										
3	28	WH-GN	S5	Trunk 5										
	3	GN-WH	S6	Trunk 6										
4	29	WH-BN	S7	Trunk 7										
	4	BN-WH	S8	Trunk 8										
5	30	WH-SL	S9	Trunk 9										
	5	SL-WH	S10	Trunk 10										
6	31	RD-BL	S11	Trunk 11										
	6	BL-RD	S12	Trunk 12										
7	32	RD-OR	S13	Trunk 13										
	7	OR-RD	S14	Trunk 14										
8	33	RD-GN	S15	Trunk 15										
	8	GN-RD	S16	Trunk 16										
9	34	RD-BN	S17	Trunk 17										
	9	BN-RD	S18	Trunk 18										
10	35	RD-SL	S19	Trunk 19										
	10	SL-RD	S20	Trunk 20										
11	36	BK-BL	S21	Trunk 21										
	11	BL-BK	S22	Trunk 22										
12	37	BK-OR	S23	Trunk 23										
	12	OR-BK	S24	Trunk 24										
13	38	BK-GN	-48VF											
	13	GN-BK	-48VF											
14	39	BK-BN												
	14	BN-BK												
15	40	BK-SL												
	15	SL-BK												
16	41	Y-BL												
	16	BL-Y												
17	42	Y-OR												
	17	OR-Y												
18	43	Y-GN												
	18	GN-Y												
19	44	Y-BN												
	19	BN-Y												
20	45	Y-SL												
	20	SL-Y												
21	46	VI-BL												
	21	BL-VI												
22	47	VI-OR												
	22	OR-VI												
23	48	VI-GN												
	23	GN-VI												
24	49	VI-BN												
	24	BN-VI												
25	50	VI-SL												
	25	SL-VI												

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J035 (Future)

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL												
	1	BL-WH												
2	27	WH-OR												
	2	OR-WH												
3	28	WH-GN												
	3	GN-WH												
4	29	WH-BN												
	4	BN-WH												
5	30	WH-SL												
	5	SL-WH												
6	31	RD-BL												
	6	BL-RD												
7	32	RD-OR												
	7	OR-RD												
8	33	RD-GN												
	8	GN-RD												
9	34	RD-BN												
	9	BN-RD												
10	35	RD-SL												
	10	SL-RD												
11	36	BK-BL												
	11	BL-BK												
12	37	BK-OR												
	12	OR-BK												
13	38	BK-GN												
	13	GN-BK												
14	39	BK-BN												
	14	BN-BK												
15	40	BK-SL												
	15	SL-BK												
16	41	Y-BL												
	16	BL-Y												
17	42	Y-OR												
	17	OR-Y												
18	43	Y-GN												
	18	GN-Y												
19	44	Y-BN												
	19	BN-Y												
20	45	Y-SL												
	20	SL-Y												
21	46	VI-BL												
	21	BL-VI												
22	47	VI-OR												
	22	OR-VI												
23	48	VI-GN												
	23	GN-VI												
24	49	VI-BN												
	24	BN-VI												
25	50	VI-SL												
	25	SL-VI												

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J036 (Future)

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL												
	1	BL-WH												
2	27	WH-OR												
	2	OR-WH												
3	28	WH-GN												
	3	GN-WH												
4	29	WH-BN												
	4	BN-WH												
5	30	WH-SL												
	5	SL-WH												
6	31	RD-BL												
	6	BL-RD												
7	32	RD-OR												
	7	OR-RD												
8	33	RD-GN												
	8	GN-RD												
9	34	RD-BN												
	9	BN-RD												
10	35	RD-SL												
	10	SL-RD												
11	36	BK-BL												
	11	BL-BK												
12	37	BK-OR												
	12	OR-BK												
13	38	BK-GN												
	13	GN-BK												
14	39	BK-BN												
	14	BN-BK												
15	40	BK-SL												
	15	SL-BK												
16	41	Y-BL												
	16	BL-Y												
17	42	Y-OR												
	17	OR-Y												
18	43	Y-GN												
	18	GN-Y												
19	44	Y-BN												
	19	BN-Y												
20	45	Y-SL												
	20	SL-Y												
21	46	VI-BL												
	21	BL-VI												
22	47	VI-OR												
	22	OR-VI												
23	48	VI-GN												
	23	GN-VI												
24	49	VI-BN												
	24	BN-VI												
25	50	VI-SL												
	25	SL-VI												

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J037

PAIR	PIN	COLOR	LEAD DESIG. NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	ALK	Att. Line Key										
	1	BL-WH	ARK	Att. Release Key										
2	27	WH-OR	CONK	Connect Key										
	2	OR-WH	TAC	Trunk Access										
3	28	WH-GN	+24V											
	3	GN-WH	AS-2	Trunk Reservation On										
4	29	WH-BN	TEL	Talk Extension Key										
	4	BN-WH	NS	Night Service										
5	30	WH-SL	POC	Power On Console										
	5	SL-WH	AS-1	Trunk Reservation On										
6	31	RD-BL	PC											
	6	BL-RD	TEL	Talk Extension Lamp										
7	32	RD-OR	TCK	Talk City Key										
	7	OR-RD	DL-1	Dial Longitudinal 1										
8	33	RD-GN	+24V											
	8	GN-RD	+24V											
9	34	RD-BN	DL-2	Dial Longitudinal 2										
	9	BN-RD	TCL	Talk City Lamp										
10	35	RD-SL	AH	Attendant Flash										
	10	SL-RD	DL-4	Dial Longitudinal 4										
11	36	BK-BL	+24V											
	11	BL-BK	+24V											
12	37	BK-OR	DL-3	Dial Longitudinal 3										
	12	OR-BK	ALL	Attendant Line Lamp										
13	38	BK-GN	IRK	Busy Verification Key										
	13	GN-BK	+24V											
14	39	BK-BN	+24V											
	14	BN-BK	+24V											
15	40	BK-SL	DH-1	Dial Horizontal 1										
	15	SL-BK	DCP	Dial (DC) Pulse										
16	41	Y-BL	PK	Page Key										
	16	BL-Y	DH-3	Dial Horizontal 3										
17	42	Y-OR	GND	Ground										
	17	OR-Y	DH-2	Dial Horizontal 2										
18	43	Y-GN	OTR	Console Line Ring										
	18	GN-Y	OTT	Console Line Tip										
19	44	Y-BN	CCK	Code Call Key										
	19	BN-Y	L-MIN	Minor Alarm Lamp										
20	45	Y-SL	AAK	Overflow Att.										
	20	SL-Y	L-MAJ	Major Alarm Lamp										
21	46	VI-BL	PC	Power										
	21	BL-VI	CCL	Code Call Lamp (not used)										
22	47	VI-OR	CK	Conference Key										
	22	OR-VI	SBB	Standby Power										
23	48	VI-GN	+24V											
	23	GN-VI	TRL	(not used)										
24	49	VI-BN	BUZ	Buzzer										
	24	BN-VI	CL	Conference Lamp										
25	50	VI-SL	TRK	Trunk Reservation Key										
	25	SL-VI	PGL	Page Lamp										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J038

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	+24V											
	1	BL-WH	ATK1	Att. Trunk Key 1										
2	27	WH-OR	TSC	Trunk Switch Common										
	2	OR-WH	TSW	Trunk Switch										
3	28	WH-GN	TS24	Trunk Key (switch) 24										
	3	GN-WH	ATL1	Att. Trunk 1 - Lamp										
4	29	WH-BN	TB21											
	4	BN-WH	TS1	Trunk Key (switch) 1										
5	30	WH-SL	TB20	Trunk 20, Lamp B										
	5	SL-WH	GND	Ground										
6	31	RD-BL	TB19	Trunk 19, Lamp B										
	6	BL-RD	TA1	Trunk 1, Lamp A										
7	32	RD-OR	TB9	Trunk 9, Lamp B										
	7	OR-RD	TS2	Trunk Key (switch) 2										
8	33	RD-GN	+24V											
	8	GN-RD	TB24	Trunk 24, Lamp B										
9	34	RD-BN	TB8	Trunk 8, Lamp B										
	9	BN-RD	TA2	Trunk 2, Lamp A										
10	35	RD-SL	+24V											
	10	SL-RD	TS3	Trunk Key (switch) 3										
11	36	BK-BL	TB7	Trunk 7, Lamp B										
	11	BL-BK	TB23	Trunk 23, Lamp B										
12	37	BK-OR	+24V											
	12	OR-BK	TA3	Trunk 3, Lamp A										
13	38	BK-GN	TB6	Trunk 6, Lamp B										
	13	GN-BK	TS4	Trunk Key (switch) 4										
14	39	BK-BN	+24V											
	14	BN-BK	TB22	Trunk 22, Lamp B										
15	40	BK-SL	TB5	Trunk 5, Lamp B										
	15	SL-BK	TA4	Trunk 4, Lamp A										
16	41	Y-BL	+24V											
	16	BL-Y	TS5	Trunk Key (switch) 5										
17	42	Y-OR	TB4											
	17	OR-Y	TA9	Trunk 9, Lamp A										
18	43	Y-GN	+24V											
	18	GN-Y	TA5	Trunk 5, Lamp A										
19	44	Y-BN	TB3	Trunk 3, Lamp B										
	19	BN-Y	TS6	Trunk Key (switch) 6										
20	45	Y-SL	+24V											
	20	SL-Y	TS9	Trunk Key (switch) 9										
21	46	VI-BL	TB2	Trunk 2, Lamp B										
	21	BL-VI	TA6	Trunk 6, Lamp A										
22	47	VI-OR	+24V											
	22	OR-VI	TS7	Trunk Key (switch) 7										
23	48	VI-GN	TB1	Trunk 1, Lamp B										
	23	GN-VI	TA8	Trunk 8, Lamp A										
24	49	VI-BN	+24V											
	24	BN-VI	TA7	Trunk 7, Lamp A										
25	50	VI-SL	IL-1	Intercept Lamp 1										
	25	SL-VI	TS8	Trunk Key (switch) 8										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J039

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	HLD	Hold										
	1	BL-WH	ATK2	Att. Trunk Key 2										
2	27	WH-OR	TA21	Trunk 21, Lamp A										
	2	OR-WH	TA23	Trunk 23, Lamp A										
3	28	WH-GN	TS23	Trunk Key (switch) 23										
	3	GN-WH	ATL 2	Att. Trunk 2 - Lamp										
4	29	WH-BN	TS19	Trunk Key (switch) 19										
	4	BN-WH	TS10	Trunk Key (switch) 10										
5	30	WH-SL	TA24	Trunk 24, Lamp A										
	5	SL-WH	TA22	Trunk 22, Lamp A										
6	31	RD-BL	TA19	Trunk 19, Lamp A										
	6	BL-RD	TA10	Trunk 10, Lamp A										
7	32	RD-OR	TB18	Trunk 18, Lamp B										
	7	OR-RD	TS11	Trunk Key (switch) 11										
8	33	RD-GN	+24V											
	8	GN-RD	TS22	Trunk Key (switch) 22										
9	34	RD-BN	TB17	Trunk 17, Lamp B										
	9	BN-RD	TA11	Trunk 11, Lamp A										
10	35	RD-SL	TS21	Trunk Key (switch) 21										
	10	SL-RD	TS12	Trunk Key (switch) 12										
11	36	BK-BL	TB16	Trunk 16, Lamp B										
	11	BL-BK	TA20	Trunk 20, Lamp A										
12	37	BK-OR	+24V											
	12	OR-BK	TA12	Trunk 12, Lamp A										
13	38	BK-GN	TB15	Trunk 15, Lamp B										
	13	GN-BK	TS13	Trunk Key (switch) 13										
14	39	BK-BN	+24V											
	14	BN-BK	TS20	Trunk Key (switch) 20										
15	40	BK-SL	TB14	Trunk 14, Lamp B										
	15	SL-BK	TA13	Trunk 13, Lamp A										
16	41	Y-BL	+24V											
	16	BL-Y	TS14	Trunk Key (switch) 14										
17	42	Y-OR	TB13	Trunk 13, Lamp B										
	17	OR-Y	TA18	Trunk 18, Lamp A										
18	43	Y-GN	+24V											
	18	GN-Y	TA14	Trunk 14, Lamp A										
19	44	Y-BN	TB12	Trunk 12, Lamp B										
	19	BN-Y	TS15	Trunk Key (swjtch) 15										
20	45	Y-SL	+24V											
	20	SL-Y	TS18	Trunk Key (switch) 18										
21	46	VI-BL	TB11	Trunk 11, Lamp B										
	21	BL-VI	TA15	Trunk 15, Lamp A										
22	47	VI-OR	+24V											
	22	OR-VI	TS16	Trunk Key (switch) 16										
23	48	VI-GN	TB10	Trunk 10, Lamp B										
	23	GN-VI	TA17	Trunk 17, Lamp A										
24	49	VI-BN	+24V											
	24	BN-VI	TA16	Trunk 16, Lamp A										
25	50	VI-SL	IL-2	Intercept Lamp 2										
	25	SL-VI	TS17	Trunk Key (switch) 17										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J040

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	LG											
	1	BL-WH	LG											
2	27	WH-OR	LG											
	2	OR-WH	LG	Lamp Ground										
3	28	WH-GN	LG											
	3	GN-WH	LG											
4	29	WH-BN	LG											
	4	BN-WH	LG											
5	30	WH-SL	L-01	Station Lamp 01										
	5	SL-WH	L-00	Station Lamp 00										
6	31	RD-BL	L-03	Station Lamp 03										
	6	BL-RD	L-02	Station Lamp 02										
7	32	RD-OR	L-05	Station Lamp 05										
	7	OR-RD	L-04	Station Lamp 04										
8	33	RD-GN	L-07	Station Lamp 07										
	8	GN-RD	L-06	Station Lamp 06										
9	34	RD-BN	L-09	Station Lamp 09										
	9	BN-RD	L-08	Station Lamp 08										
10	35	RD-SL	L-11	Station Lamp 11										
	10	SL-RD	L-10	Station Lamp 10										
11	36	BK-BL	L-13	Station Lamp 13										
	11	BL-BK	L-12	Station Lamp 12										
12	37	BK-OR	L-15	Station Lamp 15										
	12	OR-BK	L-14	Station Lamp 14										
13	38	BK-GN	L-17	Station Lamp 17										
	13	GN-BK	L-16	Station Lamp 16										
14	39	BK-BN	L-19	Station Lamp 19										
	14	BN-BK	L-18	Station Lamp 18										
15	40	BK-SL	L-21	Station Lamp 21										
	15	SL-BK	L-20	Station Lamp 20										
16	41	Y-BL	L-23	Station Lamp 23										
	16	BL-Y	L-22	Station Lamp 22										
17	42	Y-OR	L-25	Station Lamp 25										
	17	OR-Y	L-24	Station Lamp 24										
18	43	Y-GN	L-27	Station Lamp 27										
	18	GN-Y	L-26	Station Lamp 26										
19	44	Y-BN	L-29	Station Lamp 29										
	19	BN-Y	L-28	Station Lamp 28										
20	45	Y-SL	L-31	Station Lamp 31										
	20	SL-Y	L-30	Station Lamp 30										
21	46	VI-BL	L-33	Station Lamp 33										
	21	BL-VI	L-32	Station Lamp 32										
22	47	VI-OR	L-35	Station Lamp 35										
	22	OR-VI	L-34	Station Lamp 34										
23	48	VI-GN	L-37	Station Lamp 37										
	23	GN-VI	L-36	Station Lamp 36										
24	49	VI-BN	L-39	Station Lamp 39										
	24	BN-VI	L-38	Station Lamp 38										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J041

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	LG											
	1	BL-WH	LG											
2	27	WH-OR	LG											
	2	OR-WH	LG	Lamp Ground										
3	28	WH-GN	LG											
	3	GN-WH	LG											
4	29	WH-BN	LG											
	4	BN-WH	LG											
5	30	WH-SL	L-41	Station Lamp 41										
	5	SL-WH	L-40	Station Lamp 40										
6	31	RD-BL	L-43	Station Lamp 43										
	6	BL-RD	L-42	Station Lamp 42										
7	32	RD-OR	L-45	Station Lamp 45										
	7	OR-RD	L-44	Station Lamp 44										
8	33	RD-GN	L-47	Station Lamp 47										
	8	GN-RD	L-46	Station Lamp 46										
9	34	RD-BN	L-49	Station Lamp 49										
	9	BN-RD	L-48	Station Lamp 48										
10	35	RD-SL	L-51	Station Lamp 51										
	10	SL-RD	L-50	Station Lamp 50										
11	36	BK-BL	L-53	Station Lamp 53										
	11	BL-BK	L-52	Station Lamp 52										
12	37	BK-OR	L-55	Station Lamp 55										
	12	OR-BK	L-54	Station Lamp 54										
13	38	BK-GN	L-57	Station Lamp 57										
	13	GN-BK	L-56	Station Lamp 56										
14	39	BK-BN	L-59	Station Lamp 59										
	14	BN-BK	L-58	Station Lamp 58										
15	40	BK-SL	L-61	Station Lamp 61										
	15	SL-BK	L-60	Station Lamp 60										
16	41	Y-BL	L-63	Station Lamp 63										
	16	BL-Y	L-62	Station Lamp 62										
17	42	Y-OR	L-65	Station Lamp 65										
	17	OR-Y	L-64	Station Lamp 64										
18	43	Y-GN	L-67	Station Lamp 67										
	18	GN-Y	L-66	Station Lamp 66										
19	44	Y-BN	L-69	Station Lamp 69										
	19	BN-Y	L-68	Station Lamp 68										
20	45	Y-SL	L-71	Station Lamp 71										
	20	SL-Y	L-70	Station Lamp 70										
21	46	VI-BL	L-73	Station Lamp 73										
	21	BL-VI	L-72	Station Lamp 72										
22	47	VI-OR	L-75	Station Lamp 75										
	22	OR-VI	L-74	Station Lamp 74										
23	48	VI-GN	L-77	Station Lamp 77										
	23	GN-VI	L-76	Station Lamp 76										
24	49	VI-BN	L-79	Station Lamp 79										
	24	BN-VI	L-78	Station Lamp 78										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

TABLE 1.01 Cabinet, Cable and Frame Cross-Connections, J042

PAIR	PIN	COLOR	LEAD DESIG-NATION	USAGE 1	LEAD DESIGNATION	USAGE 2	CROSS-CONNECT FRAME							NOTES
							INT.	EXTERNAL						
							TER.	BLOCK	ROW	TERMINAL	BLOCK	ROW	TERMINAL	
1	26	WH-BL	LG											
	1	BL-WH	LG	Lamp Ground										
2	27	WH-OR	LG											
	2	OR-WH	LG											
3	28	WH-GN	L-81	Station Lamp 81										
	3	GN-WH	L-80	Station Lamp 80										
4	29	WH-BN	L-83	Station Lamp 83										
	4	BN-WH	L-82	Station Lamp 82										
5	30	WH-SL	L-85	Station Lamp 85										
	5	SL-WH	L-84	Station Lamp 84										
6	31	RD-BL	L-87	Station Lamp 87										
	6	BL-RD	L-86	Station Lamp 86										
7	32	RD-OR	L-89	Station Lamp 89										
	7	OR-RD	L-88	Station Lamp 88										
8	33	RD-GN	L-91	Station Lamp 91										
	8	GN-RD	L-90	Station Lamp 90										
9	34	RD-BN	L-93	Station Lamp 93										
	9	BN-RD	L-92	Station Lamp 92										
10	35	RD-SL	L-95	Station Lamp 95										
	10	SL-RD	L-94	Station Lamp 94										
11	36	BK-BL	L-97	Station Lamp 97										
	11	BL-BK	L-96	Station Lamp 96										
12	37	BK-OR	L-99	Station Lamp 99										
	12	OR-BK	L-98	Station Lamp 98										
13	38	BK-GN	GND											
	13	GN-BK	+24V											
14	39	BK-BN	GND											
	14	BN-BK	+24V											
15	40	BK-SL	GND											
	15	SL-BK	+24V											
16	41	Y-BL	GND											
	16	BL-Y	+24V											
17	42	Y-OR	GND											
	17	OR-Y	+24V											
18	43	Y-GN	GND											
	18	GN-Y	+24V											
19	44	Y-BN	GND											
	19	BN-Y	+24V											
20	45	Y-SL		Spare										
	20	SL-Y		Spare										
21	46	VI-BL		Spare										
	21	BL-VI		Spare										
22	47	VI-OR		Spare										
	22	OR-VI		Spare										
23	48	VI-GN		Spare										
	23	GN-VI		Spare										
24	49	VI-BN		Spare										
	24	BN-VI		Spare										
25	50	VI-SL		Spare										
	25	SL-VI		Spare										

CABINET TESTS AND INSPECTIONS
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section contains installation tests and inspections to be performed at the cabinet of the TD-100 Electronic Private Automatic Branch Exchange (EPABX).

1.02 General. Prior to performing the tests and inspections of this section, the procedures of the following sections must have been completed:

a. Section OB-000-002, Cabinet and Apparatus Installation.

b. Section OB-410-XXX, individual feature strapping documents as required.

c. Section OB-000-004, Console Installation.

d. Section OB-000-005, Cable Connections at Cross-Connect Terminals.

The tests and inspections are divided into the following categories.

a. Power tests.

b. Transmission tests.

c. Final inspection.

The tests and inspections should be performed in the sequence given in this section. When the procedures of this section are completed, the tests of Section OB-000-007 (Console Operation Tests) and Section OB-000-008 (Station Operation Tests) should be performed to ensure satisfactory system operation.

2.00 TEST EQUIPMENT

2.01 Test Equipment. The test equipment required for the test described in this section is a volt-ohmmeter (20,000 ohms/volt minimum).

3.00 INITIAL TESTS

3.01 General. The initial tests consist of checking the system approved ground connection and checking the voltages of the cabinet power supply with the plug-in boards pulled out from the connectors.

3.02 Ground Test. This test verifies that the previously installed system ground has an adequately low resistance. Perform the test as follows:

a. Check the physical installation of the

ground wire connecting the approved ground source to the cabinet ground cable.

NOTE: A warning tag should be attached to the cabinet ground cable to caution against its removal. The approved ground connection must be in addition to the ground provided through the power cord to the commercial AC power ground.

b. Switch the ohmmeter to the OHMS x 1 position and carefully zero the meter.

c. Connect one lead of the ohmmeter to the approved ground. Connect the other lead to any convenient location on the cabinet framework. The meter deflection must be approximately zero ohms. Any appreciable resistance, one ohm or more, must be investigated and the installer must be satisfied that it is due to the meter and not to a faulty ground connection.

3.03 Power Tests. These test check the power system voltages when all the plug-in boards are pulled out from the connectors. Perform the tests as follows:

a. Ensure the POWER switch on the front of the cabinet is in the OFF position.

b. Pull all plug-in boards out of the connectors, leaving the boards in the guide rails. The connectors at the rear of the boards should be approximately one inch from the connectors of the motherboards.

c. Carefully check the connections at the power supply terminal blocks, the connections to the bus bar at the bottom rear of the cabinet, and the power connections at each board subrack. The connections must be secure, with no evidence of shorts to ground.

d. Verify that the fuses on the power supply control box and the power supply are properly inserted and that there is no sign of damage to the fuse holders or circuit breaker.

e. Plug the cabinet power cord into the commercial AC power receptacle.

f. Set the POWER switch to the ON position at the power supply control box. The POWER ON indicator must light.

g. Using the voltmeter, check the outputs of the power supply as outlined in table 1.00 (refer to figure 1.00). Also check the voltages at the motherboards as outlined in table 1.01 (refer to figure 1.01).

NOTE: 100 VAC ringing may not be present with PCB's extracted; if the remaining voltages for step g. are not present, operate the RESET button.

h. Set the POWER switch on the front of the cabinet to the OFF position.

i. Carefully re-insert all plug-in boards.

j. Set the POWER switch to the ON position and verify that the (power on) LED's light for all circuits.

4.00 FINAL TESTS

4.01 General. These tests check the circuit board lamps and verify that the system will go into power failure transfer.

4.02 Lamp Tests. The following tests verify operation of the alarm panel board and circuit board lamps.

a. Alarm tests. Momentarily operate the LAMP TEST switch. All lamps on the alarm panel light. If the alarm board is equipped with a MEM AL RESET switch, momentarily operate the switch to the MEM AL RESET position. All alarm lamps extinguish; all power supply lamps are lit.

b. Set the XFER switch to ON. The system goes into power failure transfer; the MAJOR ALARM and XFER lamps light; the MAJ ALM lamp on the console also lights. Set the XFER switch to OFF and momentarily operate the LAMP TEST switch to the MEM AL RESET position. All alarm lamps extinguish. When the system is equipped with an audible alarm to indicate a major alarm, the audible

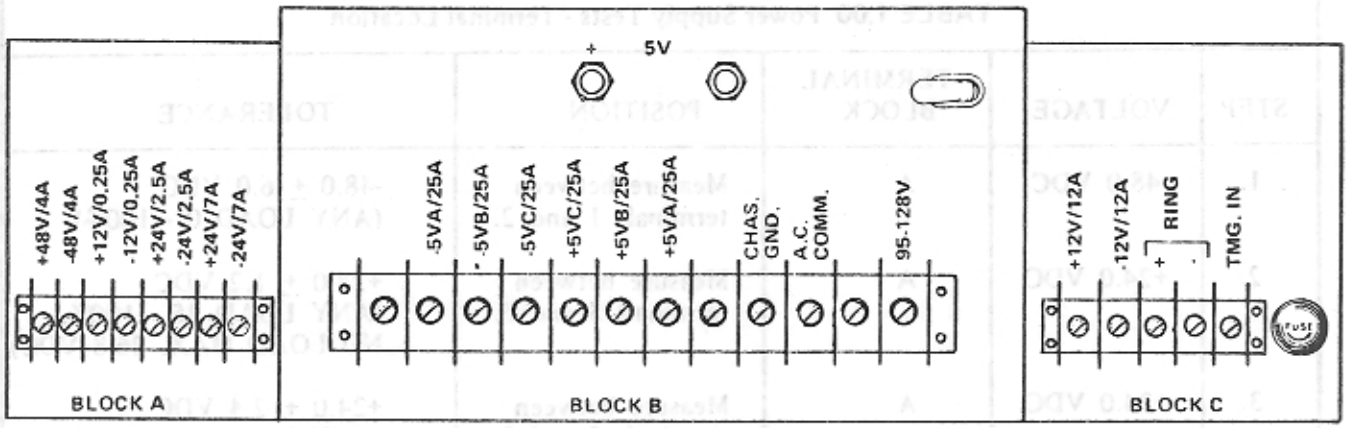
TABLE 1.00 Power Supply Tests - Terminal Location

STEP	VOLTAGE	TERMINAL BLOCK	POSITION	TOLERANCE
1.	-48.0 VDC	A	Measure between terminals 1 and 2.	-48.0 ± 6.0 VDC (ANY LOAD 0 - 100%)
2.	+24.0 VDC	A	Measure between terminals 5 and 6.	+24.0 ± 1.2 VDC (ANY LOAD 25 - 100%, NO LOAD MAX. 26.8 VDC)
3.	+24.0 VDC	A	Measure between terminals 7 and 8.	+24.0 ± 2.4 VDC (ANY LOAD 25 - 100%, NO LOAD MAX. 26.8 VDC)
4.	+12.0 VDC	A	Measure between terminals 3 and 4.	½ of measurement at step 2 ± 2%
5.	+5.0 VDC	B	Measure between terminals 2 and 7.	5.15 to 5.7 VDC (ANY LOAD 25 - 100%, NO LOAD 5.9 V MAX)
6.	+5.0 VDC	B	Measure between terminals 3 and 6.	5.15 to 5.7 VDC (ANY LOAD 25 - 100%, NO LOAD 5.9 V MAX)
7.	+5.0 VDC	B	Measure between terminals 4 and 5.	5.15 to 5.7 VDC (ANY LOAD 25 - 100% NO LOAD 5.9 V MAX)
8.	115 VAC*	B	Measure between terminals 10 and 12.	95 to 128 VAC* (59.7 to 60.3 Hz)
9.	+12.0 VDC	C	Measure between terminals 1 and 2.	9 to 15 VDC (ANY LOAD 0 - 100%)
10.	90 VAC (Ringing may not be present with PCB's extracted)	C	Measure between terminals 3 and 4.	100 V RMS (MAX) to 75 V RMS (MIN) For No Load to Full Load. (18 - 22 Hz)
11.	90 VAC †	C	Measure between terminal 6 and ground.	100 V RMS (MAX) to 75 V RMS (MIN) For No Load to Full Load. (18 - 22 Hz)

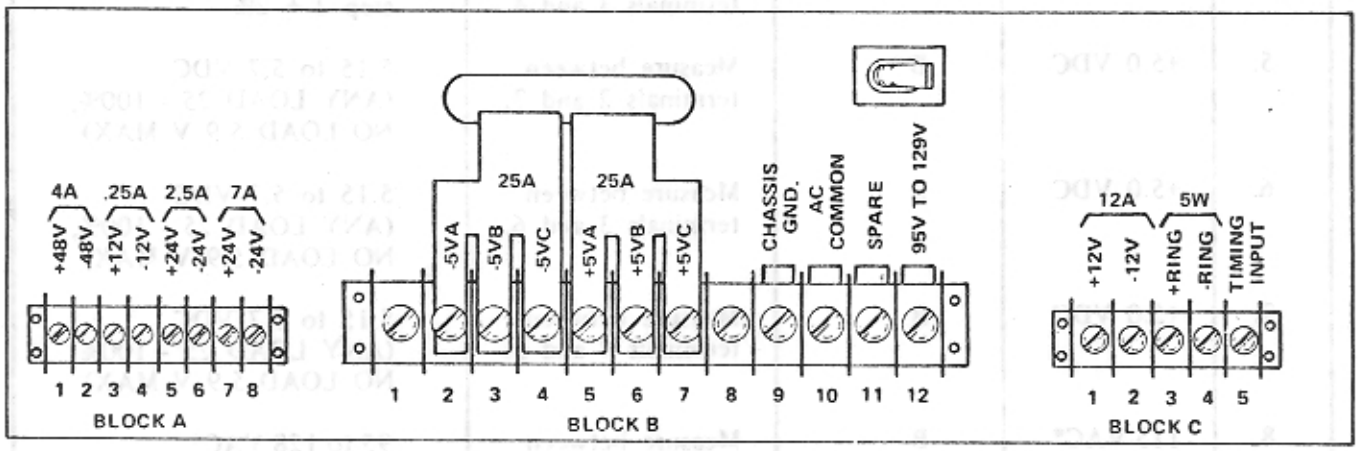
*NOTE: With Lorain power supply only, voltage may be between 185 and 254 VAC and the frequency may vary from 47 to 63 Hz, depending upon locally available power and the position of the AC input voltage adjustment plug.

†NOTE: Lorain export model only.

REAR VIEW OF 4200341 (POWER MATE) POWER SUPPLY



REAR VIEW OF 4200340 (NORTH) POWER SUPPLY



REAR VIEW OF 4200419 (LORAIN) POWER SUPPLY

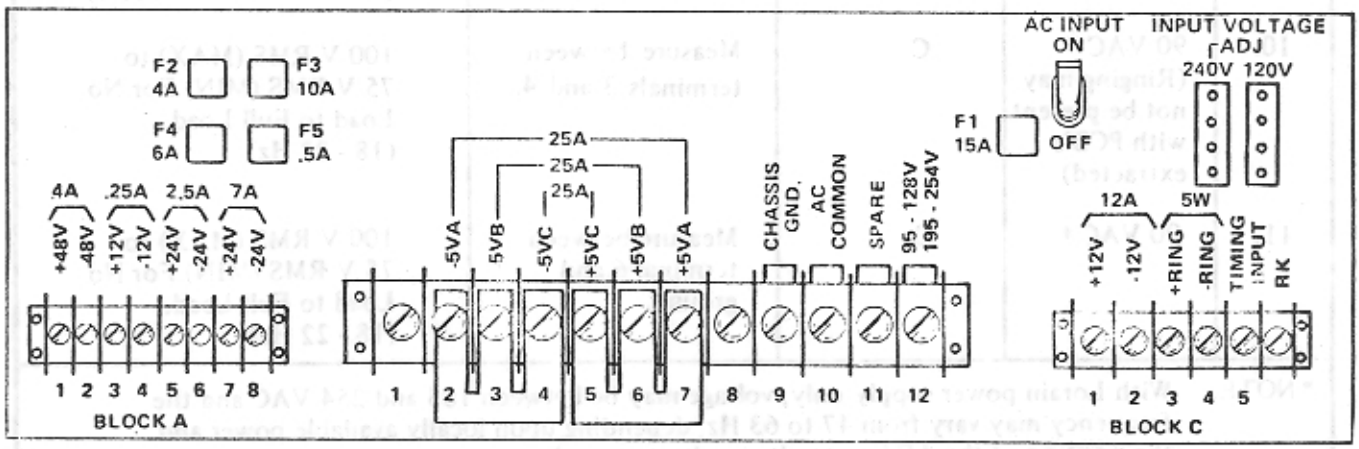


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FIGURE 1.00 Power Supply Terminal Blocks

TABLE 1.01 Motherboard Voltages

STEP	VOLTAGE	TEST LOCATION		POWER SUPPLY TOLERANCE
		SUBRACK	TEST POINTS	
1.	+5.0 VDC	Top	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
2.	+24.0 VDC	Top	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
3.	+24.0 VDC	Top	+24 V B and GND C	+ 24.0 ± 2.4 VDC (no load 26.8 V max.)
4.	+12.0 VDC	Top	+12 V A and GND B	½ of measurement at step 2
5.	-48.0 VDC	Top	-48 V and GND C	-48.0 ± 6.0 VDC
6.	+12 VDC	Top	+12 V B and GND D	+12.0 ± 3 VDC
7.	+5.0 VDC	Middle	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
8.	+24.0 VDC	Middle	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
9.	+12.0 VDC	Middle	+12 V A and GND B	½ of measurement at step 8
10.	-12.0 VDC	Middle	-12 V and GND A	-12.0 ± 0.6 VDC
11.	+24.0 VDC	Middle	+24 V B and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
12.	+5.0 VDC	Bottom	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
13.	+12.0 VDC	Bottom	+12 V A and GND B	½ of measurement at step 8
14.	+24.0 VDC	Bottom	+24 V B and GND C	+24.0 ± 2.4 VDC (no load 26.8 V max.)
15.	+24.0 VDC	Bottom	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
16.	-48.0 VDC	Bottom	-48 V and GND C	-48 ± 6.0 VDC
17.	90 VAC	Top	RB and GND D	100 V to 75 V RMS
18.	90 VAC	Top	RK (Pin 35A) and GND D	100 V to 75 V RMS
19.	90 VAC	Bottom	RB and GND C	100 V to 75 V RMS

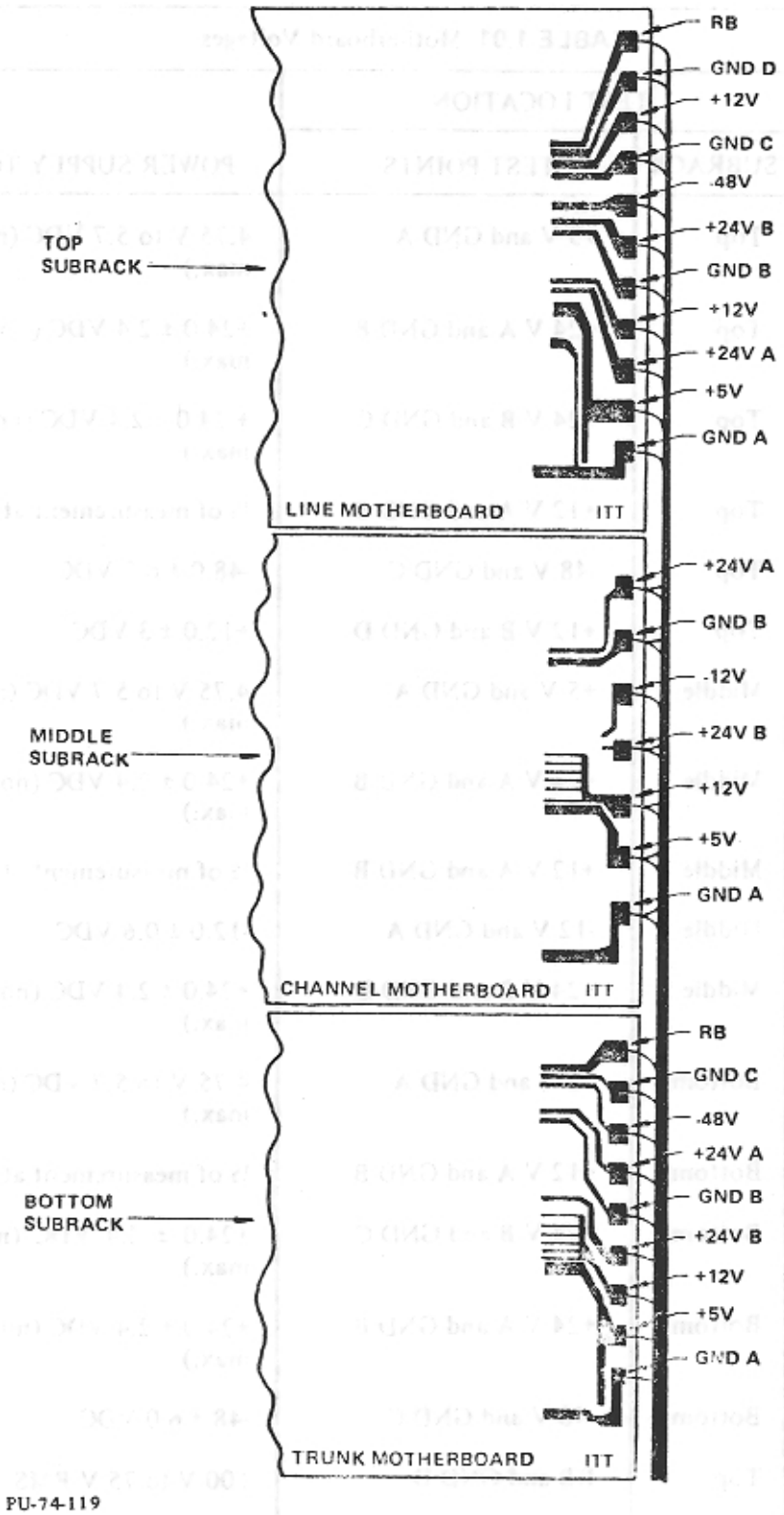

FIGURE 1.01 Motherboards

alarm may be turned off temporarily by setting the ACO switch on the alarm panel to the ON position.

NOTE: Before placing the system in service, set the ACO switch to the OFF position.

c. Momentarily make busy each circuit equipped with a busy switch and verify that the associated LED flashes when the circuit is made busy.

5.00 TRANSMISSON TESTS

5.01 General. If local practices require transmission measurements to be made, refer to table 1.02 for the transmission parameters applicable to the TD-100 EPABX. The following paragraphs and the instruction manual provided with the transmission measuring test set provide all information necessary to perform the tests.

5.02 Trunk Line Tests. To perform transmission measurements on the cable pairs from the central office, the transmission measuring equipment is set for a 600-ohm or 900-ohm termination impedance to match the central office trunking arrangement. The EPABX is disconnected from the pair under test prior to taking the measurements. For the TD-100 EPABX, the trunk loop resistance should not be more than 1600 ohms.

5.03 Station Line Tests. When testing through the EPABX, the nominal impedence of a station line is 600 ohms. The impedence of a CO trunk is 900 ohms, and the impedence of a tie trunk is (strappable) 600 or 900 ohms. The station apparatus or trunk lines or equipment must be disconnected from the line under test.

For telephone sets. The maximum line loop resistance limit is 1000 ohms (excluding telephone set). This limit may be extended to 2000 ohms maximum by making a strapping option on the line circuit board, increasing the battery feed from 48 volts to 72 volts. (This only applies to the fifth line circuit on each board.) For lines with key telephone sets, the maximum loop resistance limit is 50 ohms (set by limit of lamp drive circuitry).

5.04 Console Line Tests. Console line tests are performed in the same manner as station line tests. The maximum loop resistance limit for the console is 50 ohms (set by limit of lamp drive circuitry).

6.00 FINAL INSPECTION

6.01 General. When the previous tests are completed, a final visual inspection of the cabinet and cabinet area shall be performed. The inspection should ensure:

a. That all plug-in boards are properly installed.

b. That the plug-in cables are properly routed and secured, if required.

c. That the cabinet fans are operating.

d. That the area around the cabinet is free of any debris resulting from the installation procedures.

This completes the tests to be performed on the cabinet. The system should be allowed a "soak" period of 2 to 3 hours (power on) to stabilize before being cut over.

TABLE 1.02 Transmission Parameters

PARAMETER	CONDITION	TD-100 PERFORMANCE
Impedance	Any Connection	Stations 600 Ohms Trunks 900 Ohms
Insertion Loss	Line to Line	5.0 dB ± 0.5 dB
	Line to Trunk	0 - 0.5 dB
	Trunk/Tie Trunk to Tie Trunk	0.3 dB Max. Contrast
	Line to Tie Trunk	2 - 2.5 dB (Pad Switching) 0.3 dB Max. Contrast
Frequency Response Relative to 1000 Hz (+) is more loss (-) is less loss	Line to Line	300 - 3400 Hz -0.1 to +0.6 dB 400 - 3000 Hz -0.1 to +0.4 dB
	Line to Trunk	300 - 3400 Hz -0.1 to +0.75 dB
	Trunk/Tie Trunk to Tie Trunk	400 - 3000 Hz -0.1 to +0.5 dB
Metallic Noise	All Calls	Less than 16 dBrnc Less than 36 dBrn (3 kHz)
Impulse Noise	All Calls	0 counts above 42 dBrnc
Harmonic Distortion	All Calls (-10 dBm input)	Less than -53 dBm for 2nd or 3rd harmonics.
Echo Return Loss	All Calls	Greater than 20 dB @ 300 - 3400 Hz
Singing Return Loss	All Calls	TALK: Greater than 14 dB NON TALK: Greater than 6 dB (200 - 3200 Hz)
Crosstalk Attenuation	All Calls	Greater than 75 dB

TABLE 1.02 Transmission Parameters (Cont.)

PARAMETER	CONDITION	TD-100 PERFORMANCE
Longitudinal Balance	Trunk Circuit and Line Circuit	Greater than 66 dB @ 200 Hz Greater than 60 dB @ 1000 Hz Greater than 58 dB @ 3000 Hz
Overload Distortion	All Calls	Does not exceed 0.4 dB when input increased from 0 dBm to +10 dBm.
Envelope Delay Distortion	All Calls	Less than 200 μ sec @ 400 to 3200 Hz Less than 100 μ sec @ 600 to 3000 Hz
Tone Levels	Dial Tone	350 + 440 Hz @ -12 ± 3 dBm continuous
	Audible Ringing	440 + 480 Hz @ -14 ± 3 dBm (1 sec. on, 3 secs. off)
	Busy Tone	480 + 620 Hz @ -20 ± 3 dBm (60 IPM)

CONSOLE OPERATION TESTS
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section lists the tests to be performed from the console to ensure the TD-100 Electronic Private Automatic Branch Exchange (EPABX) is operating satisfactorily before being placed in service.

1.02 Documents and Drawings. The documents and drawings applicable to this section are listed in Section OB-000-001.

1.03 Test Considerations. The following considerations apply to the tests in this section.

a. Tests need not be performed in the order in which they are presented. However, the sequence chosen for a particular installation should be such that all features applicable to the system are tested in a logical order.

b. To perform the tests in this section, at least two installation personnel are required; one to operate the console and coordinate test activities, and one to originate and receive test calls at station telephones. In some instances, it may also be necessary to obtain assistance from the central office.

c. If possible, the EPABX test telephones (stations) in the tests should be located in the vicinity of the TD-100 console or equipment cabinet. This is for convenience and ease of access.

d. Many of the tests in this section refer to use of a headset at the console. This is for convenience only; either a handset or a headset may be used.

e. In some of the tests, it is necessary to make calls into the EPABX from a distant office. Where it is not possible to do so, the test call can be made by seizing an outgoing trunk and then dialing the EPABX listed number or the desired station number. If this alternative procedure is used, the same outgoing trunk should be used to perform successive tests over different incoming trunks.

f. In some tests where it is necessary to complete calls to a distant office, the distant office station can be a supervisory or transmission test termination, a local test desk, or any working line in the distant office.

2.00 TESTS

2.01 General. When the instructions in Section OB-000-001 through OB-000-006 have been complied with, perform the following tests to verify proper operation of the TD-100 console.

2.02 Tone Switch Test. This test (table 1.00) verifies that the TONE switch can be positioned to turn the buzzer off, or to allow the buzzer to operate at a high or low level.

2.03 Handset/Headset Test. This test (table 1.01) verifies that with the HDST/HNST switch in the HDST position, extra amplification for transmission is provided. In the HNST position, the amplifier is bypassed and the console is arranged for handset operation.

2.04 Station-to-Console Call Test. This test (table 1.02) verifies correct operation of both attendant information links, and the attendant line and control circuitry.

2.05 Console-to-Trunk Call Test. This test (table 1.03) verifies correct operation of all trunks providing outgoing service.

2.06 Trunk-to-Console Test. This test (table 1.04) verifies correct operation of all trunks which provide incoming service via the console.

2.07 DID Trunk Call Test. This test (table 1.05) verifies correct operation of all the DID trunks.

2.08 Camp-on-Busy Test. This test (table 1.06) verifies correct operation of the camp-on-busy feature in all outgoing or two-way trunks.

2.09 Call Splitting Test. This test (table 1.07) verifies that the TALK CITY and TALK EXT push buttons on the console will permit the attndant to talk privately with either the inside station or the distant office.

2.10 Station-to-Trunk via Console Test. This test (table 1.08) verifies correct operation of the console's circuitry when connecting a station to a trunk.

2.11 Unassigned Night Answer (UNA) Test. This test (table 1.09) verifies that when the NIGHT switch on the console is set to the ON position, the system will switch to the unassigned night answer service mode of operation and work as specified.

2.12 Assigned Night Answer (ANA) Test. This test (table 1.10) verifies that when the NIGHT switch on the console is set to the ON position, the system will switch to the assigned night answer service mode of operation and work as specified.

2.13 Manual Power Failure Transfer Test. This test (table 1.11) verifies correct operation of the power failure transfer circuitry when the system is in the power failure transfer mode of operation.

2.14 Trunk Access Test. This test (table 1.12) verifies that all outgoing trunk calls will be routed to reorder tone when the TRUNK ACCESS switch on the console is set to the ATT position.

2.15 Trunk Reservation Test. This test (table 1.13) verifies that all two-way trunks (that have been strapped for trunk reservation) will provide only incoming service when the TK RES ON push button has been depressed at the console.

2.16 Busy Verification Test. This test (table 1.14) verifies that when the BUSY VER push button at the console is depressed and held, the attendant can intrude on a busy station, and that continuous low level busy tone will be heard by the console attendant and both stations.

2.17 Conference Call Test. This test (table 1.15) verifies correct operation of the conference network and links from the console.

2.18 Code Call Test. This test (table 1.16) verifies correct operation of the code call circuitry when used from the console.

2.19 Paging Test. This test (table 1.17) verifies correct operation of the paging circuitry when used from the console.

2.20 Alarm Lamp Test. This test (table 1.18) verifies that the alarm lamps on the console provide the correct alarm indications in the event of a trouble condition.

2.21 Busy Lamp Field Test. This test verifies that the busy lamp field, if equipped, will indicate the status of each individual line in the TD-100 EPABX.

The following lamp indications on the console should be observed while performing the tests in Section OB-000-008, Station Operation Tests.

a. Station on-hook - lamp extinguished.

b. Station off-hook - lamp lit steady.

c. Station ringing - lamp flashing (.5 sec on, .5 sec off).

d. Station on-hold - lamp winking (50 ms off, 450 ms on).

3.00 FINAL CHECKS

3.01 General. When all of the tests of this section and those of Section OB-000-008, Station Operation Tests, are completed, the system is ready for service.

Prior to in-service operation:

a. Ensure all console lamp indications are correct and that the PWR ON lamp is lit.

b. Ensure the console is properly fitted with a handset or headset and that the HDST/HNST switch is in the correct position.

c. Ensure the TONE, NIGHT, TK RES OFF, TK RES ON, and TRUNK ACCESS switches are in the correct positions.

d. Ensure the console is properly placed on the desk. That it sits flat with all four rubber "feet" making contact with the desk.

e. Ensure the console is not scratched and that none of the lamps, switches, or buttons are cracked or broken.

f. Ensure the console is clean.

TABLE 1.00 Tone Switch Test

STEP	ACTION	VERIFICATION
1.	Set the TONE switch on the console to the LO position.	–
2.	Go off-hook at an EPABX test station and upon receipt of dial tone, dial zero.	Ringback tone heard at station. Audible signal is heard (low tone) and ATT TK I push button starts flashing.
3.	Set TONE switch to the HI position.	Audible signal is louder.
4.	Set TONE switch to the OFF position.	No signal. ATT TK I push button continues to flash.
5.	Go on-hook at test station, and set the TONE switch to the desired position for the succeeding tests.	ATT TK I push button extinguishes.

TABLE 1.01 Handset/Headset Test

STEP	ACTION	VERIFICATION
1.	Set the HNST/HDST switch to the HDST position, and insert the plug of the headset into the jacks provided on the right hand side of the console; insert the plug of the handset in the jacks on the left side.	–
2.	Momentarily depress the ATT LINE push button and dial the number of an EPABX test station.	Push button lights steady and ringback tone heard in headset, station starts ringing.
3.	Go off-hook at test station.	Ringing and ringback tone stop. Transmission level is satisfactory.
4.	Set the HNST/HDST switch to the HNST position.	Transmission level at the test station is not satisfactory.
5.	Go on-hook at test station and momentarily depress the release bar at the console.	ATT LINE push button extinguishes. Call is terminated.

TABLE 1.02 Station-to-Console Call Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at two EPABX test stations and upon receipt of dial tone, dial zero.	Ringback tone heard at both stations. ATT TK I and ATT TK II push buttons start flashing and audible signal is heard.
2.	Momentarily depress ATT TK I push button.	ATT TK I push button lights steady and ringback tone is removed from one of the test stations. Transmission level is satisfactory.
3.	Momentarily depress ATT TK II push button.	ATT TK II push button lights steady and ATT TK I push button starts winking. Ringback tone stops at second station and the audible signal stops. Transmission level is satisfactory.
4.	Momentarily depress the ATT TK I push button.	ATT TK I push button lights steady and ATT TK II push button starts winking. Reconnection to first station has been made.
5.	Momentarily depress the HOLD push button.	ATT TK I push button winks. No transmission path to station.
6.	Momentarily depress the RELEASE bar.	No change of status.
7.	Momentarily depress the CONNECT bar.	No change of status.
8.	Momentarily depress the ATT TK I push button.	ATT TK I push button lights steady. Transmission path satisfactory.
9.	Momentarily depress the RELEASE bar.	ATT TK I push button extinguishes. Busy tone heard at test station.
10.	Go on-hook at station.	—
11.	Momentarily depress ATT TK II push button.	ATT TK II push button lights steady.
12.	Repeat steps 5 through 10 for ATT TK II push button.	Same as steps 5 through 10.

TABLE 1.03 Console-to-Trunk Call Test

STEP	ACTION	VERIFICATION
1.	Momentarily depress the push button assigned to a trunk which has outgoing capabilities.	Trunk push button and associated lamp light steady. C.O. Dial tone heard in headset.
2.	Dial the number of a distant office test station.	Ringback tone heard in headset followed by answer of call. Transmission level is satisfactory.
3.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady and trunk push button starts winking. Dial tone heard in headset.
4.	Dial the number of an EPABX test station and momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady, station starts ringing. In approximately 30 seconds, the trunk push button and associated lamp will start flashing, indicating timed recall.
5.	Momentarily depress flashing push button.	Trunk push button and associated lamp light steady. Distant office is reconnected to console.
6.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady and trunk push button starts winking. Dial tone heard in headset.
7.	Dial the number of an EPABX test station and momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady. Station starts ringing and distant office receives ringback tone.
8.	Go off-hook at test station.	Ringing and ringback tone stop. Transmission level between test station and distant office is satisfactory.
	NOTE: If automatic recall is not applicable to this trunk, go on-hook at test station and distant office. Advance to step 12.	Trunk push button extinguishes.
9.	Go on-hook at test station and remain off-hook at distant office.	In approximately eight seconds, the trunk push button and associated lamp start flashing indicating automatic recall.

TABLE 1.03 Console-to-Trunk Call Test (Cont.)

STEP	ACTION	VERIFICATION
10.	Momentarily depress flashing push button.	Trunk push button and associated lamp light steady. Reconnection between distant office and console has been made.
11.	Release from test call at distant office and momentarily depress the RELEASE bar at the console.	Trunk push button and associated lamp extinguish.
12.	Repeat steps 1 through 11 for all outgoing trunks.	Same as steps 1 through 11.

TABLE 1.04 Trunk-to-Console Test

STEP	ACTION	VERIFICATION
1.	At distant office, seize the desired trunk dial the digits to access the TD-100 console.	Trunk push button flashes and audible signal is heard at console.
2.	Momentarily depress the flashing push button.	Trunk push button and associated lamp light steady. Audible signal stops. Transmission level is satisfactory.
3.	Momentarily depress the HOLD push button.	Trunk push button winks. Trunk party hears music, if music on hold is provided.
4.	Momentarily depress the RELEASE bar.	No change.
5.	Momentarily depress the CONNECT bar.	Trunk lamp extinguishes.
6.	Momentarily depress the trunk push button.	Trunk push button and associated lamp light steady. Transmission path restored.
7.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady, trunk push button winks, and dial tone heard in headset.
8.	Dial the number of an EPABX test station and momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady. Test station rings. Trunk party hears ringback tone.
9.	Go off-hook at called station.	Ringing and ringback tone stop. Transmission level satisfactory.
10.	Momentarily depress the trunk push button.	No change.
11.	Go on-hook at test station and release the trunk at the distant office.	Trunk push button extinguishes.
12.	Repeat steps 1 through 11 for each applicable trunk.	—

TABLE 1.05 DID Trunk Tests

STEP	ACTION	VERIFICATION
	TEST I	
1.	At the distant office, seize the selected DID trunk and dial the number of EPABX test station A.	Trunk push button on console lights steady. Test station A starts ringing. Distant office receives ringback tone.
2.	Go off-hook at station A.	Transmission level is satisfactory.
3.	Release the trunk at the distant office. Go on-hook at test station A.	Trunk push button extinguishes. Call is terminated.
	TEST II	
4.	At the distant office, seize the DID trunk and dial the number of EPABX test station A.	Trunk push button on console lights steady. Test station A starts ringing. Distant office receives ringback tone. In approximately 30 seconds, the trunk push button and associated lamp start flashing indicating timed recall. Station A stops ringing.
5.	At the console, momentarily depress the flashing trunk push button.	Trunk push button and associated lamp light steady. Transmission level is satisfactory.
6.	Establish a call between EPABX test stations A and B.	—
7.	Momentarily depress the ATT LINE push button at the console.	ATT LINE push button lights steady and trunk push button starts winking. Dial tone heard in headset.
8.	Dial the number of test station A, then momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady. Distant office hears music if music on hold is provided. Test stations A and B hear camp-on tone.
9.	Go on-hook at both test stations.	Station A starts ringing. Distant office hears ringback tone.
10.	Go off-hook at station A.	Ringing and ringback tone stop. Transmission level is satisfactory between distant office and station A.

TABLE 1.05 DID Trunk Test (Cont.)

STEP	ACTION	VERIFICATION
11.	If the trunk is not arranged for automatic recall, go on-hook at station A and release the trunk at the distant office. Omit steps 12 - 14.	Trunk push button extinguishes. Call is terminated.
12.	If the trunk is arranged for automatic recall, go on hook at station A.	In approximately eight seconds, the trunk push button and associated lamp start flashing.
13.	Momentarily depress the flashing trunk push button.	Trunk push button and associated lamp light steady. Transmission level between distant office and console is satisfactory.
14.	Release the trunk at the distant office and momentarily depress the RELEASE bar at the console.	Trunk push button and associated lamp extinguish. Call is terminated.
	TEST III	
15.	If the DID trunk is strapped to route calls to busy station to the console, omit steps 16 - 18 and test the trunk per steps 19 - 26.	—
16.	Go off-hook at test station A.	—
17.	At the distant office, seize the DID trunk and dial the number of test station A.	Trunk push button on console lights steady. Busy tone heard at distant office.
18.	Go on-hook at test station A and release the DID trunk at the distant office.	Trunk push button extinguishes. Call is terminated. Go to step 27.
19.	Go off-hook at test station A.	—
20.	At distant office, seize the DID trunk and dial the number of test station A.	Trunk push button lights steady. After a short time, the trunk push button and associated lamp start flashing. Ringback tone heard at distant office.
21.	Momentarily depress the flashing trunk push button.	Trunk push button and associated lamp light steady. Transmission level between distant office and console is satisfactory.
22.	Release the trunk at the distant office and momentarily depress the RELEASE bar on the console.	Trunk push button and associated lamp extinguish. Call is terminated.

TABLE 1.05 DID Trunk Test (Cont.)

STEP	ACTION	VERIFICATION
23.	Place the NIGHT switch on the console in the ON position.	–
24.	At the distant office seize the DID trunk and dial the number of test station A.	Trunk push button on console lights steady. Distant office receives busy tone.
25.	Release the DID trunk and go on-hook at test station A.	Trunk push button extinguishes. Call is terminated.
26.	Place the NIGHT switch on the console in the OFF position.	–
	TEST IV	
27.	At the distant office, seize the DID trunk and dial the number of EPABX test station A.	Trunk push button on console lights steady. Test station A starts ringing. Distant office hears ringback tone. In approximately 30 seconds, the trunk push button and associated lamp start flashing. Station A stops ringing.
28.	Momentarily depress the flashing trunk push button.	Trunk push button and associated lamp light steady. Transmission level is satisfactory.
29.	Momentarily depress the HOLD push button.	Trunk push button winks. Distant office hears music, if music on hold is provided.
30.	Momentarily depress the RELEASE bar.	No change.
31.	Momentarily depress the CONNECT bar.	Trunk lamp extinguishes.
32.	Momentarily depress the trunk push button.	Trunk push button and associated lamp light steady. Transmission level between console and distant office is satisfactory.
33.	Release the trunk at the distant office and momentarily depress the RELEASE bar at the console.	Trunk push button and associated lamp extinguish. Call is terminated.

TABLE 1.05 DID Trunk Test (Cont.)

STEP	ACTION	VERIFICATION
	TEST V	
34.	If the DID trunk is strapped to route calls directly to the TD-100 console, perform steps 35 - 37. If not, go to step 38.	–
35.	At the distant office, seize the DID trunk and dial the number to access the TD-100 console.	Trunk push button flashes and audible signal is heard. Distant office hears ring-back tone.
36.	Momentarily depress the flashing trunk push button.	Trunk push button and associated lamp light steady. Audible signal stops. Transmission level between console and distant office is satisfactory.
37.	Release the trunk at the distant office and momentarily depress the RELEASE bar on the console.	Trunk push button and associated lamp extinguish. Call is terminated.
38.	Repeat steps 1 - 37 for all DID trunks.	Same as steps 1 - 37.

TABLE 1.06 Camp-on-Busy Test

STEP	ACTION	VERIFICATION
1.	Establish a call between EPABX test stations A and B.	—
2.	At the console, momentarily depress the push button associated with a trunk which has outgoing capabilities.	Trunk push button and associated lamp light steady. C.O. dial tone heard in headset.
3.	Dial the number of a distant office test station.	Ringback tone heard in headset followed by answer of call. Transmission level is satisfactory.
4.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady. Trunk push button starts winking. Dial tone is heard in headset.
5.	At the console, dial the number of EPABX test station A, then momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady. Camp-on tone heard at both inside stations. Distant office hears music, if music on hold is provided.
6.	Maintain this condition.	In approximately 30 seconds, the trunk push button and associated lamp start flashing.
7.	Momentarily depress the flashing push button.	Trunk push button and associated lamp light steady. Trunk and console are reconnected.
8.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady. Trunk push button starts winking. Dial tone is heard in headset.
9.	Dial the number of test station A, then momentarily depress the CONNECT bar.	ATT LINE push button and trunk lamp extinguish. Trunk push button lights steady. Camp-on tone heard at both inside stations. Distant office hears music, if music on hold is provided.
10.	Go on-hook at test stations A and B.	Station A starts ringing and distant office hears ringback tone.

TABLE 1.06 Camp-on-Busy Test (Cont.)

STEP	ACTION	VERIFICATION
11.	Go off-hook at test station A.	Ringing and ringback tone stop. Transmission level is satisfactory.
12.	Go on-hook at distant office.	Trunk push button extinguishes. Test station A receives busy tone.
13.	Go on-hook at test station A.	Call is terminated.
14.	Repeat steps 1 - 13 for all applicable trunks.	–

TABLE 1.07 Call Splitting Test

STEP	ACTION	VERIFICATION
1.	At the console, momentarily depress the push button associated with a trunk which has outgoing capabilities.	Trunk push button and associated lamp light steady. C.O. dial tone heard in headset.
2.	Dial the number of a distant office test station.	Ringback tone heard in headset, followed by answer of call. Transmission level is satisfactory.
3.	Momentarily depress the ATT LINE push button.	ATT LINE push button lights steady. Trunk push button starts winking. Dial tone is heard in headset.
4.	Dial the number of an EPABX test station.	Ringback tone heard in headset. Test station rings.
5.	Go off-hook at test station.	Ringing and ringback tone stop. Transmission level is satisfactory between test station and console. Distant office is on hold.
6.	Momentarily depress the TALK CITY push button.	TALK CITY and trunk push buttons light steady. ATT LINE push button winks. Transmission level is satisfactory between distant office and console. Test station is on hold.
7.	Momentarily depress the TALK EXT push button.	TALK EXT and ATT LINE push buttons light steady. Trunk push button winks. TALK CITY push button extinguishes. Transmission level is satisfactory between test station and console. Distant office is on hold.
8.	Momentarily depress the CONNECT bar.	Trunk push button lights steady. Trunk lamp, ATT LINE push button, and TALK EXT push button extinguish. Test station and distant office are connected.
9.	Go on-hook at the distant office and at the EPABX test station.	Trunk push button extinguishes. Call is terminated.

TABLE 1.08 Station-to-Trunk via Console Test

STEP	ACTION	VERIFICATION
1.	Go on-hook at an EPABX test station and upon receipt of dial tone, dial zero.	Ringback tone heard at test station. ATT TK I push button at console starts flashing and the audible signal is heard.
2.	Momentarily depress the flashing push button.	ATT TK I push button lights steady, ringback tone stops, and the audible signal stops. Transmission level is satisfactory.
3.	Momentarily depress the push button assigned to an idle trunk with outgoing capabilities.	Trunk push button and associated lamp light steady. ATT TK I push button starts winking. C.O. dial tone heard in headset.
4.	Momentarily depress the CONNECT bar.	ATT TK I push button and trunk lamp extinguish. C.O. dial tone heard at test station.
5.	Go on-hook at test station.	Trunk push button extinguishes.
6.	Repeat steps 1 through 5 for ATT TK II push button.	–

TABLE 1.09 Unassigned Night Answer (UNA) Test

STEP	ACTION	VERIFICATION
1.	Set the NIGHT switch on the console to the ON position.	–
2.	Go off-hook at distant office and dial the digits required for the TD-100 EPABX.	Common audible signal for UNA is heard.
3.	Go off-hook at an unrestricted station and dial the UNA answer code.	Common audible signal stops. Transmission level between station and distant office is satisfactory.
4.	Release from test call at distant office and test station.	–
5.	Return the NIGHT switch to the OFF position.	–

TABLE 1.10 Assigned Night Answer (ANA) Test

STEP	ACTION	VERIFICATION
1.	Set the NIGHT switch on the console to the ON position.	—
2.	At the distant office seize the desired trunk and dial the digits to access the TD-100 EPABX.	Assigned night answer station starts ringing.
3.	Go off-hook at station.	Ringing stops. Transmission level is satisfactory.
4.	Go on-hook at ANA station. At distant office, release the trunk.	Call is terminated.
5.	Establish a call between the ANA station and another EPABX test station.	—
6.	At distant office, reseize the trunk and dial the digits to access the TD-100 EPABX.	Both inside stations receive camp-on tone and distant office receives ringback tone. In approximately 40 seconds, the above indication still exists. NOTE: If the ANA station is also assigned to the master position in a station hunt group and hunting is allowed during ANA service, the next station in the group will start ringing. When this condition exists, go off-hook at station, verify the transmission level, and advance to step 9.
7.	Go on-hook at both stations.	ANA station starts ringing.
8.	Go off-hook at ANA station.	Transmission level is satisfactory.
9.	Go on-hook at ANA station. At distant office, release the trunk.	Call is terminated.
10.	Repeat steps 2 through 9 for all trunks used for ANA service.	Same as steps 2 through 9.
11.	At completion of tests, set the NIGHT switch to the OFF position.	—

TABLE 1.11 Manual Power Failure Transfer Test

STEP	ACTION	VERIFICATION
1.	Set the POWER FAILURE TRANSFER switch on the bottom of the console to the ON position.	MAJ ALM lamp on the console lights.
2.	Go off-hook at an EPABX station that has been assigned for power failure transfer service. If necessary, depress the grounding push button on the station instrument. NOTE: Operation of the grounding push button is required if the assigned trunk is arranged for ground start.	C.O. dial tone is heard.
3.	Dial the number of a distant office test station.	Ringback tone heard, followed by answer of call at distant office. Transmission level is satisfactory.
4.	Set the POWER FAILURE TRANSFER switch to the OFF position.	Transmission level is still satisfactory. MAJ ALM lamp extinguishes at console.
5.	Go on-hook at distant office and power failure transfer station.	Call is terminated.
6.	Repeat steps 1 - 5 for transfer circuits 1 - 9, if applicable.	Same as steps 1 - 5.
7.	Set the POWER FAILURE TRANSFER switch to the ON position.	MAJ ALM lamp on the console lights.
8.	At the console, depress the TK RES ON push button. If the assigned trunk is arranged for ground start, momentarily depress the CONNECT bar.	C.O. dial tone is heard in headset.
9.	Dial the number of a distant office test station.	Ringback tone heard, followed by answer of call at distant office. Transmission level is satisfactory.
10.	Set the POWER FAILURE TRANSFER switch to the OFF position.	Transmission level is still satisfactory. MAJ ALM lamp extinguishes at console.
11.	Go on-hook at the distant office. Depress the TK RES OFF push button on the console.	Call is terminated.

TABLE 1.11 Manual Power Failure Transfer Test (Cont.)

STEP	ACTION	VERIFICATION
12.	If the console is equipped with an auxiliary ringer, perform steps 13 - 16. If not, go to step 17.	–
13.	Set the POWER FAILURE TRANSFER switch to the ON position.	MAJ ALM lamp on the console lights.
14.	At the distant office, seize the power failure transfer trunk assigned to the console. Dial the digits required to access the TD-100 EPABX.	Auxiliary console ringer rings.
15.	Depress the TK RES ON push button.	Ringing stops. Transmission level is satisfactory.
16.	Depress the TK RES OFF push button. At the distant office release the trunk.	Call is terminated.
17.	At the distant office, seize the trunk assigned to an EPABX station. Dial the digits required to access the TD-100 EPABX.	Assigned EPABX station starts ringing.
18.	Go off-hook at EPABX station.	Ringing stops. Transmission level is satisfactory.
19.	Go on-hook at distant office and EPABX station.	Call is terminated.
20.	Repeat steps 17 - 19 for all trunks assigned power failure transfer capabilities. (10 maximum)	Same as steps 17 - 19.
21.	At completion of tests, set the POWER FAILURE TRANSFER switch to the OFF position.	MAJ ALM lamp extinguishes.
22.	Momentarily lift the receiver at each power failure transfer station and listen for dial tone.	EPABX dial tone is heard, indicating the power failure transfer circuitry has returned to normal.

TABLE 1.12 Trunk Access Test

STEP	ACTION	VERIFICATION
1.	Set the TRUNK ACCESS switch to the ATT position.	–
2.	Go off-hook at an EPABX test station and dial the digit(s) to access an outgoing trunk group assigned to trunk access deny.	Reorder tone heard at station.
3.	Go on-hook at test station.	–
4.	Repeat steps 2 and 3 for all applicable outgoing trunk groups.	Same as steps 2 and 3.
5.	At completion of tests, set the TRUNK ACCESS switch to the DIAL position.	–

TABLE 1.13 Trunk Reservation Test

STEP	ACTION	VERIFICATION
1.	Make busy the standard two-way trunks in each pre-selected group which has not been strapped for trunk reservation.	Trunk LED's flash or light steady.
2.	Depress TK RES ON push button at the console.	–
3.	Go off-hook at test station and dial the access digits for the outgoing trunk group being tested.	Busy tone heard in receiver.
4.	Go on-hook at test station, and repeat steps 2 and 3 for all applicable trunk groups.	Same as steps 2 and 3.
5.	At the distant office, seize a trunk in the group being tested and dial the digits required to access the TD-100 EPABX.	Push button assigned to the trunk in the associated trunk group starts flashing and audible signal is heard at console.
6.	Momentarily depress flashing push button.	Audible signal stops. Trunk push button and associated lamp light steady. Transmission level is satisfactory.
7.	Release the trunk at the distant office. Momentarily depress the RELEASE bar at the console.	Trunk push button and associated lamp extinguish.
8.	Repeat steps 5 through 7 for the remaining trunks associated with trunk group under test.	Same as steps 5 through 7.
9.	Repeat steps 5 through 8 for all applicable trunk groups.	Same as steps 5 through 8.
10.	Restore to service, all trunks made busy in step 1.	Associated LED's extinguish.
11.	Depress the TK RES OFF push button on the console.	–

TABLE 1.14 Busy Verification Test

STEP	ACTION	VERIFICATION
1.	Establish a call between EPABX test stations A and B.	–
2.	Momentarily depress the ATT LINE push button at the console.	Push button lights steady. Dial tone heard in headset.
3.	Dial the number of test station A.	Busy tone heard in headset.
4.	Depress and hold the BUSY VER push button.	Low level busy tone heard at both test stations and the console. Transmission level is satisfactory between console and both stations.
5.	Release the BUSY VER push button and momentarily depress the RELEASE bar.	ATT LINE push button extinguishes. Low level busy tone is removed. Station A still connected to station B.
6.	Go on-hook at the test stations.	–

TABLE 1.15 Conference Call Test

STEP	ACTION	VERIFICATION
1.	Momentarily depress the ATT LINE push button at console.	ATT LINE push button lights steady. Dial tone is heard in headset.
2.	Key the three-digit number of an EPABX test station, station A.	Station A starts ringing and ringback tone heard in headset.
3.	Go off-hook at station A.	Ringing and ringback tone stop. Transmission level is satisfactory.
4.	Momentarily depress the CONF push button.	CONF push button lights steady. Dial tone heard in headset. Station A is connected to the conference circuit.
5.	Repeat steps 2 through 4 for EPABX test stations B, C, and D.	Same as steps 2 through 4. NOTE: As each station is added, conversation may take place between the connected stations.
6.	Momentarily depress the RELEASE bar at the console.	ATT LINE push button extinguishes.
7.	Momentarily depress a push button assigned to a trunk which has outgoing capabilities.	Trunk push button and associated lamp light steady. Dial tone heard in headset.
8.	Dial the number of a distant office test station.	Ringback tone heard in headset followed by answer of call at distant office. Ringback tone is removed.
9.	Momentarily depress the CONF push button.	Trunk lamp extinguishes. Distant office test station is now connected to the conference circuit.
10.	Repeat steps 7 through 9 for a second distant office test station.	Same as steps 7 through 9. (Sixth conferee) NOTE: When the second distant office test station is connected, the CONF lamp starts winking, indicating the conference network has reached its maximum capacity.
11.	Go on-hook at EPABX and distant office test stations.	CONF and trunk push buttons extinguish.

TABLE 1.16 Code Call Test

STEP	ACTION	VERIFICATION
	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION	

TABLE 1.17 Paging Call Test

STEP	ACTION	VERIFICATION
1.	Depress and hold the PAGE push button at the console.	PAGE push button lights steady. One second of tone is heard in the headset and, if applicable, over the paging system. If music is normally played over the paging system, it is removed for the duration of the page.
2.	Speak into the paging system.	Voice heard over the loud speaker system in all designated areas.
3.	Release the PAGE push button.	PAGE push button extinguishes. Music is heard over paging system if music is provided.

TABLE 1.18 Alarm Lamp Test

STEP	ACTION	VERIFICATION
1.	Momentarily place the TEST/RESET switch (on the alarm board at the cabinet) in the upper (TEST) position.	MAJ ALM and MIN ALM lamps light at the console.
2.	Momentarily place the TEST/RESET switch in the lower (RESET) position.	MAJ ALM and MIN ALM lamps at console extinguish.
3.	If standby power is provided, turn the AC power off at the main breaker.	STBY PWR lamp on console lights.
4.	Restore AC power.	STBY PWR lamp extinguishes.

STATION OPERATION TESTS
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1.00 INTRODUCTION

1.01 Purpose of Section. This section contains the tests to be performed from station telephone sets to verify the correct operation of the TD-100 Electronic Private Automatic Branch Exchange (EPABX).

2.00 TEST PREPARATION

2.01 General. A minimum of two testers can perform the tests described in this section when test stations are arranged as follows: four test telephones set up in the vicinity of the console, with three of the telephones connected to station lines in the TD-100 and one of the telephones connected to a line in the local central office.

> NOTE: For installation testing only, it may be advantageous to temporarily connect the console directly to the equipment cabinet, thus allowing observation of the console indicators and the LED's on the plug-in boards.

The tests in this section need not be performed in the order in which they are presented. The sequence in which the tests are performed can best be determined by on-site installation personnel.

While it may not be practical to test every feature at every station telephone set, enough tests should be performed to satisfy the installer that all equipment is operating satisfactorily.

CAUTION: When lines from an auxiliary key telephone unit (KTU) and lines from the TD-100 appear on the same key telephone, the key telephone must be modified to isolate the RT leads of the TD-100 from the RT leads of the KTU.

3.00 TESTS

3.01 General. The following tests are to be performed prior to placing the TD-100 system in service and will verify system operation as specified. The test procedures are arranged to individually test the operation of each component in its relationship to the entire TD-100 system.

In some of the tests, it is necessary to make calls into the EPABX from a central office. Where this is not possible, the test call can be made by seizing an outgoing trunk and then dialing the EPABX listed number or the desired station number. If this alternative procedure is used, the same outgoing trunk should be used to perform successive tests to different incoming trunks.

3.02 Station-to-Station Test. The test in table 1.00 verifies correct operation of all line circuits during station-to-station calls. The test also verifies operation of all local links and registers.

3.03 Class-of-Service and Vacant Number Intercept Test. The test in table 1.01 verifies that the class-of-service and vacant number intercept circuit will allow or deny system features, route unassigned number calls to intercept, and provide toll restriction. The test is also a partial check of the processor 1 and 2 circuits.

3.04 Station Hunting Test. The test in table 1.02 verifies that all stations strapped for station hunting will be hunted in the correct sequence.

3.05 Consultation Hold and Transfer Test. The test in table 1.03 verifies that a station can place an incoming or outgoing trunk call on hold, consult with another station, return to the call, or transfer the call to another station. A portion of the transfer and add-on links board is checked by this test.

3.06 Call Forward Follow Me Test. The test in table 1.04 verifies correct operation of the call forward follow me feature.

3.07 Call Forward Follow Me, Busy Line, No Answer Test. The test in table 1.05 verifies correct operation of the call forward follow me, busy line, no answer feature.

3.08 Meet-Me Conference Test. The test in table 1.06 verifies correct operation of each conference link and a portion of the conference network. A maximum of four local stations can be connected to the meet-me conference simultaneously.

3.09 Paging with Answer Back Test. The test in table 1.07 verifies that a station can access all paging circuits and that the paging circuits will allow the user to speak over the system. The test also checks the operation of the answer back feature.

3.10 Dictation Access Test. The test in table 1.08 verifies that the customer-provided dictation equipment can be accessed, and that it performs as outlined in the manufacturer's instruction manual.

3.11 Private Line (Key Telephone Unit) Test. The test in table 1.09 verifies that a station connected to a private line is provided the calling, holding, and lamp features of a normal central office line.

3.12 Manual Intercom Test. The test in table 1.01 verifies that a station arranged for manual intercom service can manually signal and converse with another station within the selected group.

3.13 Busy Trunk Call Back Test. The test in table 1.12 verifies that the busy trunk call back feature functions correctly.

3.14 Busy Line Call Back Test. The test in table 1.12 verifies that the busy line call back feature functions correctly.

3.15 Tel-Touch to Dial Pulse Converter Test. The test in table 1.13 verifies proper Tel-Touch to dial pulse conversion.

3.16 Dial Call Hold Test. The test in table 1.14 verifies the proper operation of the dial call hold feature.

3.17 Dial Call Pickup Test. The test in table 1.15 verifies the proper operation of the dial call pickup feature.

3.18 Directed Call Pickup Test. The test in table 1.16 verifies the proper operation of the directed call pickup feature.

TABLE 1.00 Station-To-Station Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at selected station telephone 200 (line 00).	The station receives dial tone and the line circuit LED at the cabinet lights. The key-set's line lamp (if provided) and the busy lamp at console light. In approximately eight or 16 seconds (strapping option), the station receives busy tone indicating line lockout, and the line circuit LED winks.
2.	Go on-hook.	The LED and lamps extinguish.
3.	Go off-hook and dial the digits required for station 201 (line 01).	The station receives ringback tone; station 201 rings and the associated line LED flashes. The busy lamp at the console and the keyset's line lamp (if provided) flash.
4.	Go off-hook at station 201.	Ringing and ringback tone stop; the LED and lamps light. The transmission level is satisfactory.
5.	If station 200 is a key phone, operate the HOLD button.	The LED and key telephone lamp wink.
6.	Operate the key for station 200, removing hold condition.	The LED and lamps light.
7.	Go on-hook at station 201.	The LED and lamps extinguish at station 201. Station 200 receives lockout tone.
8.	Go on-hook at station 200.	The LED and lamps extinguish at station 200.
9.	Make busy the local link and register used.	The associated LED's flash.
10.	Transpose the stations used and repeat steps 1 through 5.	Same as steps 1 through 5.
11.	Make busy the local link and register used.	The associated LED's flash.
12.	Repeat steps 1 through 8 (using different lines) until all registers and links have been tested.	Same as steps 1 through 8.

TABLE 1.00 Station-To-Station Test (Cont.)

STEP	ACTION	VERIFICATION
13.	Restore all registers and links to service.	The associated LED's extinguish.
14.	Repeat steps 1 through 8 until all lines have been tested.	Same as steps 1 through 8.

TABLE 1.01 Class of Service and Vacant Number Intercept Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a station strapped to class of service 1 and dial the access digit(s) for that class of service.	The station receives re-order tone indicating that feature access is denied.
2.	Go on-hook at the station.	The test call is terminated.
3.	Go off-hook at a station not strapped to the first class of service and dial the access digit(s) for that class of service. NOTE: Some of the features assigned a class of service will require additional digits to determine if the call was allowed.	The feature is accessed.
4.	Go on-hook at the station.	The test call is terminated.
5.	Repeat steps 1 through 4 for classes of service 2 through 6.	Same as steps 1 through 4.
6.	Repeat step 1 for class of service 7. NOTE: Some of the features assigned a class of service will require additional digits to determine if the call was allowed.	The feature is accessed.
7.	Go on-hook at the station.	The call is terminated.
8.	Go off-hook at a station not strapped to class of service 7 and dial the access digit(s) for that class of service.	The station receives re-order tone indicating that feature access is denied.
9.	Go on-hook at the station.	The test call is terminated.
10.	Repeat steps 6 through 9 for class of service 8 through 14.	Same as steps 6 through 9.
11.	Go off-hook at a station strapped to class of service 15 and dial the access digit(s) required for connection to the central office.	The station receives central office dial tone.
12.	Dial a restricted number. (A restricted number is determined by the type of toll restriction equipped.)	The station receives re-order tone indicating the toll call is denied.
13.	Go on-hook at the station.	The test call is terminated.

TABLE 1.01 Class of Service and Vacant Number Intercept Test (Cont.)

STEP	ACTION	VERIFICATION
14.	Go off-hook at a station not strapped to class of service 15 and dial the access digit(s) required for connection to the central office.	The station receives central office dial tone.
15.	Dial the same number dialed in step 12.	The test termination responds.
16.	Go on-hook at the station.	The test call is terminated.
17.	Go off-hook at any station and dial the number of a station strapped to vacant number intercept.	The station receives re-order tone or recorded announcement heard (whichever is applicable).
18.	Go on-hook at the station.	The test call is terminated.
19.	Go off-hook at a station strapped as a vacant number.	The station receives re-order tone.
20.	Go on-hook at the station.	The test is terminated.

TABLE 1.02 Station Hunting Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at the station assigned to the master position (station 1) of the first hunting group.	—
2.	Go off-hook at the originating test station and dial the digits required for the off-hook station (station 1).	Station assigned to the next position in the hunting group rings and the originating test station receives ringback tone.
3.	Go off-hook at the ringing station.	The transmission is satisfactory.
4.	Go on-hook at the originating test station, and leave the terminating station off-hook.	The terminating station receives re-order tone.
5.	Repeat steps 2 through 4, until all stations in the group have been tested.	Same as steps 2 through 4.
6.	Go off-hook at the originating test station and dial the digits required for the off-hook station (station 1).	The origination station receives busy tone, indicating that all stations in the hunt group are busy.
7.	Go on-hook at all stations.	The test call is terminated.
8.	Repeat steps 1 through 7 until all groups have been tested.	Same as steps 1 through 7.

TABLE 1.03 Consultation Hold and Transfer Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a distant office and dial the digits required to access the TD-100 console.	The trunk push button at console flashes.
2.	Answer the call at the console and extend it to the selected test station (station A).	Station A rings and the trunk receives ringback tone.
3.	Go off-hook at station A.	The ringback tone and ringing stop. The transmission is satisfactory.
4.	Momentarily depress the hookswitch at station A.	Station A receives transfer dial tone and the trunk is put on hold.
5.	Dial the digits required for the second station (station B).	Station A receives ringback tone and station B rings. The LED on the transfer link seized lights.
6.	Go off-hook at station B.	The ringing and ringback tone stop. The transmission is satisfactory between stations A and B.
7.	Go on-hook at station A.	Station B and the trunk are connected. The transfer link LED extinguishes and transmission is satsifactory.
8.	Momentarily depress the hookswitch at station B.	Station B receives transfer dial tone and the trunk is put on hold.
9.	Dial the digits required to access station A.	Station B receives ringback tone and station A rings. The LED on the seized transfer link lights.
10.	Go off-hook at station A.	The ringback tone and ringing stop. The transmission is satisfactory between stations A and B.
11.	Momentarily depress the hookswitch at station B.	The transfer link LED extinguishes and the LED associated with the add-on link lights. All three stations are now connected. The transmission is satisfactory.
12.	Go on-hook at station A.	Station B is connected to the trunk.
13.	Go off-hook at station A.	The station receives dial tone.

TABLE 1.03 Consultation Hold and Transfer Test (Cont.)

STEP	ACTION	VERIFICATION
14.	Momentarily depress the hookswitch at station B and dial the digits required to access station A.	The trunk is put on hold, then reconnected to station B. Both receive approximately four seconds of busy tone.
15.	Go on-hook at station A.	—
16.	Momentarily depress the hookswitch at station B and dial the digits required to access station A.	The trunk is put on hold. Station A rings, and station B receives ringback tone.
17.	Momentarily depress the hookswitch at station B.	Station B is reconnected to the trunk.
18.	Go on-hook at the central office and at station B.	The link LED extinguishes and the call is terminated.
19.	Make busy the transfer link tested.	The transfer link LED flashes.
20.	Repeat steps 1 through 13 for all transfer links.	Same as steps 1 through 13.
21.	Restore all transfer links to service.	All links' LED's extinguish and the test is terminated.

TABLE 1.04 Call Forward Follow Me Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station (station A) and on receipt of dial tone, dial the call forward follow me access code.	Station A receives call forward follow me dial tone.
2.	Dial the number of the station (station B) to which subsequent calls are to be forwarded.	Station A receives busy tone.
3.	Go on-hook at station A.	–
4.	Go off-hook at another TD-100 station (station C) and dial the digits to access station A.	Station C receives ringback tone and station B rings.
5.	Go off-hook at station B.	The ringing and ringback tone stop. The transmission is satisfactory between stations B and C.
6.	Go on-hook at both stations.	The test call is terminated.
7.	Repeat steps 1 through 6 using three additional groups of stations.	Same as steps 1 through 6.
8.	Repeat step 1 from a fifth station.	The station receives busy tone, indicating that all ports to the call forward follow me circuit are in use.
9.	Go on-hook at the fifth station.	The test call is terminated.
10.	Go off-hook at a station set up (in step 1) for follow me operation and dial the station's assigned number.	The station receives busy tone.
11.	Go off-hook at any other station and dial the digits to access the station used in step 10.	The dialed station rings demonstrating that the call forward follow me instruction has been canceled.
12.	Go on-hook at the originating station.	The ringing stops.
13.	Repeat steps 10 through 12 for the remaining three stations with call forward follow me instructions.	Same as steps 10 through 12.

TABLE 1.05 Call Forward Follow Me, Busy Line, No Answer Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station (station A) and on receipt of dial tone, dial the call forward follow me, busy line, no answer access code.	Station A receives call forward follow me dial tone.
2.	Dial the number of the station (station B) to which subsequent calls are to be forwarded when station A is busy or does not answer.	Station A receives busy tone.
3.	Go on-hook at station A.	—
4.	Go off-hook at another TD-100 station (station C) and dial the digits to access station A. (Do not answer station A.)	Station C receives ringback tone and station A rings. Station A stops ringing after approximately 8 seconds; station B rings.
5.	Go off-hook at station B.	The ringing and ringback tone stop. The transmission is satisfactory between stations B and C.
6.	Go on-hook at both stations.	The test call is terminated.
7.	Go off-hook at station A.	—
8.	Go off-hook at station C and dial the digits to access station A.	Station C receives ringback tone and station B rings.
9.	Go off-hook at station B.	The ringing and ringback tone stop. The transmission is satisfactory between stations B and C.
10.	Go on-hook at all three stations.	The test call is terminated.
11.	Repeat steps 1 through 10 using three additional groups of stations.	Same as steps 1 through 10.
12.	Repeat step 1 from a fifth station.	The station receives busy tone, indicating that all ports to the call forward follow me, busy line, no answer circuit are in use.
13.	Go on-hook at the fifth station.	The test call is terminated.
14.	Go off-hook at a station set up (in step 1) for follow me operation and dial the station's assigned number.	The station receives busy tone.

TABLE 1.05 Call Forward Follow Me, Busy Line, No Answer Test (Cont.)

STEP	ACTION	VERIFICATION
15.	Go off-hook at any other station and dial the digits to access the station used in step 14.	The dialed station rings demonstrating that the call forward follow me, busy line no answer, instruction has been canceled.
16.	Go on-hook at the originating station.	The ringing stops.
17.	Repeat steps 14 through 16 for the remaining three stations with call forward follow me, busy line, no answer instructions.	Same as steps 14 through 16.

TABLE 1.06 Meet-Me Conference Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station and dial the digits to access the conference network.	The CONF lamp on the console lights and the conference link 1 LED lights.
2.	Repeat step 1 for three additional stations.	As each station enters, successive conference links are seized and the associated LED lights. The transmission is satisfactory between all stations.
3.	Repeat step 1 from a fifth station.	The fifth station receives busy tone.
4.	Go on-hook at all stations.	The CONF lamp and all conference links' LED's extinguish. The test is terminated.

TABLE 1.07 Paging with Answer Back Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station and dial the digits to access the first paging circuit.	The PAGE push button on the console and the LED's on the paging access circuits light. One second of tone is received at the station and over the paging system (strapping option), if applicable. If music is normally provided over the paging system, it is removed for the duration of the page.
2.	Announce your presence.	The announcement is transmitted over the loud speaker system for the designated area.
3.	If answer back operation is provided, go off-hook at a second TD-100 station and dial the answer back access code.	The two stations are connected; the transmission is satisfactory.
4.	Go on-hook at the TD-100 stations.	The PAGE push button on the console and the LED's on the paging access board extinguish. Music is transmitted over the paging system, if applicable.
5.	If applicable, repeat steps 1 through 4 for the next two paging circuits by dialing the appropriate access code.	Same as steps 1 through 4.

TABLE 1.08 Dictation Access Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station and dial the digits to access the customer provided dictation equipment.	Check the manufacturer's manual for indication provided upon seizure.
2.	Check the start, stop, record, playback, etc. functions per the manufacturer's instruction manual.	Check the manufacturer's manual for verification of operation.
3.	Go on-hook at the TD-100 station.	The test call is terminated.

TABLE 1.09 Private Line (Key Telephone Unit) Test

STEP	ACTION	VERIFICATION
1.	Depress the line push button on the keyset associated with a private line and go off-hook. Upon receipt of dial tone, dial the digits required to access the TD-100 console.	The line push button lights and the keyset receives ringback tone. An incoming trunk call appears on the console.
2.	At the console, momentarily depress the flashing trunk push button.	The keyset and the console are in connection. The transmission is satisfactory.
3.	Depress the HOLD push button on the keyset.	The line push button winks and the console is put on hold.
4.	Depress the winking line push button.	The line push button lights. The keyset and the console are reconnected; the transmission is satisfactory.
5.	Release the test call at the keyset and the console.	The line push button extinguishes. The test call is terminated.
6.	Momentarily depress an idle central office trunk push button at the console. Upon receipt of central office dial tone, dial the digits required to access the private line used in step 1.	The console receives ringback tone and the keyset rings. The line push button at the keyset flashes.
7.	Go off-hook at the keyset.	The ringing and ringback tone stop; the line push button lights steady. The transmission is satisfactory.
8.	Release the test call at the keyset and the console.	The line push button extinguishes. The test call is terminated.
9.	Repeat steps 1 through 8 for all keysets connected to private line circuits.	Same as steps 1 through 8.

TABLE 1.10 Manual Intercom Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at the keyset connected to the first manual intercom circuit.	–
2.	Depress the line push button for the first manual intercom circuit.	The line push button lights.
3.	Momentarily depress the SIGNAL push button on the originating keyset.	All associated keysets momentarily buzz.
4.	Go off-hook at one of the signaled keysets and depress the manual intercom push button.	The line push button lights; the transmission is satisfactory.
5.	Go on-hook at both keysets.	The line push buttons extinguish.
6.	Repeat steps 1 through 5 for all manual intercom circuits.	Same as steps 1 through 5.

TABLE 1.11 Busy Trunk Call Back Test

STEP	ACTION	VERIFICATION
1.	At the attendant's console, momentarily depress the trunk push button assigned to one of the trunks in the busy call back trunk group to be tested.	The trunk push button and associated lamp light.
2.	Momentarily depress the HOLD push button.	The trunk push button lamp winks.
3.	Repeat steps 1 and 2 for each trunk assigned to the trunk group being tested.	Same as steps 1 and 2.
4.	At a test station (station A) that is allowed access to the trunk group that was made busy in steps 1 through 3, go off-hook and dial the trunk group access code.	Station A receives busy tone for approximately eight seconds, followed by reorder tone, indicating that the busy trunk call back reservation is made.
5.	Go on-hook at station A.	–
6.	Repeat steps 4 and 5 using six additional stations (B, C, D, E, F, & G).	Same as steps 4 and 5.
7.	Repeat step 4 using station H.	Station H receives reorder tone indicating that all the access ports assigned to the trunk group being tested are busy.
8.	Go on-hook at station H.	–
9.	At the attendant's console, momentarily depress one of the winking trunk push buttons.	The trunk push button and associated lamp lights.
10.	Momentarily operate the RELEASE bar.	The trunk push button and associated lamp extinguish. After a short delay, station A rings.
11.	–	After a short delay, station A stops ringing and station B rings.
12.	–	After a short delay, station B stops ringing and station C rings.
13.	Go off-hook at station C and dial the digits required to terminate the call in the distant office.	The distant office test termination responds.

TABLE 1.11 Busy Trunk Call Back Test (Cont.)

STEP	ACTION	VERIFICATION
14.	Go off-hook at station H and dial the access code of the trunk group being tested.	Station H receives busy tone for approximately eight seconds, and then reorder tone indicating that the busy trunk call back reservation is made.
15.	Go on-hook at station H.	—
16.	Go off-hook at station E.	Station E receives EPABX dial tone.
17.	Go on-hook at station C.	After a short delay, station D rings.
18.	—	After a short delay, station D stops ringing and station F rings. Note that station E was not called because it was off-hook.
19.	Go on-hook at station E.	—
20.	—	After a short delay, station F stops ringing and station E rings.
21.	—	After a short delay, station E stops ringing and station H rings.
22.	—	After approximately eight seconds, station H stops ringing.
23.	Repeat steps 1 through 22 for each trunk group assigned for busy trunk call back.	—

TABLE 1.12 Busy Line Call Back Test

STEP	ACTION	VERIFICATION
1.	At a test station (station A) go off-hook and dial the digits required to access station B.	Station B rings.
2.	At station C, go off-hook and dial the digits required to access station A.	Station C receives busy tone for approximately eight seconds and then reorder tone, indicating that the busy line call back reservation is made.
3.	Go on-hook at station C; go off-hook at station D and dial the digits required to access station A.	Station D receives busy tone for approximately eight seconds and then reorder tone, indicating that the busy line call back reservation is made.
4.	Go on-hook at station D.	–
5.	Go on-hook at station A.	After a short delay, stations A and C ring. In approximately eight seconds stations A and C stop ringing and stations A and D ring.
6.	Go off-hook at stations A and D.	The transmission is satisfactory between stations A and D.
7.	Go on-hook at stations A and D.	The test is completed.

TABLE 1.13 Tel-Touch to Dial Pulse Converter Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at an unrestricted TD-100 station equipped with a Tel-Touch dial and dial the access code of a trunk group that terminates in a DP only office.	The station receives CO dial tone.
2.	Tone dial a test number into the central office.	The test termination responds.
3.	Go on-hook at the station.	The test call is terminated.
4.	Go off-hook at the station and dial the access code of a trunk group that terminates in a Tel-Touch office.	The station receives CO dial tone.
5.	Tone dial a test number into the central office.	The test termination responds.
6.	Go on-hook at the station.	The test is terminated.

TABLE 1.14 Dial Call Hold Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at a TD-100 station (station A) and on receipt of dial tone, dial the digits to access station B.	Station A receives ringback tone and station B rings.
2.	Go off-hook at station B.	The ringing and ringback tone stop. The transmission is satisfactory between stations A and B.
3.	Momentarily depress the hookswitch at station A.	Station A receives transfer dial tone.
4.	Dial the call hold exit code.	Station B is put on hold; station A receives EPABX dial tone.
5.	Dial the digits required to access station C.	Station A receives ringback tone and station C rings.
6.	Go off-hook at station C.	The ringing and ringback tone stop. The transmission is satisfactory between stations A and C.
7.	Go on-hook at stations A and C.	The connection is terminated.
8.	Go off-hook at station A and on receipt of dial tone, dial the call hold enter code.	Stations A and B are reconnected. The transmission is satisfactory between them.
9.	Go on-hook at both stations A and B.	The test is terminated.

TABLE 1.15 Dial Call Pickup Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at station A and dial the digits required to access station B.	Station A receives ringback tone and station B rings.
2.	Go off-hook at another station (station C) within the same programmed dial call pick-up group as station B. Dial the dial call pickup access code.	Station B stops ringing: the transmission is satisfactory between stations A and C.
3.	Go on-hook at both stations.	The test call is terminated.
4.	Repeat steps 1 through 3 for all dial call pickup groups.	Same as steps 1 through 3.

TABLE 1.16 Directed Call Pickup Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at station A and dial the digits required to access station B.	Station A receives ringback tone and station B rings.
2.	Go off-hook at another station (station C) and dial the directed call pickup access code.	Station C receives EPABX dial tone.
3.	Dial the digits required to access station B.	Station B stops ringing: the transmission is satisfactory between stations A and C.
4.	Go on-hook at both stations.	The test is terminated.

ACCESS TEST SET INSTALLATION
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

CONTENTS PAGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides instructions for installing the access test set in the TD-100 Electronic Private Automatic Branch Exchange equipment cabinet.

1.02 Purpose of Equipment. The access test set permits maintenance personnel to perform system tests and initiate test calls from the front of the TD-100 cabinet. The test set operator may choose any one of lines 295, 296, 297, 298 or 299 as an access test line to the system. When a line is selected at the test set, the station telephone set on that line is automatically disconnected from the system. When the test set is not being used, the station telephone sets on lines 295-299 will be connected to the system in the normal manner. Note that if lines 295-299 are equipped with key telephones, the lamps on the instruments will indicate line status during testing as well as during normal operation.

1.03 Tools Required. The only tool required for installation of the access test set is a medium size bladed screwdriver.

2.00 INSTALLATION

2.01 General. The access test set is a self-contained panel that connects to the TD-100 system wiring through three pairs of pre-wired connectors. The panel is held in place at the top of the equipment cabinet by four screws and cup washers. Installation of the test set requires momentary disruption of service and should be performed during a period of light traffic.

2.02 Unpacking. The access test set is wrapped in static-free bubble pack and padded with foam. It may be packaged alone in a tri-wall container or together with other equipment or drawings. In any case, all items received at the delivery site should be checked against the packing slip.

All cartons should be checked for visible signs of shipping damage. If cartons show signs of damage, a note of such damage should be made on the packing slip and on the carrier bills. Report any shortages an/or damaged equipment promptly to:

Sales Service Department
ITT Telecommunications
Telecom Drive
Milan, Tennessee 38358
Telephone: (901) 686-7401

Open the container and remove the test set. Carefully remove the packing wrap and check the equipment for damage. Damage should be recorded and reported as previously described. Avoid touching the exposed wires, printed circuit board and component leads at the rear of the panel.

2.03 Connection Procedure. The test set is connected to the equipment cabinet by three connectors; two 50-pin connectors and one 14-pin connector. The test set half of each of these is readily identifiable at the rear of the panel. The cabinet halves are located above the line subrack. The two halves of the 50-pin connectors are one male and one female and (at the equipment cabinet) are connected to each other. The 14-pin male connector half is loose.

After removing the TD-100 cabinet front panel, remove the four screws and cup washers from

around the opening above the line subrack. Save the screws and cup washers for reuse. Locate the 50-pin connector and loosen the screws at the ends of the connector halves.

> NOTE: When the connector halves are separated, lines 295-299 will be disconnected.

Separate the connector halves. Connect the male half to the female half on the rear of the test set. Connect the female half (from the cabinet) to the male half on the rear of the test set. Connect the 14-pin (male) connector half from the cabinet to the 14-pin (female) connector half on the rear of the test set.

Secure the two 50-pin connectors by tightening the screws at the ends of the connector halves. Secure the two halves of the 14-pin connector by means of the spring clips on the connector. Taking care not to trap or pinch wires, place the test panel in the cabinet and secure it with the four screws and cup washers.

2.04 Testing. Verifying the operation of the access test set is the required testing. Detailed operating instructions are contained in ITT practice OC-000-002. Note that a line PCB must be provided in the line subrack position dedicated to lines 295 through 299.

NUMERICAL INDEX
OF
TD-100 EPABX FEATURE STRAPPING DOCUMENTS

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1.00 INTRODUCTION 1
Purpose of Section 1
2.00 MASTER NUMERICAL INDEX 1

1.00 INTRODUCTION

1.01 Purpose of Section. This section provides a master numerical index of feature strapping documents for the various circuits of the TD-100 electronic private automatic branch exchange. The circuit assembly numbers are listed together with the circuit names and the applicable strapping documents. Strapping document numbers shown in parenthesis indicate that the enclosed document may be required, depending on the nature of the strapping to be performed.

2.00 MASTER NUMERICAL INDEX

Assembly	Name	Strapping Document
TD-4101516-003, -004, -010	Line	OB-410-151, Iss. 2
TD-4101526-010	Attendant Line and Control	OB-410-152, Iss. 1
TD-4101536-003, -004, -005, -006	CO Trunk	OB-410-153, Iss. 1 (See also: OB-410-155 †OB-410-160 *OB-410-163 OB-410-228)
TD-4101556-001, -002, -003	Assigned Night Answer	OB-410-155, Iss. 1
TD-4101576-001, -002, -003, -004 -010	Conference Network	OB-410-157, Iss. 2
TD-4101606-002, -003, -004, -005 -010	Class of Service	†OB-410-160, Iss. 2
TD-4101616-003, -004, -005	Memory	OB-410-161, Iss. 2

Assembly	Name	Strapping Document
TD-4101626-010	Processor 1	OB-410-162, Iss. 1
TD-4101636-003, -004, -005, -010	Processor 2	*OB-410-163, Iss. 2
TD-4101646-001, -002, -010	Loop Tie Trunk	OB-410-164, Iss. 3 (See also: †OB-410-160 *OB-410-163 OB-410-228)
TD-4101656-002, -003, -004, -010	Station Hunt	OB-410-165, Iss. 2
TD-4101666-004, -005	Register	OB-410-166, Iss. 1
TD-4101686-001, -002, -003, -010	Local/Conference Links	OB-410-168, Iss. 2
TD-4101696-001, -002	Attendant Register and Links	(See †OB-410-160 *OB-410-163)
TD-4101726-001, -002, -010	E & M Tie Trunk	OB-410-172, Iss. 2 (See also: †OB-410-160 *OB-410-163 OB-410-228)
TD-4101776-001, -002	DID Trunk	OB-410-177, Iss. 1
TD-4101786-002, -003, -005	Alarm	OB-410-178, Iss. 1
TD-4101916-001, -002, -010	Private Line and Manual Intercom	OB-410-191, Iss. 3
TD-4101926-001, -002, -010	Paging Access	OB-410-192, Iss. 2
TD-4101936-001, -002	Dictation Access	(See *OB-410-163)
TD-4102246-001	Call Forward/Follow Me	(See *OB-410-163)
TD-4102266-001	Message Registration IA	OB-410-226, Iss. 2
TD-4102276-001	Message Registration IB	(See OB-410-226)
TD-4102286-001, -010	Toll Restrictor	OB-410-228, Iss. 2
TD-4102946-001	Number Translator	OB-410-294, Iss. 2
TD-4102956-001	Recorder Disconnect	OB-410-295, Iss. 1
TD-4102966-001	Busy Trunk, Busy Line Call Back	OB-410-296, Iss. 1

Assembly	Name	Strapping Document
TD-4103086-001	Call Forward, Follow Me/Busy Line, Don't Answer	OB-410-308, Iss. 1 (See also: †OB-410-160 *OB-410-163 OB-410-165 OB-410-400)
TD-4103226-101	Dial/Directed Call Pickup	OB-410-322, Iss. 1
TD-4103346-001	Executive Access Trunk	OB-410-334, Iss. 1 (See also: †OB-410-160)
TD-4103456-001	2-Way DID Translator	OB-410-345, Iss. 1 (See also: †OB-410-160)
TD-4103546-001	Combined 2-Way DID and Room Number Translator	OB-410-354, Iss. 1 (See also: †OB-410-160)
TD-4104006-001	CO Trunk	OB-410-400, Iss. 1 (See also: †OB-410-160 *OB-410-163 OB-410-228 OB-410-308)
TD-4104046-001	Assigned Night Answer	OB-410-404, Iss. 1
TD-4104066-001	Quad Transfer Trunk/Station Add-on Links	OB-410-406, Iss. 1
TD-4104306-001	Dial/Directed Call Pickup	OB-410-430, Iss. 1
TD-4104456-001	Line Circuit with CO to CO Connection	OB-410-445, Iss. 1

† Certain system features require strapping on the class of service board for implementation. These include standard toll restriction (day/night), allow or denial of access codes, attendant access to features and vacant number intercept. Strapping for these is explained in OB-410-160.

* Access codes for system features (trunk access, trunk access deny, access to attendant, meet me conference, dictation, paging, CFFM, etc.) are strapped on the processor 2 PCB; also contained thereon is the strapping for vacant level intercept, call hold and intercept routing. Strapping for these is explained in OB-410-163.

FEATURE STRAPPING
TD-100
LINE CIRCUIT PCB
(TD-4101516-003, -004, -010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section explains how to strap the TD-100 line circuit PCB, TD-4101516. This information is applicable to line circuit PCB's 4101516-003, -004 and -010. It should be referred to when strapping the line circuits for a new installation, or when adding or replacing a line circuit PCB in a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply a 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The line circuit PCB contains five individual line circuits. The system is arranged to accommodate as many as 20 of these PCB's for a total capacity of 100 lines. The line circuit PCB's mount in card positions 2 through 20 of the line shelf.

2.02 Information Required. Before strapping the line circuit PCB, the following must be determined.

a. The type (single line or key telephone) and quantity of station instruments to be assigned to each line.

b. Which, if any, lines will require a 2000-ohm loop.

It should be possible to obtain the above information by consulting a line record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The chart should show all applicable line features. It should be updated any time line circuit PCB's are replaced, changed, or added to the system.

2.03 Procedure. Two feature strappings are provided on a line circuits board (refer to figure 1.01). When only single-line telephone sets are used on a line, a strap must be added on the appropriate line circuit. When a single-line telephone set and a key telephone set are used on the same line, the strap is not installed. The single-line telephone set must be modified for A-lead operation and the A-lead connection made in the same manner as for a key telephone set. Strap A-B should preferably be made at the distributing frame between lead A and A1 of the corresponding line circuit to prevent unnecessary service interruption. When it is required to extend the loop limit of a single-line telephone set from 1000 ohms to 2000 ohms, remove the strap from terminal x to terminal y and add the strap from terminal y to terminal z. Only one strap is required, never both.

NOTE: This single strap increases the battery feed of the fifth line circuit on the board from 48V to 72V.

FEATURE STRAPPING
TD-100
ATTENDANT LINE AND CONTROL PCB
(TD-4101526-010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping terminal arrangement for the TD-100 attendant line and control PCB. This information is applicable to the attendant line and control assemblies numbered TD-4101526-010. It should be consulted when strapping the attendant line and control PCB for a new installation, when adding a new feature, or when replacing the attendant line and control PCB in a working system.

1.02 Tools and Equipment. No tools or equipment are required to strap the attendant line and control PCB. However, should it become necessary to perform any strapping in the future, the following items are required:

a. A 24 AWG wire-wrap tool.

b. A wire-stripping tool.

c. 24 AWG (tinned) wire.

2.00 STRAPPING

2.01 General. The attendant line and control PCB mounts in position 24 of the line subrack. Terminals E1 and E2 are reserved for future use and do not require strapping at the present time. Figure 1.00 shows the arrangement of these terminals.

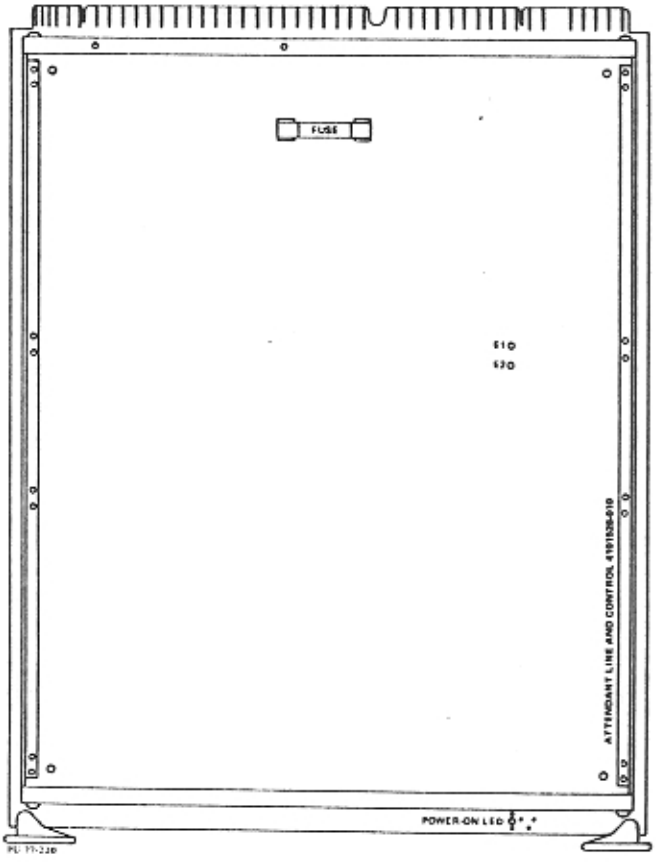

FIGURE 1.00 Attendant Line and Control PCB Strapping (TD-4101526-010)

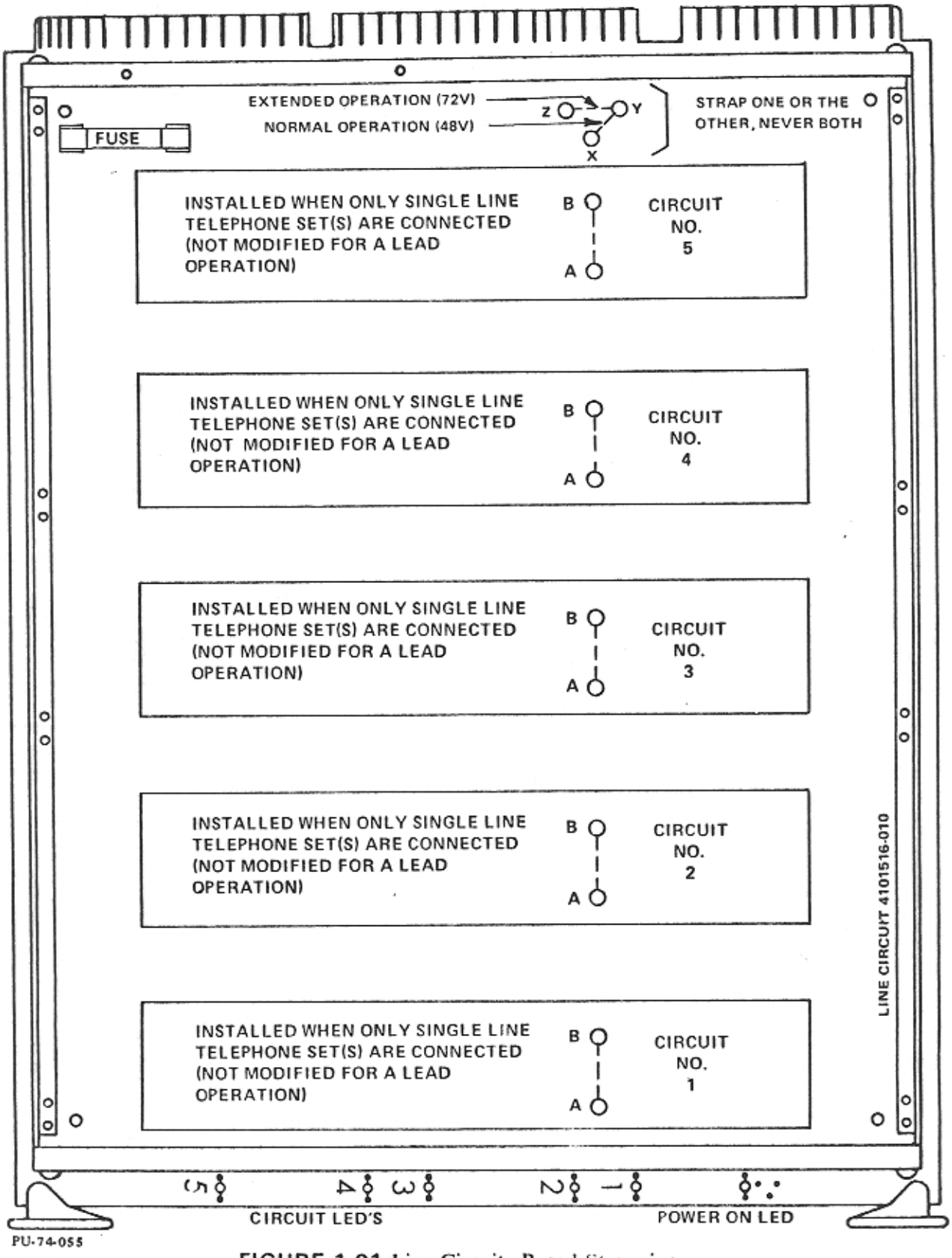

FIGURE 1.01 Line Circuits Board Strapping

FEATURE STRAPPING
TD-100
CO TRUNK (TD-4101536-003, -004, -005, -006)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 CO trunk TD-4101536. This information is applicable to CO trunk PCB's numbered TD-4101536-003, -004, -005, and -006. It should be referred to when strapping a CO trunk for a new installation, or when adding or replacing a CO trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to CO trunk strapping can be found in the following related documents.

a. OB-410-155 ANA Strapping.

b. OB-410-160 Class of Service Strapping.

c. OB-410-163 Processor II PCB Strapping.

d. OB-410-228 Toll Restrictor PCB Strapping.

1.03 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The CO trunks mount in card positions 1 through 24 of the trunk subrack. Each CO trunk PCB provides strapping terminals for a variety of features. These strappable features are listed below.

a. Loop start, ground start, or CDH operation.

b. Attendant controlled directional reservation.

c. Incoming only or two-way operation.

d. Trunk group assignment, wherein any trunk can be assigned to one of six possible trunk groups.

e. Automatic recall.

f. Disable consultation hold, wherein the hookswitch flash feature is inhibited on outgoing calls.

g. Variable CO release timing.

h. Make busy, wherein the trunk circuit indicates a busy condition to the CO when the trunk is removed from service. (This feature applies only to TD-4101536-003, and -004 trunks.)

i. Continuous answer supervision to tie trunks. (Applies only to TD-4101536-005 and -006 trunks.)

j. Camp-on-busy tone option wherein the called party will receive no indication, a single tone burst, or multiple tone bursts. (Applies only to TD-4101536-006 trunks.)

2.02 Information Required. The following information is required in order to strap the CO trunk.

a. Type of trunk operation; CDH, loop, or ground start.

b. Group to which the trunk is assigned.

c. Miscellaneous features required.

It should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The chart should show all applicable trunk features. It should be updated any time trunks are replaced or added to the system.

2.03 CO Trunk TD-4101536-003 and -004.

a. Ground start trunks. (Refer to figure 1.01.)

1. For ground start operation, strap

Terminal 2 to terminal 4.
Terminal 5 to terminal 7.
Terminal 9 to terminal 10.
Terminal 12 to terminal 13.
Terminal 18 to terminal 19.
Terminal 22 to terminal 23.
Terminal 24 to terminal 25.
Terminal 28 to terminal 29.
Terminal 31 to terminal 30.
Terminal 30 to terminal 45.
Terminal 47 to terminal 48.

2. To inhibit automatic recall, strap

Terminal 14 to terminal 15.

3. To enable automatic recall, strap

Terminal 14 to terminal 16.

b. Loop start trunks. (Refer to figure 1.02.) For loop start operation, strap

Terminal 2 to terminal 4.
Terminal 5 to terminal 7.
Terminal 9 to terminal 10.
Terminal 12 to terminal 13.
Terminal 14 to terminal 15.
Terminal 18 to terminal 19.
Terminal 26 to terminal 27.
Terminal 28 to terminal 29
Terminal 30 to terminal 32.
Terminal 32 to terminal 46.
Terminal 45 to terminal 44.
Terminal 44 to terminal 48.

c. CDH operation. (Refer to figure 1.03.)

1. For operation with CDH type interconnect devices, strap

Terminal 1 to terminal 3.
Terminal 3 to terminal 4.
Terminal 5 to terminal 10.
Terminal 6 to terminal 7.
Terminal 8 to terminal 9.
Terminal 11 to terminal 12.
Terminal 17 to terminal 18.
Terminal 18 to terminal 19.
Terminal 26 to terminal 27.
Terminal 28 to terminal 29.
Terminal 30 to terminal 33.
Terminal 44 to terminal 45.
Terminal 47 to terminal 48.

2. To inhibit automatic recall, strap

Terminal 14 to terminal 15.

3. To enable automatic recall, strap

Terminal 14 to terminal 16.

TRUNK RECORD CHART

Incoming Access Digits	985-2481	→									→	643-2XXX	→	942-2691	→			→	8-	8-	8-	8-	8-
Outgoing Access Digits	91	91	91	91	91	91	91	91	91	91	91	91			92	92	92	92	92	8-	8-	8-	8-	8-
Trunk Board Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
TRUNKS																								
Standard Two-Way	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓					
Incoming Only																								
Outgoing Only																								
DID (1-14)													✓	✓	X	X	X	X	X	X	X	X	X	X
Tie Trunk (15-24 or 1-10 and 15-24)											X	X	X	X						✓	✓	✓	✓	✓
FEATURES																								
Trunk Group (1-6) Tie Trunk Group (1-6)	1	1	1	1	1	1	1	1	1	1	1	1			2	2	2	2	2	1	1	1	1	1
ANA (1-10) Station Number	230	210	236	255	274	249	216	290	218	260	X	X	X	X	X	X	X	X	X	X	X	X	X	X
UNA																								
Power Failure Transfer (P.F.T. Circuit 1-10)	10	1	2	3	4	5	6	7	8	9														
Console and Station Number Used for P.F.T.	CONSOLE	230	210	220	213	201	208	268	250	262														
Digit Received (DID Trunks) 1-4													3	3	X	X	X	X	X	X	X	X	X	X
CDQ 2X-2W Interconnect Device (Tie Trunk Only)											X	X	X	X										
CDH (Interconnect Device)																								
Trunk Reservation											✓	✓							✓					
Make Busy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓					
Automatic Recall (Grd. Start or CDH)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓					
Consultation Hold on Incoming Only																								
C.O. Release Time																								
SIGNALING																								
Loop Start													✓	✓										
Ground Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓					
Wink Start																								
E & M																				✓	✓	✓	✓	✓
Duplex (Tie Trunks Only)											X	X	X	X										
Batt./Grd. (Tie Trunks Only)											X	X	X	X										
Delay Dial																								
Immediate Start																								
MISCELLANEOUS																								

PI 77-026

FIGURE 1.00 Typical Trunk Record Chart

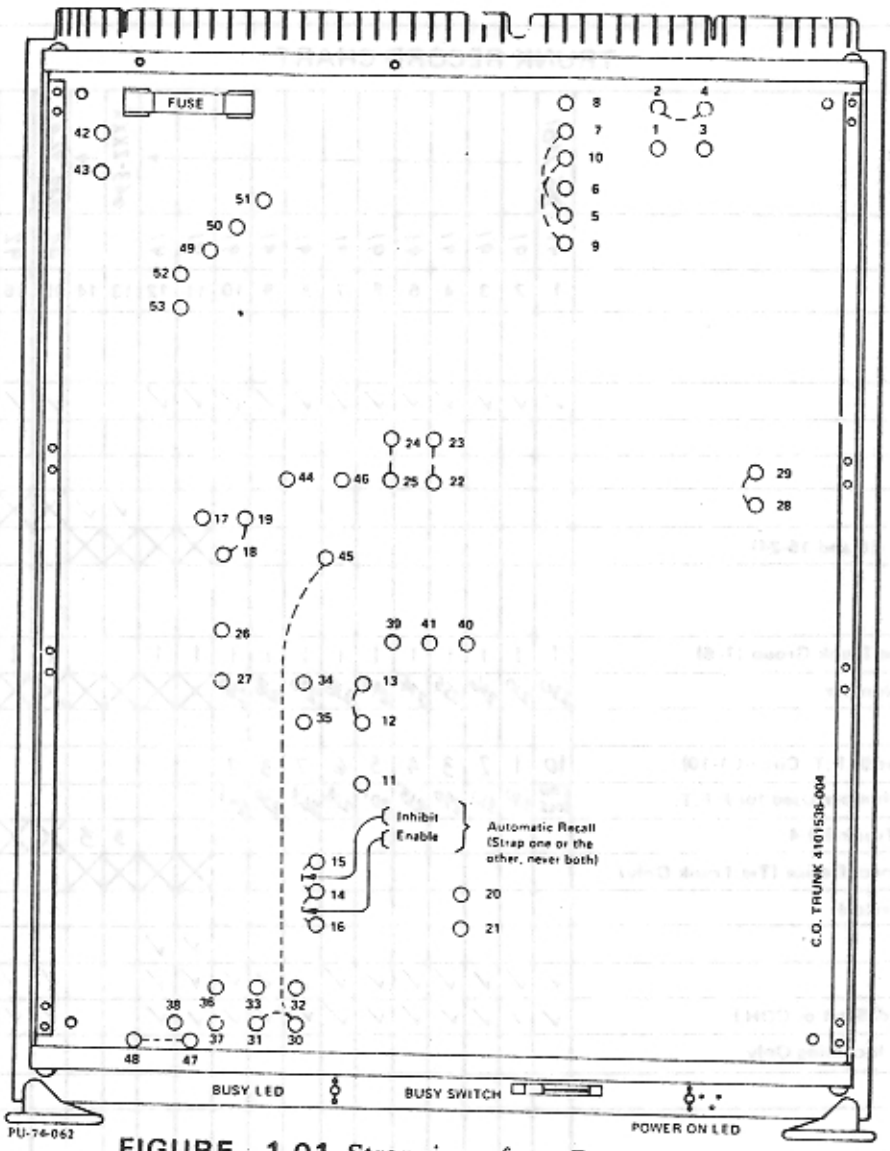

FIGURE 1.01 Strapping for Ground Start (TD-4101536-003/-004)

d. Miscellaneous strapping. (Refer to figure 1.04.)

1. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap

   Terminal 42 to terminal 43.

2. Trunk group assignment. Trunks must be assigned to a trunk group to allow seizure by the processor.

   (a) To assign the trunk to group 1, strap

   Terminal 39 to terminal 40.

   (b) To assign the trunk to group 2, strap

   Terminal 39 to terminal 41.

   (c) To assign the trunk to group 3, strap

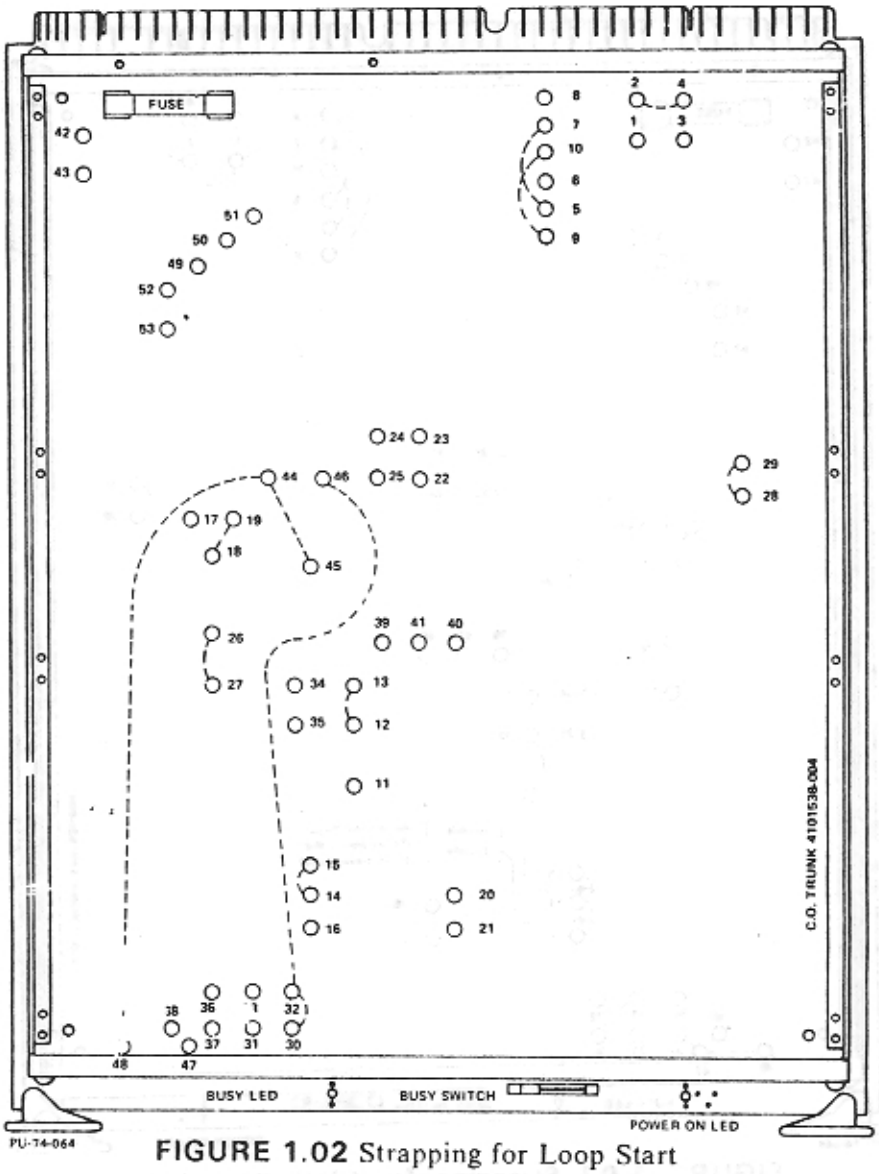

FIGURE 1.02 Strapping for Loop Start (TD-4101536-003/-004)

Terminal 39 to terminal 41.
Terminal 41 to terminal 40.

(d) To assign the trunk to group 4, strap

Terminal 36 to terminal 38.
Terminal 39 to terminal 41.
Terminal 41 to terminal 40.

(e) To assign the trunk to group 5, strap

Terminal 36 to terminal 38.
Terminal 39 to terminal 40.

(f) To assign the trunk to group 6, strap

Terminal 36 to terminal 38.
Terminal 39 to terminal 41.

3. Inhibit consultation hold. To inhibit consultation hold on outgoing calls, strap

Terminal 20 to terminal 21.

4. For incoming operation only, strap

Terminal 37 to terminal 38.

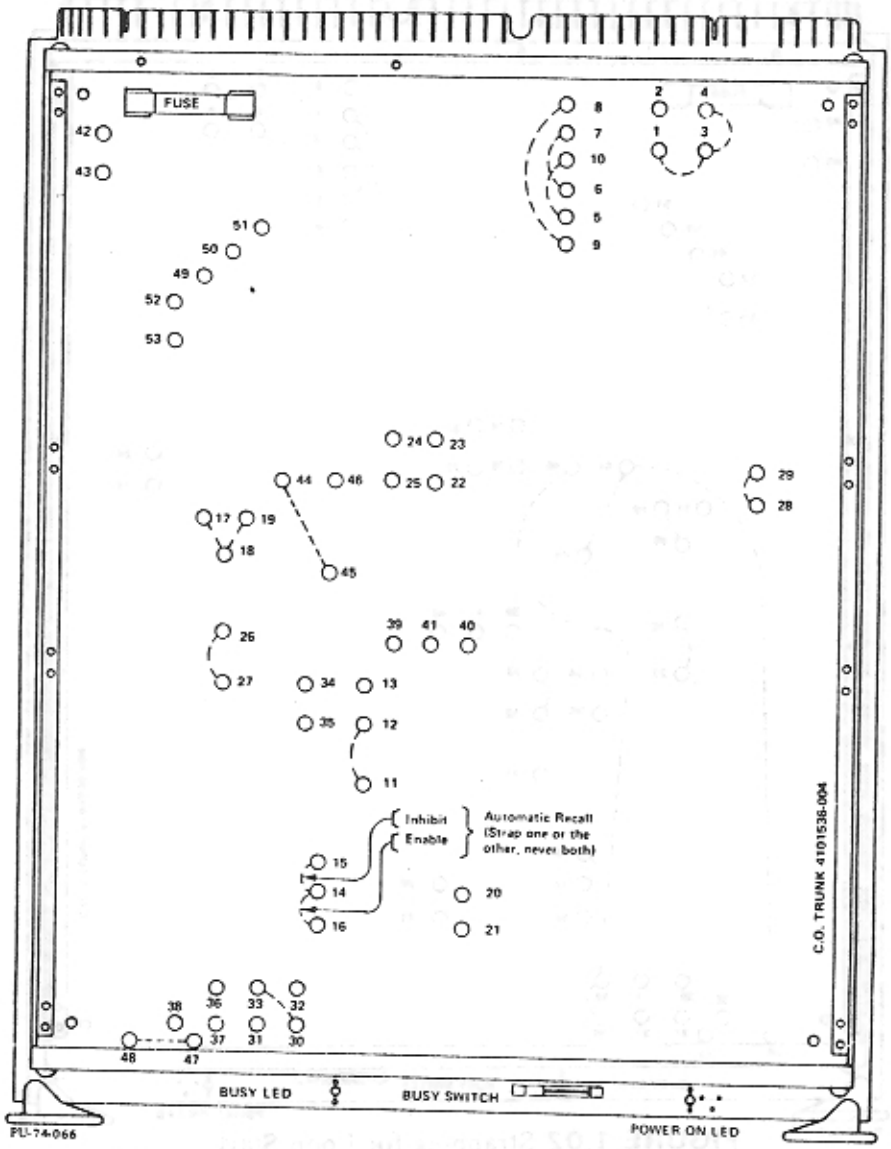

FIGURE 1.03 Strapping for CDH Operation (TD-4101536-003/-004)

5. To make busy the incoming portion of the trunk when busy switch is operated, strap

   Terminal 34 to terminal 35.

6. Central office release time. If the EPABX trunk is to disregard a momentary release signal from the CO, determine the time period, then strap as follows:

   (a) For 250 - 300 ms, strap

   Terminal 50 to terminal 52.
   Terminal 51 to terminal 53.

   (b) For 550 - 600 ms, strap

   Terminal 49 to terminal 52.
   Terminal 50 to terminal 53.

2.04 CO Trunk TD-4101536-005.

a. Ground Start Trunks. (Refer to figure 1.05.)

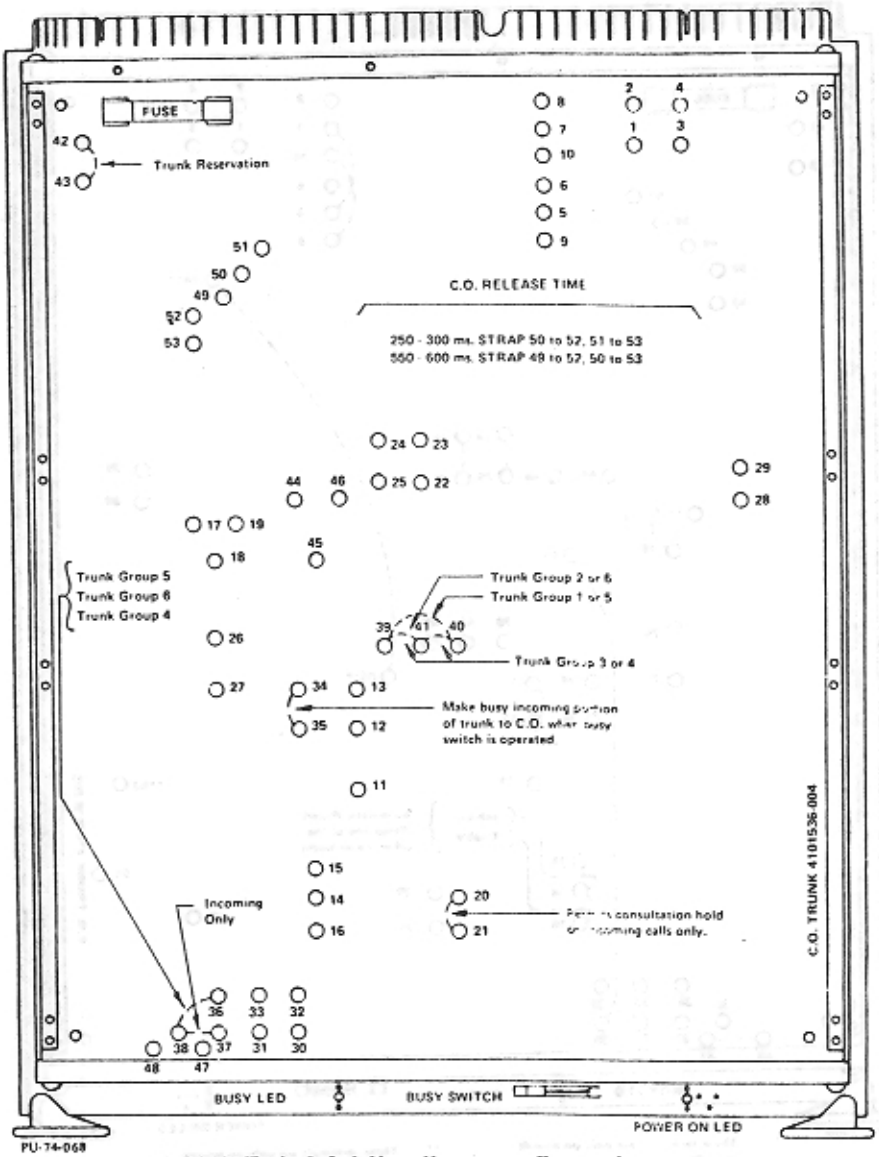

FIGURE 1.04 Miscellaneous Strapping (TD-4101536-003 -004)

1. For ground start operation, strap

   Terminal 2 to terminal 4.
   Terminal 5 to terminal 7.
   Terminal 9 to terminal 10.
   Terminal 12 to terminal 13.
   Terminal 18 to terminal 19.
   Terminal 22 to terminal 23.
   Terminal 24 to terminal 25.
   Terminal 28 to terminal 29.
   Terminal 31 to terminal 30.
   Terminal 30 to terminal 45.
   Terminal 47 to terminal 48.
   Terminal 64 to terminal 65.

2. To inhibit automatic recall, strap

   Terminal 15 to terminal 14.

3. To enable automatic recall, strap

   Terminal 14 to terminal 16.

b. Loop start trunks. (Refer to figure 1.06.)

1. For loop start operation, strap

   Terminal 2 to terminal 4.
   Terminal 5 to terminal 7.

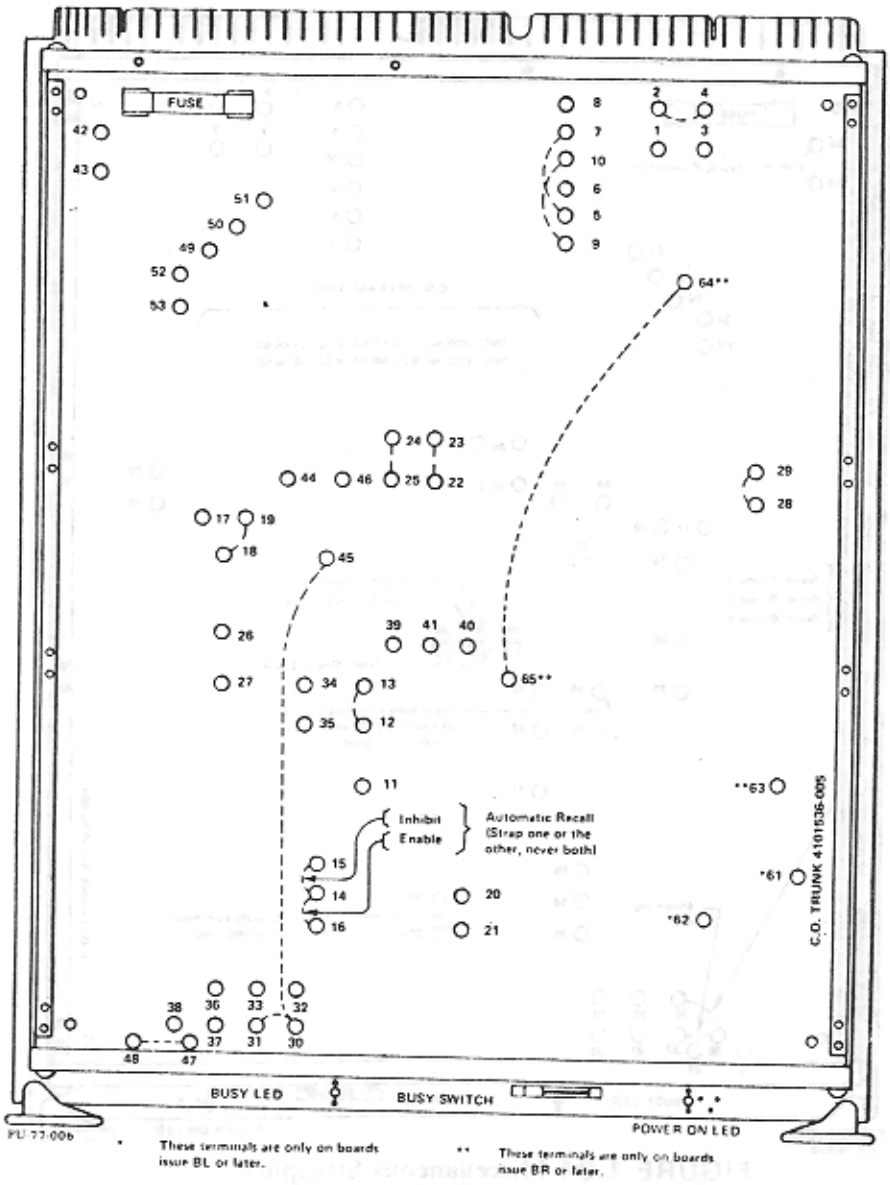

FIGURE 1.05 Strapping for Ground Start (TD-4101536-003/-004)

Terminal 9 to terminal 10.
Terminal 12 to terminal 13.
Terminal 14 to terminal 15.
Terminal 18 to terminal 19.
Terminal 26 to terminal 27.
Terminal 28 to terminal 29.
Terminal 30 to terminal 32.
Terminal 32 to terminal 46.
Terminal 44 to terminal 45.
Terminal 44 to terminal 48.

2. To provide for use of rotary dial telephones, strap

Terminal 63 to terminal 64.

Remove strap from terminal 26 to 27.

3. To provide for use of Tel-Touch telephones, strap

Terminal 64 to terminal 65.

c. CDH operation. (Refer to figure 1.07.)

1. For operation with CDH type interconnect device, strap

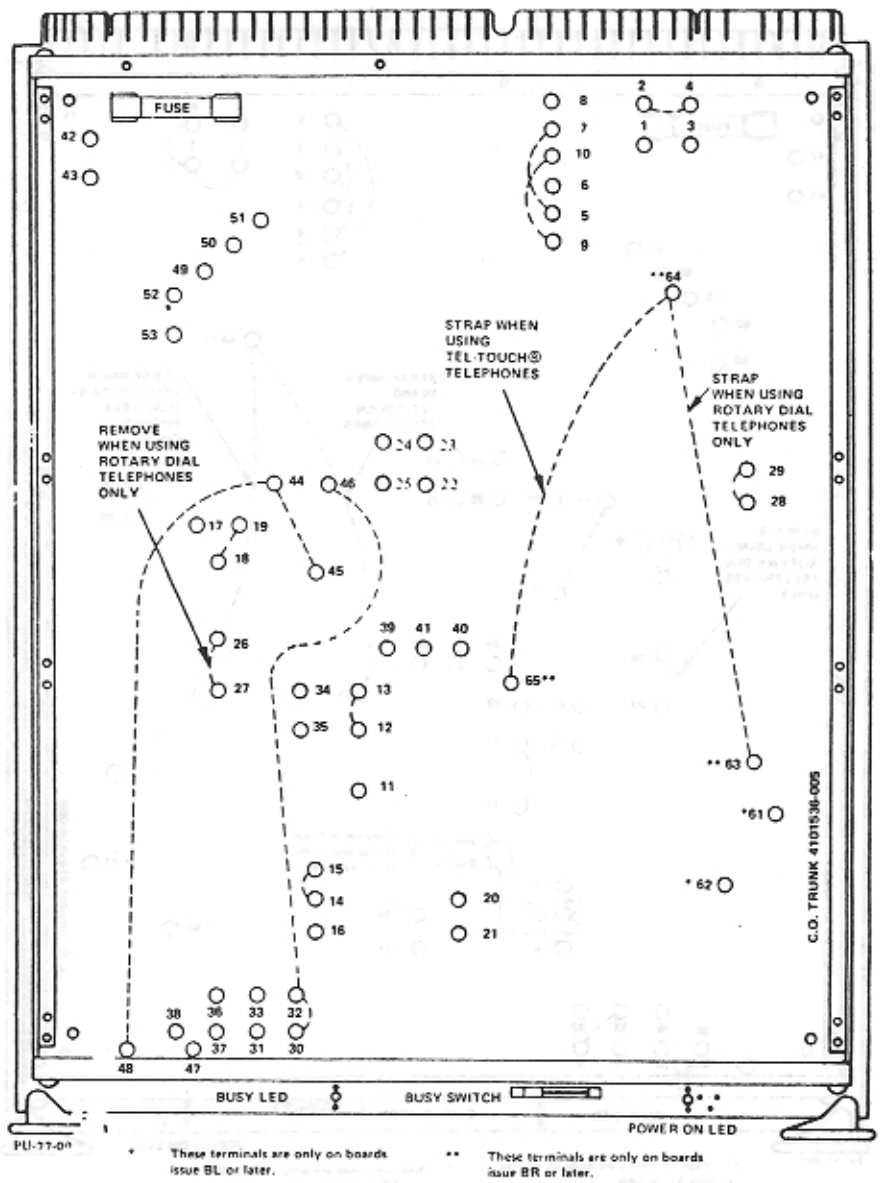

FIGURE 1.06 Strapping for Loop Start
(TD-4101536-005)

Terminal 1 to terminal 3.
Terminal 3 to terminal 4.
Terminal 5 to terminal 10.
Terminal 6 to terminal 7.
Terminal 8 to terminal 9.
Terminal 11 to terminal 12.
Terminal 17 to terminal 18.
Terminal 18 to terminal 19.
Terminal 26 to terminal 27.
Terminal 28 to terminal 29.
Terminal 30 to terminal 33.
Terminal 44 to terminal 45.
Terminal 47 to terminal 48.

2. To provide for use of rotary dial telephones, strap

Terminal 63 to terminal 64.

Remove strap from terminal 26 to 27.

3. To provide for use of Tel-Touch telephones, strap

Terminal 64 to terminal 65.

4. To inhibit automatic recall, strap

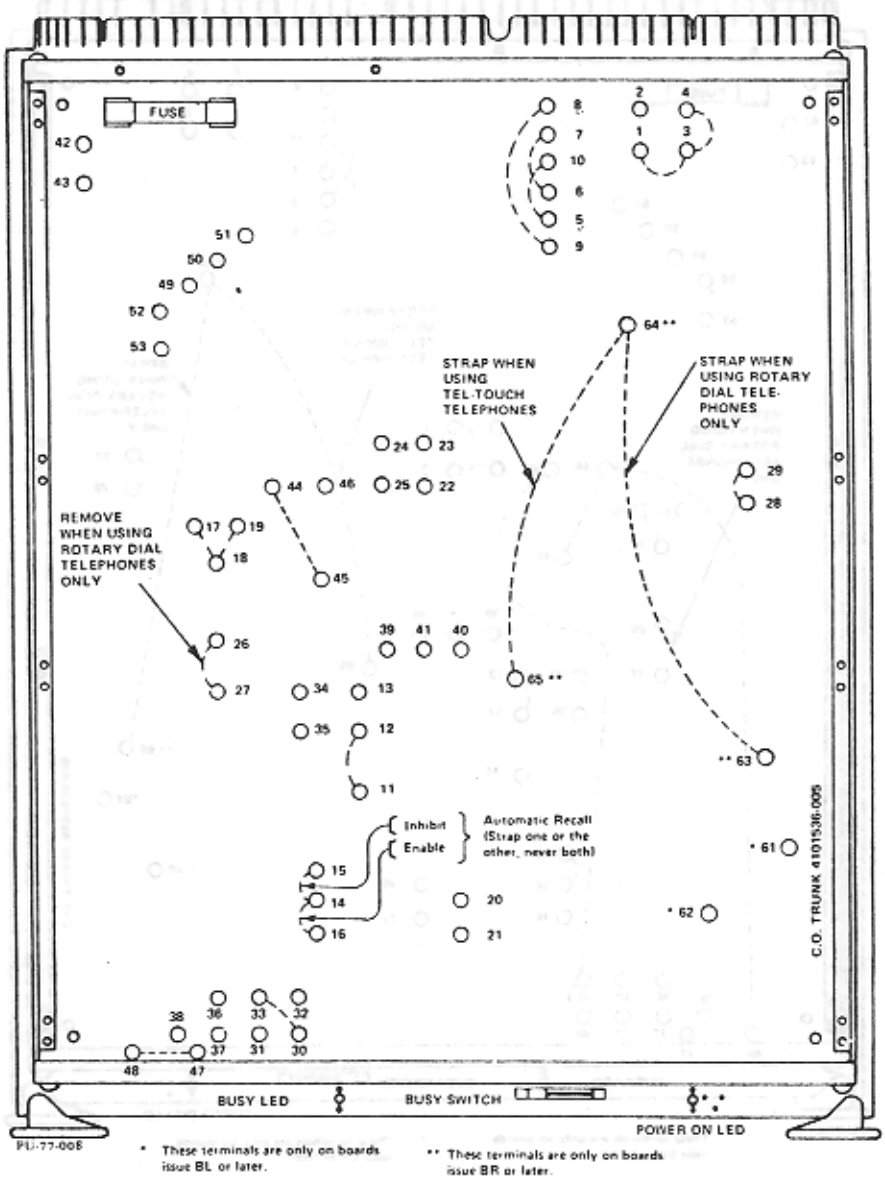

FIGURE 1.07 Strapping for CDH Operation (TD-4101536-005)

Terminal 15 to terminal 14.

5. To enable automatic recall, strap

   Terminal 14 to terminal 16.

d. Miscellaneous strapping. (Refer to figure 1.08.)

   1. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap

      Terminal 42 to terminal 43.

   2. Trunk group assignment. Trunks must be assigned to a trunk group to allow seizure by the processor.

      (a) To assign the trunk to group 1, strap

      Terminal 39 to terminal 40.

      (b) To assign the trunk to group 2, strap

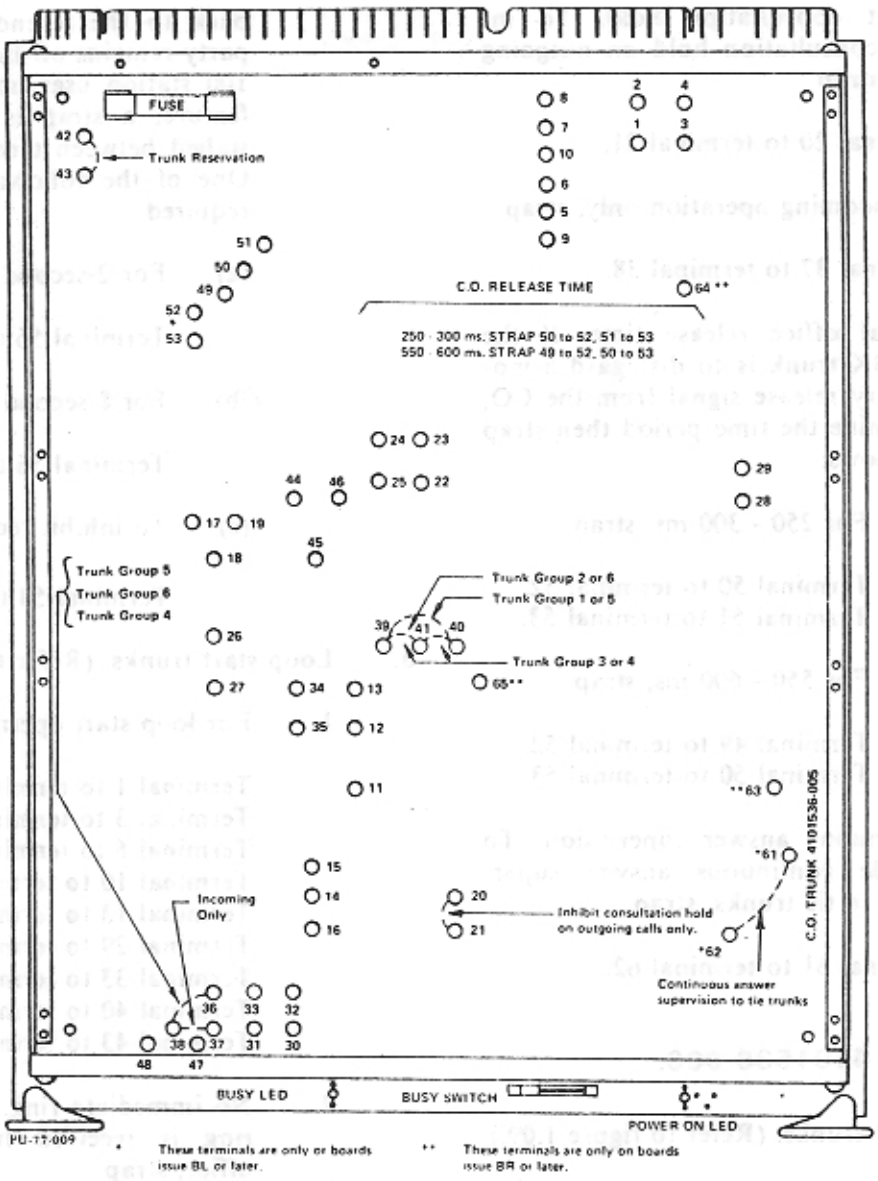

FIGURE 1.08 Miscellaneous Strapping
(TD-4101536-005)

Terminal 39 to terminal 41.

(c) To assign to trunk to group 3, strap

Terminal 39 to terminal 41.
Terminal 41 to terminal 40.

(d) To assign the trunk to group 4, strap

Terminal 39 to terminal 41.
Terminal 41 to terminal 40.
Terminal 36 to terminal 38.

(e) To assign the trunk to group 5, strap

Terminal 39 to terminal 40.
Terminal 36 to terminal 38.

(f) To assign the trunk to group 6, strap

Terminal 39 to terminal 41.
Terminal 36 to terminal 38.

3. Inhibit consultation hold. To inhibit consultation hold on outgoing calls, strap

   Terminal 20 to terminal 21.

4. For incoming operation only, strap

   Terminal 37 to terminal 38.

5. Central office release time. If the EPABX trunk is to disregard a momentary release signal from the CO, determine the time period then strap as follows:

   (a) For 250 - 300 ms, strap

   Terminal 50 to terminal 52.
   Terminal 51 to terminal 53.

   (b) For 550 - 600 ms, strap

   Terminal 49 to terminal 52.
   Terminal 50 to terminal 53.

6. Continuous answer supervision. To provide continuous answer supervision to tie trunks, strap

   Terminal 61 to terminal 62.

2.05 C.O. Trunk 4101536-006.

a. Ground start trunks. (Refer to figure 1.09.)

1. For ground start operation, strap

   Terminal 1 to terminal 3.
   Terminal 3 to terminal 4.
   Terminal 6 to terminal 7.
   Terminal 10 to terminal 11.
   Terminal 13 to terminal 14.
   Terminal 19 to terminal 20.
   Terminal 29 to terminal 30.
   Terminal 33 to terminal 35.
   Terminal 40 to terminal 41.
   Terminal 43 to terminal 44.
   Terminal 48 to terminal 49.

2. Automatic recall. Automatic recall routes an incoming CO trunk call back to the attendant if the trunk party remains off-hook after the TD-100 station user hangs up. For this feature, a strap is permanently installed between terminals 53 and 55. One of the following straps is also required.

   (a) For 2-second recall, strap

   Terminal 56 to terminal 57.

   √(b) For 8-second recall, strap

   Terminal 56 to terminal 58.

   (c) To inhibit recall, strap

   Terminal 54 to terminal 56.

b. Loop start trunks. (Refer to figure 1.10.)

1. For loop start operation, strap

   Terminal 1 to terminal 3.
   Terminal 3 to terminal 4.
   Terminal 6 to terminal 7.
   Terminal 10 to terminal 11.
   Terminal 13 to terminal 14.
   Terminal 29 to terminal 30.
   Terminal 33 to terminal 35.
   Terminal 40 to terminal 41.
   Terminal 43 to terminal 44.

2. No immediate ring. If no immediate ring is received from the central office, strap

   Terminal 15 to terminal 16.
   Terminal 17 to terminal 18.

3. Automatic recall. Automatic recall routes an incoming CO trunk call back to the attendant if the trunk party remains off-hook after the TD-100 station user hangs up. For this feature, a strap is permanently installed between terminals 53 and 55. One of the following straps is also required.

   (a) For 2-second recall, strap

   Terminal 56 to terminal 57.

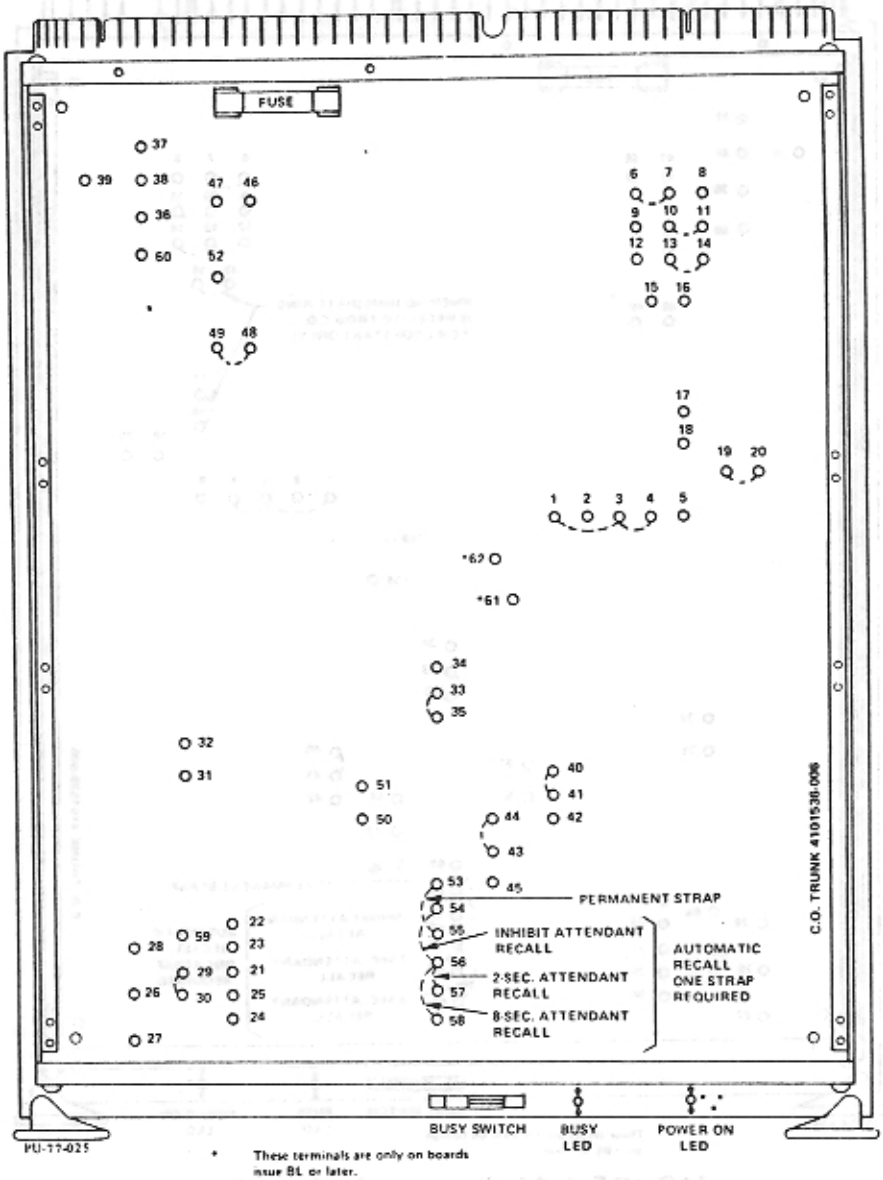

FIGURE 1.09 Strapping for Ground Start (TD-4101536-006)

(b) For 8-second recall, strap

Terminal 56 to terminal 58.

(c) To inhibit recall, strap

Terminal 54 to terminal 56.

c. CDH operation. (Refer to figure 1.11.)

1. For operation with a CDH type interconnect device, strap

Terminal 1 to terminal 5.
Terminal 2 to terminal 3.
Terminal 6 to terminal 8.
Terminal 9 to terminal 11.
Terminal 10 to terminal 14.
Terminal 12 to terminal 13.
Terminal 29 to terminal 59.
Terminal 34 to terminal 33.
Terminal 33 to terminal 35.
Terminal 40 to terminal 42.
Terminal 44 to terminal 45.

2. Automatic recall. Automatic recall routes an incoming CO trunk call back to the attendant if the trunk

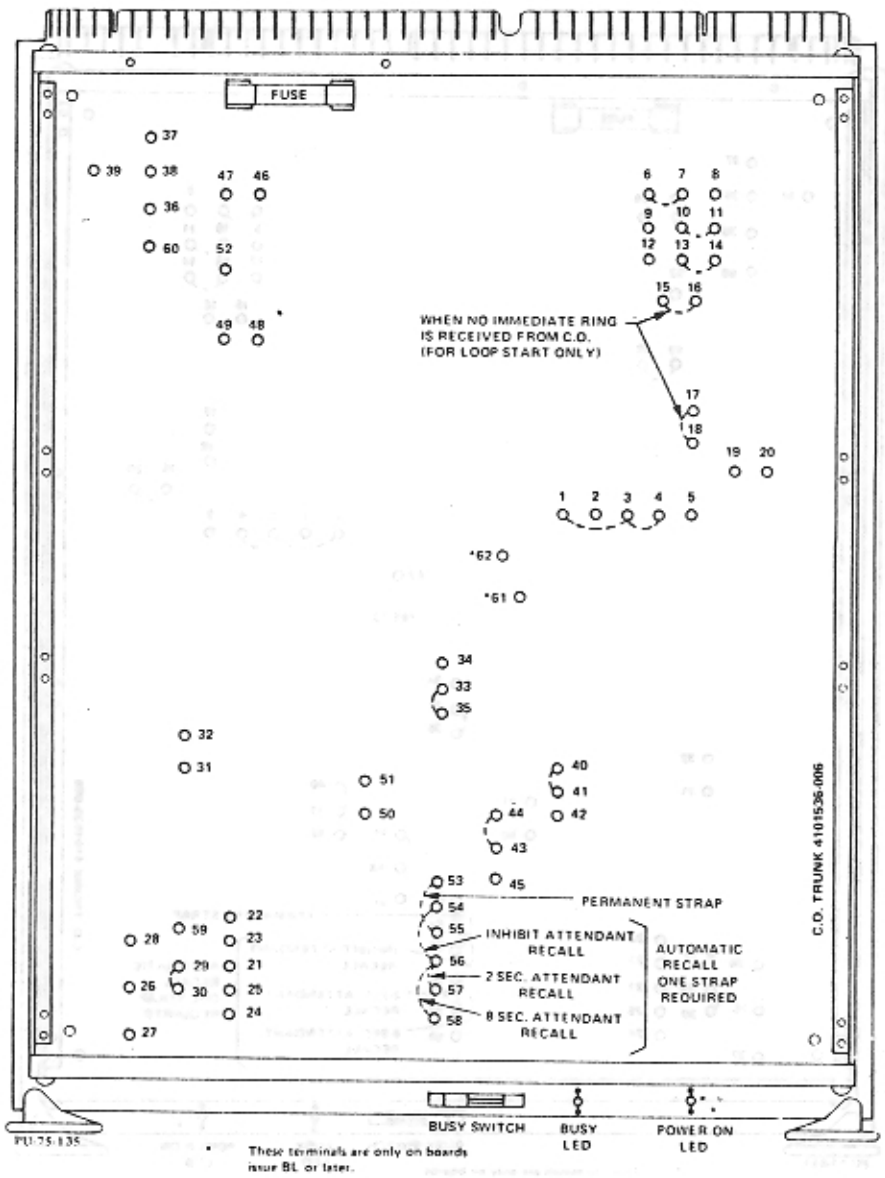

FIGURE 1.10 Strapping for Loop Start (TD-4101536-006)

party remains off-hook after the TD-100 station user hangs up. For this feature, a strap is permanently installed between terminals 53 and 55. One of the following straps is also required.

(a) For 2-second recall, strap

Terminal 56 to terminal 57.

(b) For 8-second recall, strap

Terminal 56 to terminal 58.

(c) To inhibit recall, strap

Terminal 54 to terminal 56.

d. Miscellaneous strapping. (Refer to figure 1.12.)

1. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap

Terminal 46 to terminal 47.

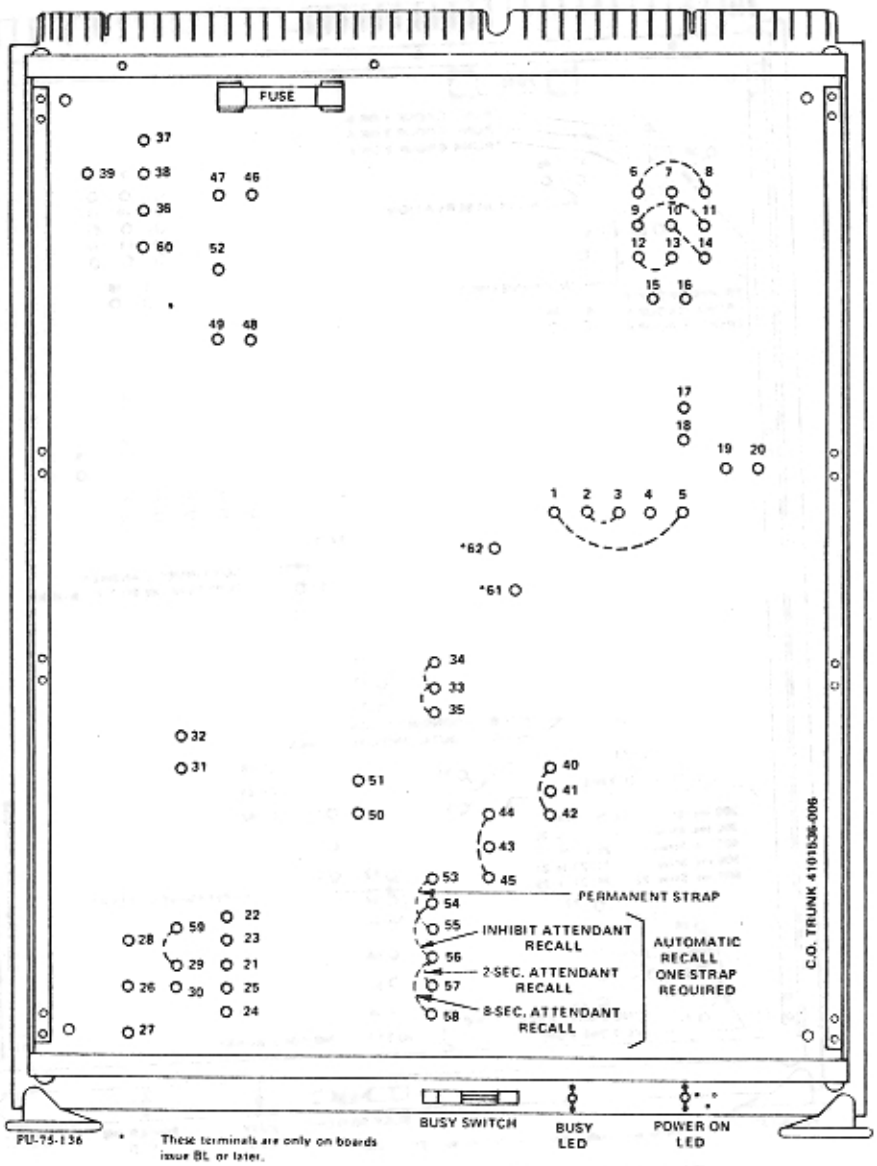

FIGURE 1.11 Strapping for CDH Operation (TD-4101536-006)

2. Trunk group assignment. Trunks must be assigned to a trunk group to allow seizure by the processor.

   (a) To assign the trunk to group 1, strap

   Terminal 36 to terminal 37.

   (b) To assign the trunk to group 2, strap

   Terminal 36 to terminal 38.

   (c) To assign the trunk to group 3, strap

   Terminal 36 to terminal 37.
   Terminal 37 to terminal 38.

   (d) To assign the trunk to group 4, strap

   Terminal 36 to terminal 37.
   Terminal 37 to terminal 38.
   Terminal 36 to terminal 39.

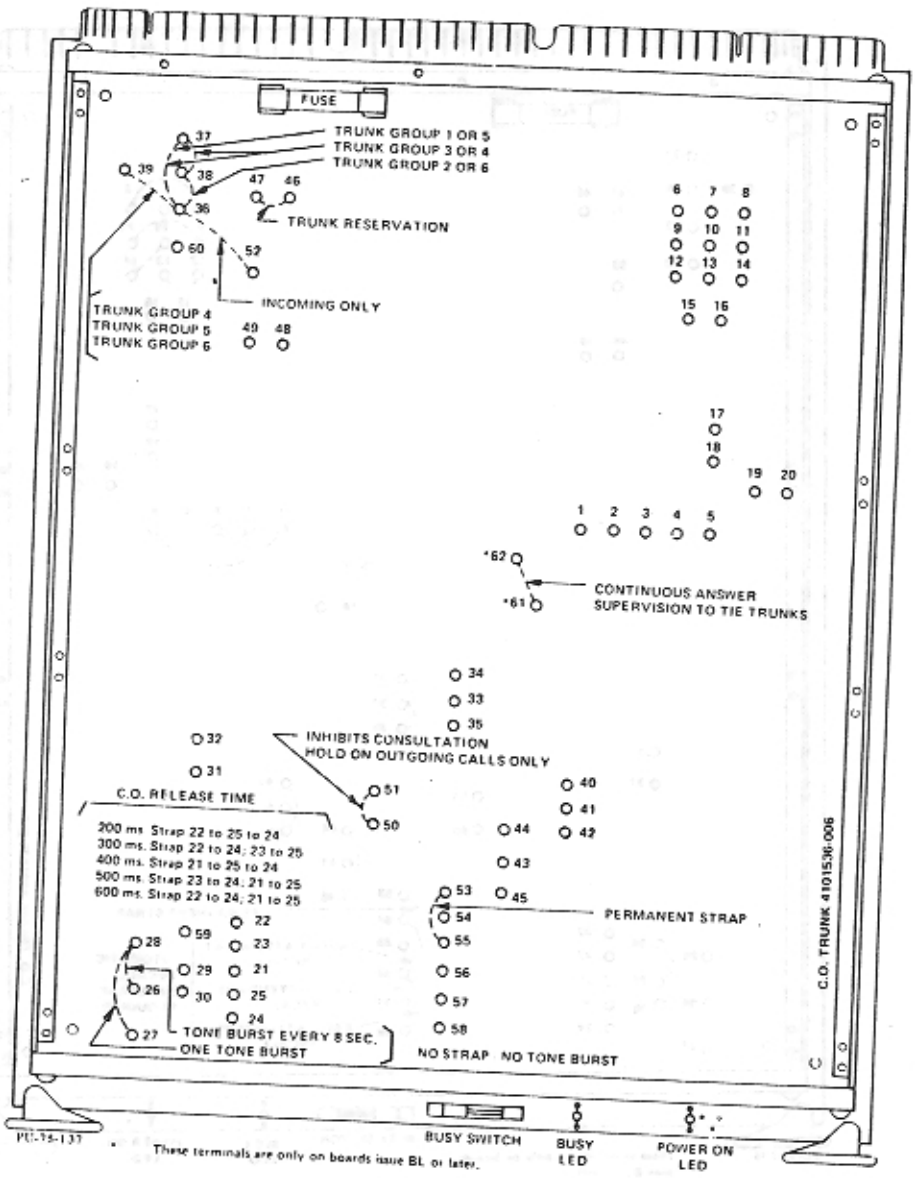

FIGURE 1.12 Miscellaneous Strapping
(TD-4101536-006)

(e) To assign the trunk to group 5, strap

Terminal 36 to terminal 37.
Terminal 36 to terminal 39.

(f) To assign the trunk to group 6, strap

Terminal 36 to terminal 38.
Terminal 36 to terminal 39.

3. Inhibit consultation hold. To inhibit consultation hold on outgoing calls, strap

Terminal 50 to terminal 51.

4. For incoming operation only, strap

Terminal 36 to terminal 52.

5. Central office release time. If the EPABX trunk is to disregard a memory release signal from the CO, determine the time period, then strap as follows:

(a) For 200 ms, strap

Terminal 22 to terminal 25.
Terminal 25 to terminal 24.

(b) For 300 ms, strap

Terminal 22 to terminal 24.
Terminal 23 to terminal 25.

(c) For 400 ms, strap

Terminal 21 to terminal 25.
Terminal 25 to terminal 24.

(d) For 500 ms, strap

Terminal 21 to terminal 25.
Terminal 23 to terminal 24.

(e) For 600 ms, strap

Terminal 21 to terminal 25.
Terminal 22 to terminal 24.

NOTE: One of the above straps must be installed for proper trunk operation.

6. Continuous answer supervision. To provide continuous answer supervision to tie trunks, strap

Terminal 61 to terminal 62.

7. Camp-on busy tone.

(a) For one burst of tone, strap

Terminal 27 to terminal 28.

(b) For one burst of tone every 8-seconds, strap

Terminal 26 to terminal 28.

(c) For no tone, no straps are required.

FEATURE STRAPPING
TD-100
CO TRUNK (TD-4101536-006)

1.00 INTRODUCTION

1.01 Purpose of Addendum. This addendum is issued to supplement OB-410-153, Issue 2 and should be destroyed upon receipt of OB-410-153, Issue 3. Strapping information is provided herein that affects certain issues of TD-100 CO trunks numbered TD-4101536-006. Strapping information for ground start and loop start operation of TD-4101536-006, issue CD and later trunks (schematic TD-4101537-004, issue BG and later) is presented in this addendum. Strapping for CDH operation is performed as described in OB-410-153, issue 2.

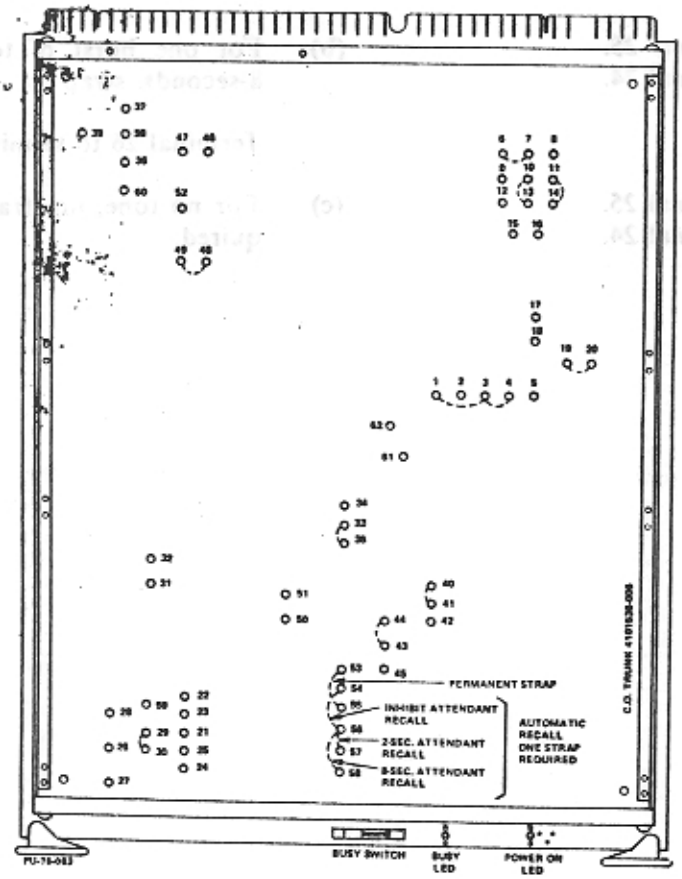

FIGURE 1.00 Strapping for Ground Start (TD-4101536-006, issue CD and later).

1.02 Ground start trunks. (Refer to figure 1.00.)

a. For ground start operation, strap

Terminal 1 to terminal 3.
Terminal 3 to terminal 4.
Terminal 6 to terminal 7.
Terminal 10 to terminal 13.
Terminal 11 to terminal 14.
Terminal 19 to terminal 20.
Terminal 29 to terminal 30.
Terminal 33 to terminal 35.
Terminal 40 to terminal 41.
Terminal 43 to terminal 44.
Terminal 48 to terminal 49.

b. Automatic recall. Automatic recall routes an incoming CO trunk call back to the attendant if the trunk party remains off-hook after the TD-100 station user hangs up. For this feature, a strap is permanently installed between terminals 53 and 55. One of the following straps is also required.

1. For 2-second recall, strap

   Terminal 56 to terminal 57.

2. For 8-second recall, strap

   Terminal 56 to terminal 58.

3. To inhibit recall, strap

   Terminal 54 to terminal 56.

FEATURE STRAPPING
TD-100
ASSIGNED NIGHT ANSWER SERVICE

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1.01 ANA Board Strapping 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 assigned night answer (ANA) feature. Included are explanations and illustrations for strapping the ANA PCB, 4101556, and the processor II PCB, 4101636. This information is applicable to ANA PCB's 4101556-001, -002, and -003, and processor II PCB 4101636-003, -004, and -005.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. By strapping the ANA PCB and the processor II PCB, incoming calls via a maximum of 10 trunks will be routed to preselected stations when the NIGHT switch on the console is placed in the ON position. Strapping on the ANA PCB determines which stations will serve as night answer stations. ANA trunks are determined by their position in the trunk shelf. The trunks in positions 1 - 10 are factory wired for this feature.

The ANA PCB is a piggyback board. It mounts on a feature 2 PCB, 4101546, or on a CFFM PCB, 4102246, if both ANA and call forward follow me service are required.

2.02 Information Required.

a. Select the trunks (maximum of 10) to be assigned to night answer stations.

b. Select the station to be assigned to each night answer trunk.

2.03 Processor II Strapping. Referring to figure 1.00, strap terminal ANA to terminal NT.

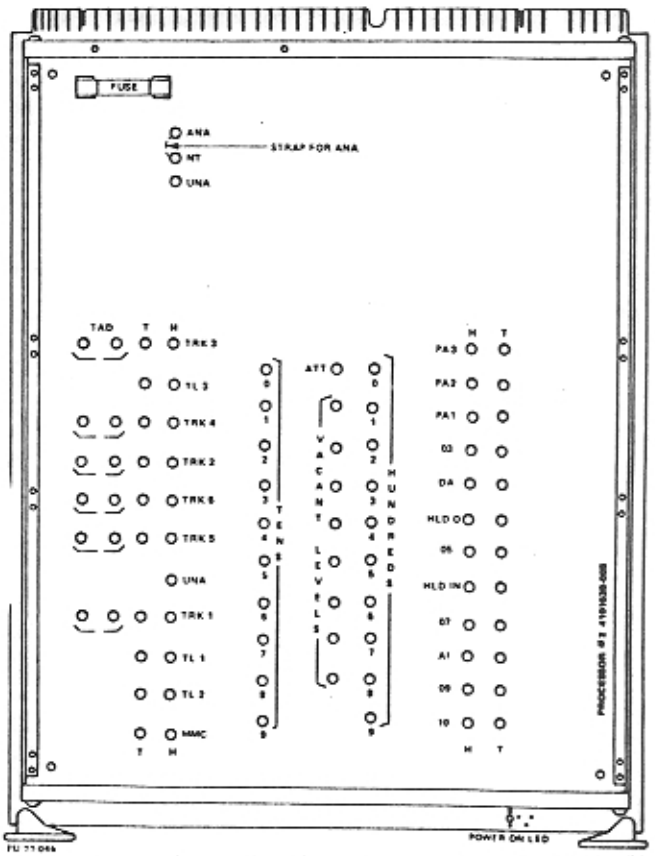

FIGURE 1.00 Processor II Strapping

NOTE: If combined UNA/ANA service is required, refer to section OB-410-163 for the additional strapping for UNA service. This option is only applicable in systems equipped with ANA PCB 4101556-003 or later.

2.04 ANA Strapping. Refer to figure 1.01. Strap the tens and units terminals of a selected trunk to the tens and units terminals of the assigned answering station.

NOTE: The tens and units digits of the trunks are paralleled from a single input, thus trunk 1 has a tens 1 and a units 1.

Figure 1.01 illustrates how trunk 1 would be strapped to be routed to station line 10. Each trunk and selected station line are strapped in a like manner (to a maximum of 10).

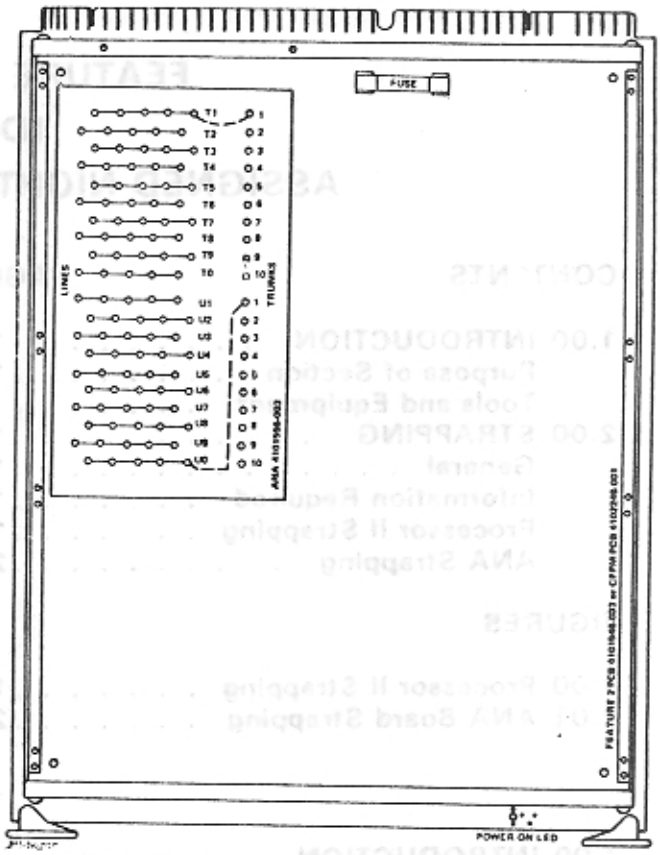

FIGURE 1.01 ANA Board Strapping

FEATURE STRAPPING
TD-100
CONFERENCE SERVICE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 conference feature. Included are explanations and illustrations for strapping the conference network PCB TD-4101576, the processor 2 PCB TD-4101636, and the links PCB TD-4101686. This information is applicable to conference network PCB's 4101576-001 through -004, and -010; Processor 2 PCB's 4101636-003, -004, -005, and -010; and link PCB's 4101686-001, -002, -003, and -010.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 CONFERENCE NETWORK

2.01 General. The conference network PCB mounts in card position 23 of the line subrack. This PCB provides a 30/60 second timer to guard against a lockup condition when loop-start trunks are provided. The timer may be strapped for 30- or 60-second time-out operation to guard against lockup under the following conditions.

a. When a trunk is the first conferee connected to the conference network and a station is not connected within 30 to 60 seconds.

b. When the conference is terminated, and all station lines connected to the conference network go on-hook and the CO trunk remains off-hook for more than 30 to 60 seconds.

2.02 Strapping (TD-4101576-001, -002, -003, -004, -010). Refer to figure 1.00 for the TD-4101576-001 through -004 PCB. For 30-second timeout, strap terminal 1 to terminal 2. For 60-second timeout, strap terminal 1 to terminal 3.

Refer to figure 1.01 for the TD-4101576-010 PCB. For 30-second timeout, strap terminal 1 to terminal 2. For 60-second timeout, strap terminal 1 to terminal 3.

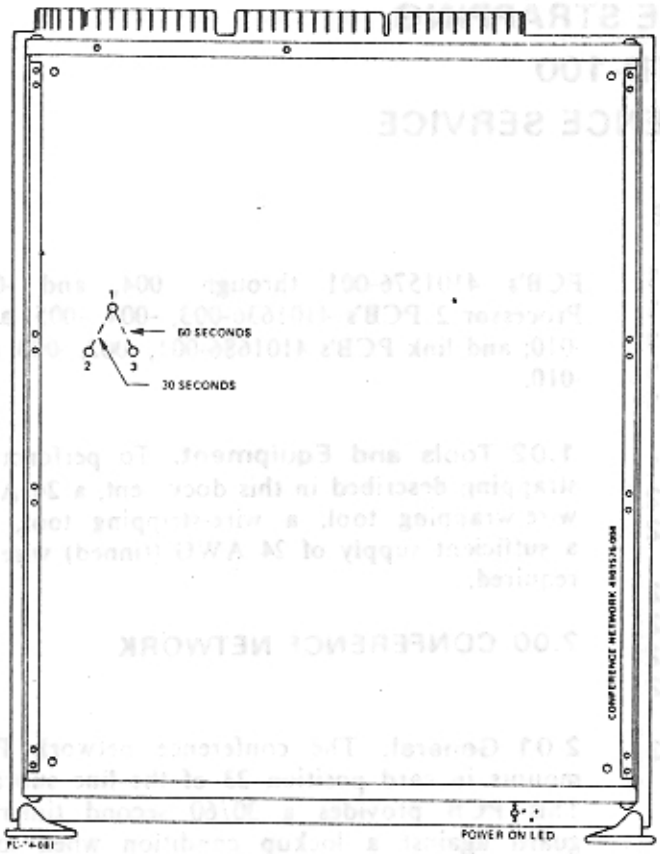

FIGURE 1.00 Conference Network Board Strapping (TD-4101576-004)

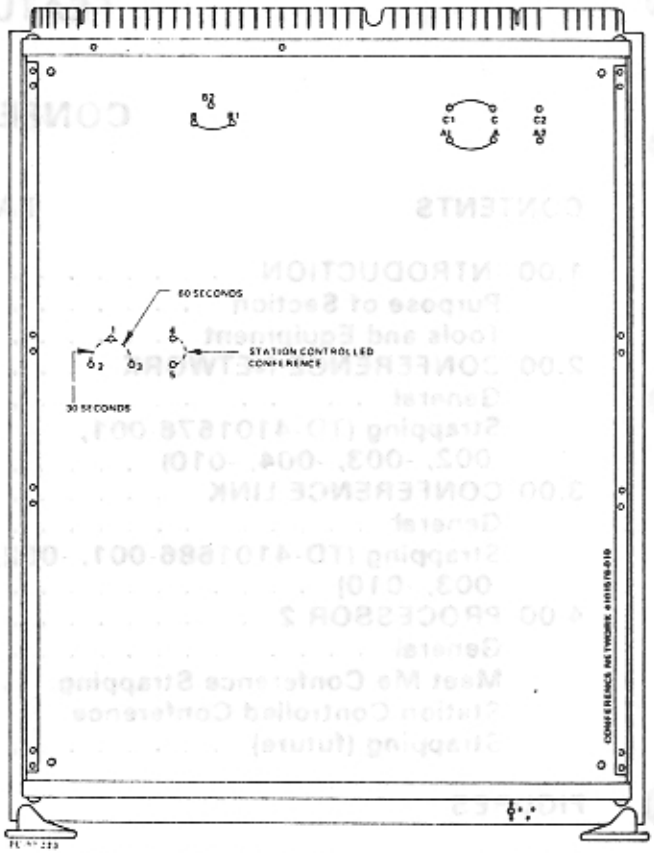

FIGURE 1.01 Conference Network Board Strapping (TD-4101576-010)

For the optional station controlled conference (future), strap terminal 4 to terminal 5.

For normal operation of the system, strap terminal A to terminal A1, terminal B to terminal B1, and terminal C to terminal C1.

3.00 CONFERENCE LINK

3.01 General. The links PCB, TD-4101686, contains four link circuits which can be used as local links or conference links. A single strap converts the circuits to local or conference links. When used as a conference links PCB, the card mounts in position 23 of the channel subrack.

3.02 Strapping (TD-4101686-001, -002, -003, -010). If the links are to serve as conference links, strap terminal B to terminal C as shown in figure 1.02.

NOTE: Consult section OB-410-168 for information concerning local links strapping.

4.00 PROCESSOR 2

4.01 General. The processor 2 PCB mounts in position 9 of the channel subrack. It provides strapping terminals for assigning most feature access codes. If the system is to be arranged for meet me conference or station controlled conference (future), the one- or two-digit access codes must be strapped on the processor 2 PCB.

4.02 Meet Me Conference Strapping. For the optional meet me conference feature, strap the desired one or two digit meet me conference access code on the processor 2 PCB.

a. Single digit access. For single digit access,

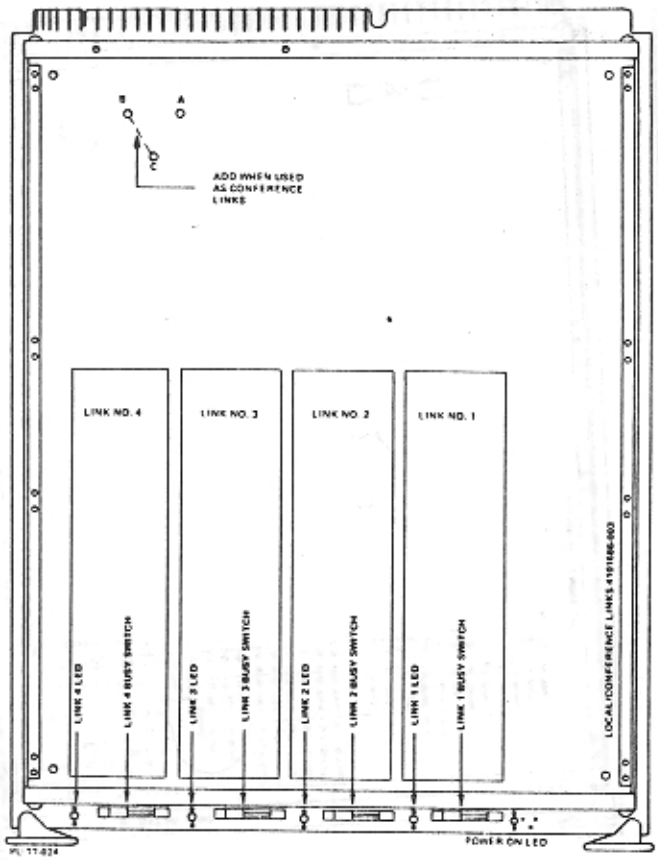

FIGURE 1.02 Links PCB Strapping (TD-4101686-010)

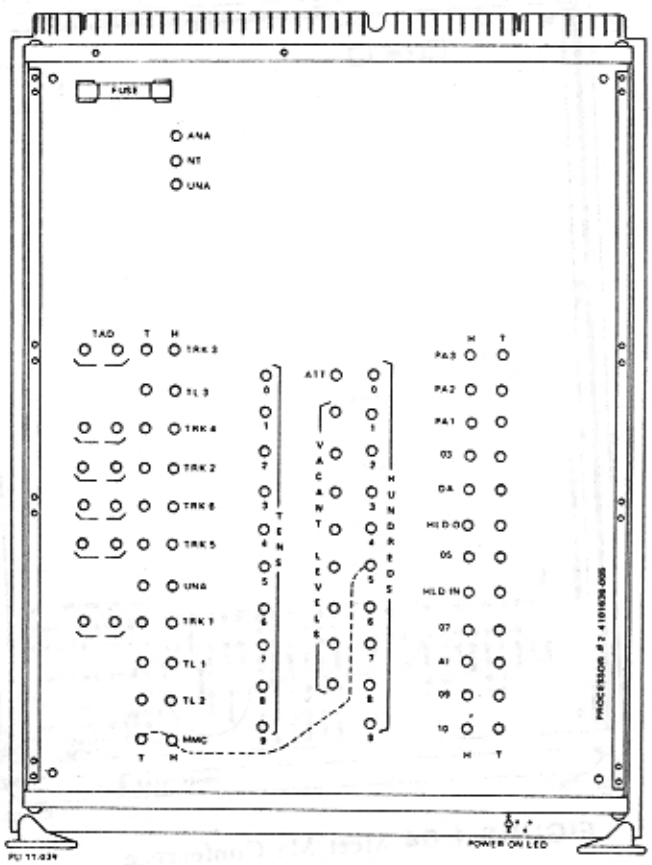

FIGURE 1.03 Meet Me Conference Strapping (Processor 2 PCB, TD-4101636-005)

1. Strap the MMC (meet me conference) H (hundreds) and T (tens) terminals together.

2. Strap the MMC H terminal to the HUNDREDS terminal that corresponds to the desired code.

b. Two-digit access. For two-digit access,

1. Strap the MMC H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.

2. Strap the MMC T (tens) terminal to the TENS terminal that corresponds to the second digit in the access code.

EXAMPLE: Figure 1.03 shows strapping for single digit access using the digit 5 on a TD-4101636-005 PCB. Figure 1.04 shows strapping for two-digit access using 51 as the meet me conference access code on a TD-4101636-010 PCB.

4.03 Station Controlled Conference Strapping (future). For the optional station controlled conference feature, strap the desired one- or two-digit station controlled conference access code on the processor 2 PCB, TD-4101636-010.

a. Single digit access. For single digit access,

1. Strap the XTC (station controlled conference) H (hundreds) and T (tens) terminals together.

2. Strap the XTC H terminal to the HUNDREDS terminal that corresponds to the desired code.

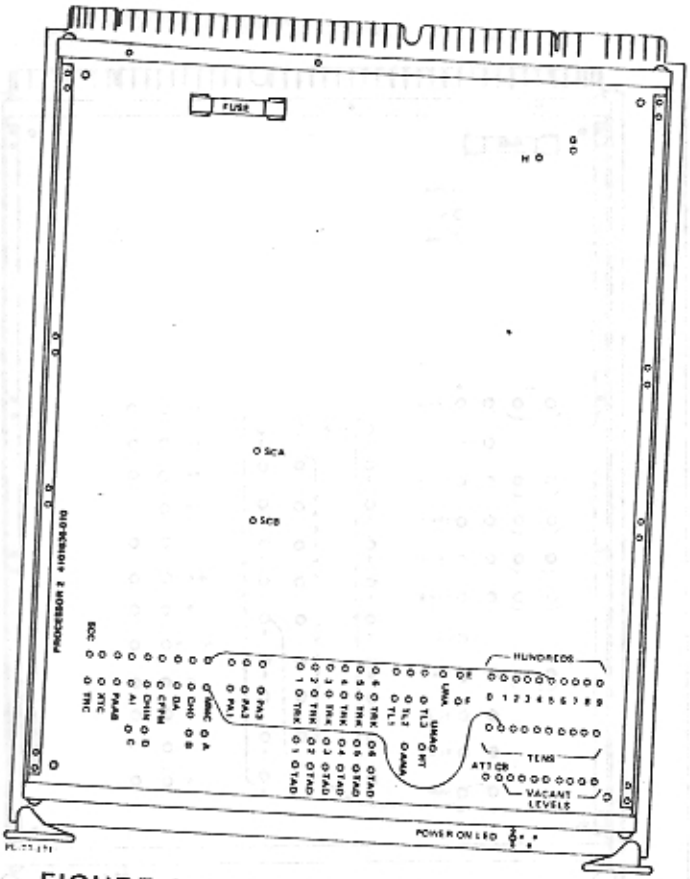

FIGURE 1.04 Meet Me Conference Strapping (Processor 2 PCB, TD- 4101636-010)

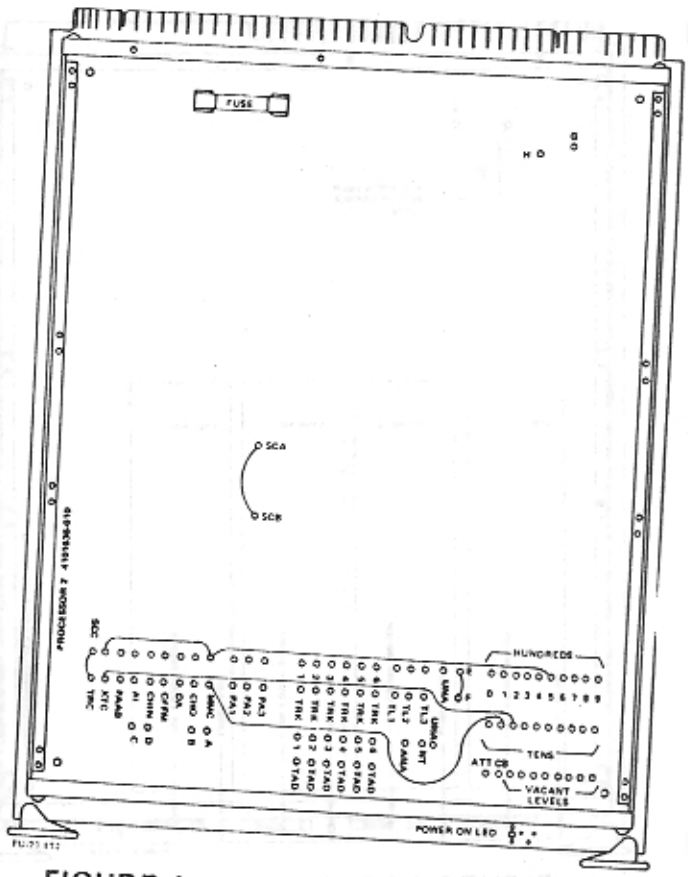

FIGURE 1.05 Future Station Controlled Conference Strapping (Processor 2 PCB, TD-4101636-010)

b. Two-digit access. For two-digit access,

1. Strap the XTC H terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.

2. Strap the XTC T terminal to the TENS terminal that corresponds to the second digit in the access code.

Additionally, for station controlled conference operation, strap from terminal E to terminal F, from terminal SCC (station controlled conference) to terminal TRC, and from terminal SCA to terminal SCB.

EXAMPLE: Figure 1.05 shows strapping for two-digit access using 52 as the station controlled conference (future) access code.

FEATURE STRAPPING
TD-100
CLASS OF SERVICE PCB (TD-4101606-001, -003, -004, -005,-010)

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1.12 Class of Service PCB (TD-4101606-010) Strapped per Example K 19

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 class of service PCB. This information is applicable to class of service PCB's numbered TD-4101606-002, -003, -004, -005, and -010. This document should be referred to when strapping the class of service PCB for a new installation, when replacing a class of service PCB, or when adding new features requiring restriction to a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING (TD-4101606-002, -003, -004, -005)

2.01 General. The class of service PCB mounts in position 7 of the channel subrack. It is used for class of service restriction and for vacant number intercept.

The class of service PCB provides strapping terminals for assigning classes of service to specific system features, and for assigning stations to class of service numbers to be allowed or denied. Terminals corresponding to class of service numbers 1 through 6 are used for deny functions; terminals corresponding to class of

service numbers 7 through 14 are used for allow functions. Terminals associated with class of service number 15 are used exclusively for toll restriction.

For vacant number intercept, the card provides terminals for strapping all unassigned station numbers so that calls to these numbers will receive reorder tone.

2.02 Information Required. To determine class of service strapping, the installer should make up a class of service assignment chart and a station/class of service grouping chart. On new installations, the charts should be filled out and left with the system as permanent records. They should be updated any time new features requiring restriction are added to the system or any time station assignments or feature access code assignments are changed.

A typical class of service assignment chart is shown in figure 1.00. The chart shows all system features requiring access codes, the assigned one- or two-digit codes, and the respective class of service numbers.

An example of a station/class of service grouping chart is shown in figure 1.01. The chart shows one- and two-digit feature access codes, their assigned class of service numbers, station and tie line grouping, and RP terminal assignments. The letters A, B, C, and D under class of service (COS) and access code numbers indicate the COS terminals to be strapped.

In constructing the station/class of service grouping chart, the installer must determine the number of stations that will be allowed or denied access to each feature. If a majority of stations are allowed access to a feature, it is best to assign that feature a deny class of service (COS 1 through COS 6). If a majority of stations are denied access to a feature, it is best to assign that feature an allow class of service (COS 7 through COS 14).

2.03 Terminal Arrangement. Arrangement of the strapping terminals on the generation -005 class of service PCB is shown in figure 1.02. With only a few exceptions, terminal arrangement on the -002, -003, and -004 PCB's is quite similar. In the following paragraphs, the purpose of each group of strapping terminals is explained.

a. Station and tie line assignment terminals. Terminals designated LINES (00-99), TIE LINES (1-10), RP1 - RP24, and CLASS OF SERVICE (COS 1 through COS 15) are used to assign stations and/or tie lines to class of service numbers. These terminals are strapped according to information on the station/class of service grouping chart. The RP1 - RP24 terminal are provided for flexibility in grouping lines and/or tie lines.

b. Access code assignment terminals. Terminals designated TENS 0-9, HUNDREDS 0-9, and CLASS SELECT COS 1 through COS 15 -H and -T are used to assign class of service numbers to feature access codes. These terminals should be strapped according to information on the class of service assignment chart.

NOTE: All unused CLASS SELECT H (hundreds) terminals must be strapped to a CB terminal; all unused CLASS SELECT T (tens) terminals must be strapped to a GRD terminal.

c. Miscellaneous terminals.

1. Day/night toll restriction terminals. Terminals S and N and terminals E, F, G, H, J, K, and L are provided on the generation -005 PCB for systems where specific groups of stations are toll restricted only during day operation, or only during night operation.

2. Intercept terminals. The INCPT terminals are used for vacant number intercept. The LINES terminals representing all unassigned stations should be strapped to the INCPT terminals. It is not necessary to strap the LINES terminals of unequipped stations.

3. Toll restriction terminals. The R and S terminals are used when the system is arranged for one- or two-digit toll restriction.

COS		ACCESS DIGIT(S) Hundreds	ACCESS DIGIT(S) Tens	FEATURE/DESTINATION
1	Deny	6		UNA AND CALL PICKUP
2	Deny	9	1	TRUNK GROUP 1 / KENTON
3	Deny	9	2	TRUNK GROUP 2/ BRAZIL
4	Deny	9.	3	TRUNK GROUP 3 / YORKVILLE
5	Deny	8		TIE TRUNK GROUP 1 / WAREHOUSE
6	Deny			
7	Allow	7	3	DICTATION
8	Allow	5	3	MEET-ME CONFERENCE
9	Allow	7	1	WATS
10	Allow	3	1	PAGING
11	Allow			
12	Allow			
13	Allow			
14	Allow			
15	Allow	0 & 1 Toll Restriction		Register Detection or C.O. Battery Reversal

PU-77-054

FIGURE 1.00 Typical Class of Service Assignment Chart

4. Restrict number terminals. The RN1 - RN4 terminals are used to identify a tens or hundreds digit to be toll restricted. They are strapped to the respective HUNDREDS (0-9) and TENS (0-9) terminals to identify the first or second digit of a restricted number. All unused RN terminals must be strapped to a CB terminal.

5. Attendant access terminals. Terminals AD1 and AD2 (on assemblies issue AB or later) are used to permit or deny the attendant access to a feature assigned to a class of service number.

2.04 Procedure. Perform the following steps, as applicable, to strap the class of service PCB.

a. Station grouping. Using the information in the station/class of service grouping chart, strap together the LINES (00-99) terminals for the first group of stations. Start at the highest number terminal and strap the terminals in descending order. Strap the terminal associated with the lowest number station in the group to the RP terminal designated on the chart.

NOTE: The designated RP terminal should be the one closest to the lowest number station terminal for that group.

STATIONS/CLASS OF SERVICE GROUPING CHART

STATION LINES (RECORD IN STRAPPING ORDER)		Class of Service	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Access Code	6	91	92	93	8		73	53	71	31					91,92,93
		Line Treatment	DENY	DENY	DENY	DENY	DENY	DENY	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW	Toll Restriction
00-16	RP-24								A	A	A	A					
17-22,28	RP-20																A
23-27,29	RP-17								B	B	B	B					
30-40	RP-15																B
42-55	RP-11		A	A	A												
57,60-62	RP-7		B	B	B												
68-71	RP-3	A	C	C	C	A											
72,73	RP-2									C		C					C
74	RP-1									D		D					
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
	RP																
41,56,58,59,63-67	INCPT	NOTE: Unequipped lines do not require a strap to INCPT.															

PU-77-055

FIGURE 1.01 Typical Station/Class of Service Grouping Chart

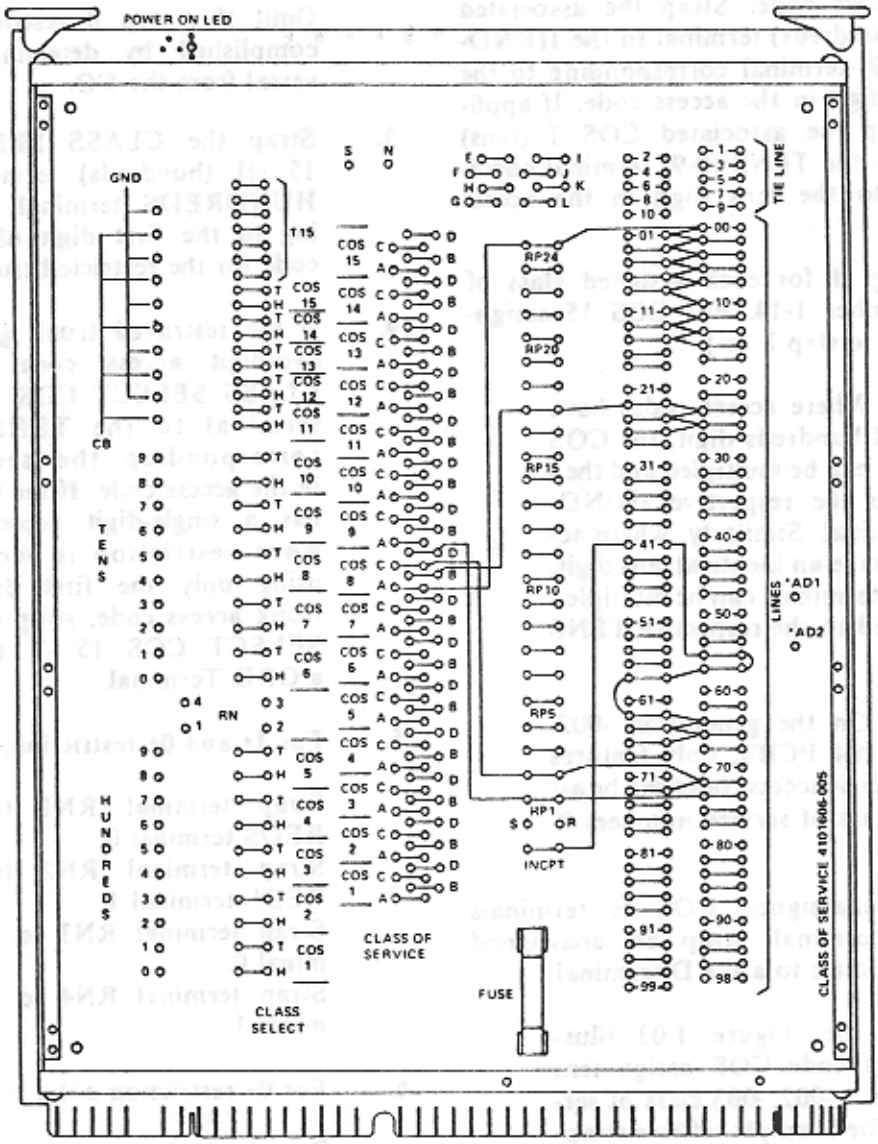

FIGURE 1.02 Class of Service PCB (TD-4101606-005) Strapped per Example A

b. RP/COS assignment. Strap the RP terminal to the A, B, C, or D terminal for the required class of service. Use the terminal indicated in the station/class of service grouping chart.

c. Repeat steps a and b for each station or tie line group.

d. Intercept. Strap together the LINES terminals associated with any unassigned stations. Strap these terminals to the INCPT terminal.

EXAMPLE A: An example of strapping explained in steps a through d is illustrated in figure 1.02. This example reflects information on the typical station/class of service grouping chart, figure 1.01. It shows strapping for the station groups assigned to class of service 8, and the stations assigned to intercept.

e. Access code/COS assignment. Refer to the station/class of service grouping chart for the hundreds and tens digits of the first

feature access code. Strap the associated COS H (hundreds) terminal to the HUNDREDS (0-9) terminal corresponding to the hundreds digit in the access code. If applicable, strap the associated COS T (tens) terminal to the TENS (0-9) terminal corresponding to the tens digit in the access code.

f. Repeat step d for each assigned class of service number 1-14. For COS 15 assignment, refer to step h or j.

NOTE 1. Where access codes have an identical hundreds digit, the COS H terminals can be multipled and then strapped to the respective HUNDREDS terminal. Similarly, where access codes have an identical tens digit, the COS T terminals can be multipled and strapped to the respective TENS terminal.

NOTE 2. On the generation -002, -003, and -004 PCB's, only features with single digit access codes can be assigned to class of service numbers 7-14.

g. Strap all unassigned COS H terminals to a CB terminal: strap all unassigned COS T terminals to a GRD terminal.

EXAMPLE B: Figure 1.03 illustrates access code/COS assignment strapping on a -002/-003 class of service PCB. The example reflects strapping of access codes 6, 91, 92, and 93 corresponding to the class of service assignments on the typical station/class of service grouping record chart, figure 1.01.

h. One- or two-digit toll restriction. For one- or two-digit toll restriction using the register,

1. Strap the stations to be restricted to the CLASS OF SERVICE COS 15 terminal as described in steps a and b.

2. Strap terminal R to terminal S. Omit this step if restriction is accomplished by detecting loop reversal from the CO.

3. Strap the CLASS SELECT COS 15 -H (hundreds) terminal to the HUNDREDS terminal corresponding to the first digit of the access code for the restricted trunk group.

4. If the restricted trunk group has a two-digit access code, strap the CLASS SELECT COS 15 -T (tens) terminal to the TENS terminal corresponding the second digit in the access code. If the trunk group has a single-digit access code, or when restriction is accomplished using only the first digit of the trunk access code, strap the CLASS SELECT COS 15 -T terminal to a GRD Terminal.

5. For 1+ and 0+ restriction,

Strap terminal RN1 to HUNDREDS terminal 0.
Strap terminal RN2 to HUNDREDS terminal 1.
Strap terminal RN3 to TENS terminal 0.
Strap terminal RN4 to TENS terminal 1.

6. For 0+ restriction only,

Strap terminal RN1 to HUNDREDS terminal 0.
Strap terminal RN2 to TENS terminal 0.
Strap terminals RN3 and RN4 to a CB terminal.

7. For 1+ restriction only,

Strap terminal RN1 to HUNDREDS terminal 1.
Strap terminal RN2 to TENS terminal 1.
Strap terminals RN3 and RN4 to a CB terminal.

EXAMPLE C: Figure 1.04 illus-

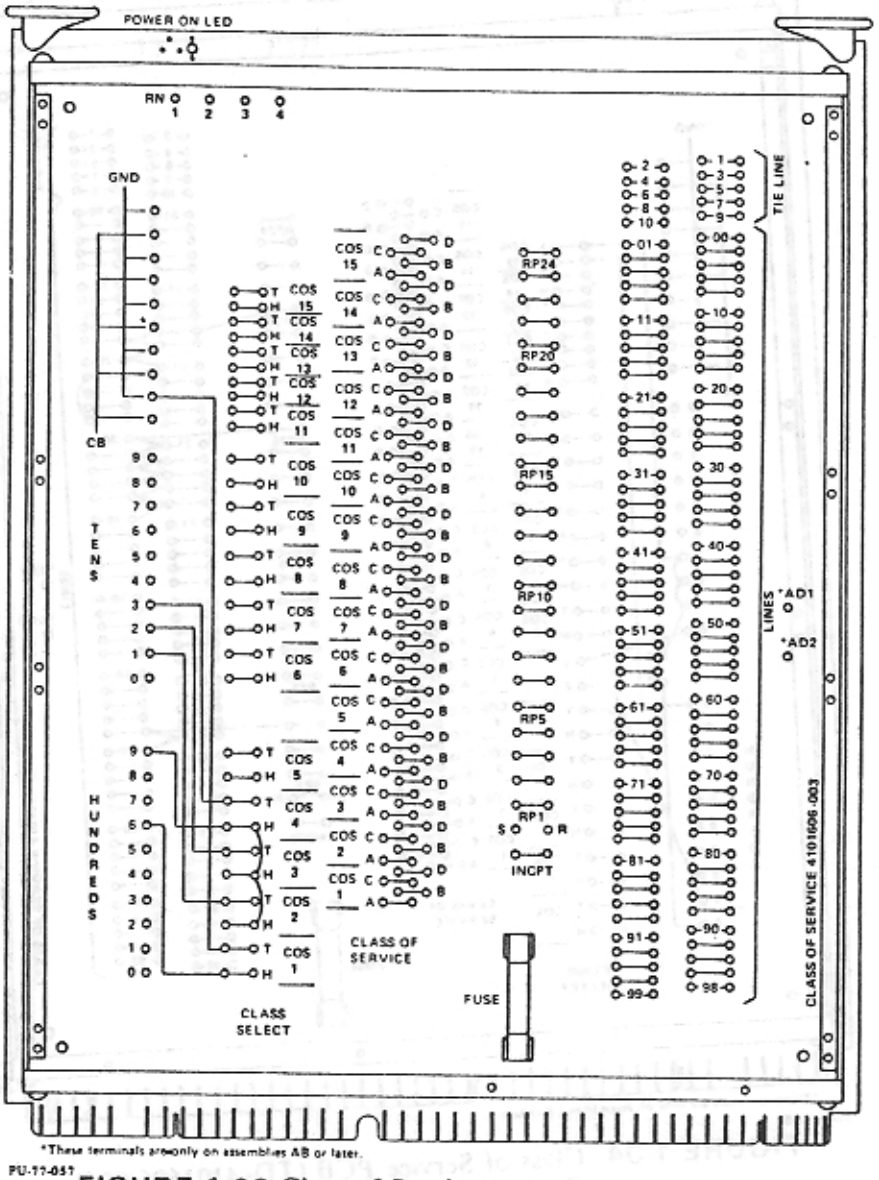

FIGURE 1.03 Class of Service PCB (TD-4101606-003) Strapped per Example B

trates strapping for toll restriction on the -004 class of service PCB. This example reflects strapping for the COS 15 assignments shown in the typical station/class of service grouping chart, figure 1.01.

i. Toll restriction using the optional toll restrictor PCB. For toll restriction using the toll restrictor PCB,

1. Strap the stations to be restricted to the CLASS OF SERVICE COS 15 terminal as described in steps a and b.

2. Strap terminal R to terminal S.

3. Strap the CLASS SELECT COS 15 -H and -T terminals to the HUNDREDS and TENS terminals corresponding to the digits in the trunk access code. If the trunk group has a single digit access code, or when restriction is accomplished using only the first digit of the access code, strap the CLASS SELECT COS 15 -T terminal to a GRD terminal.

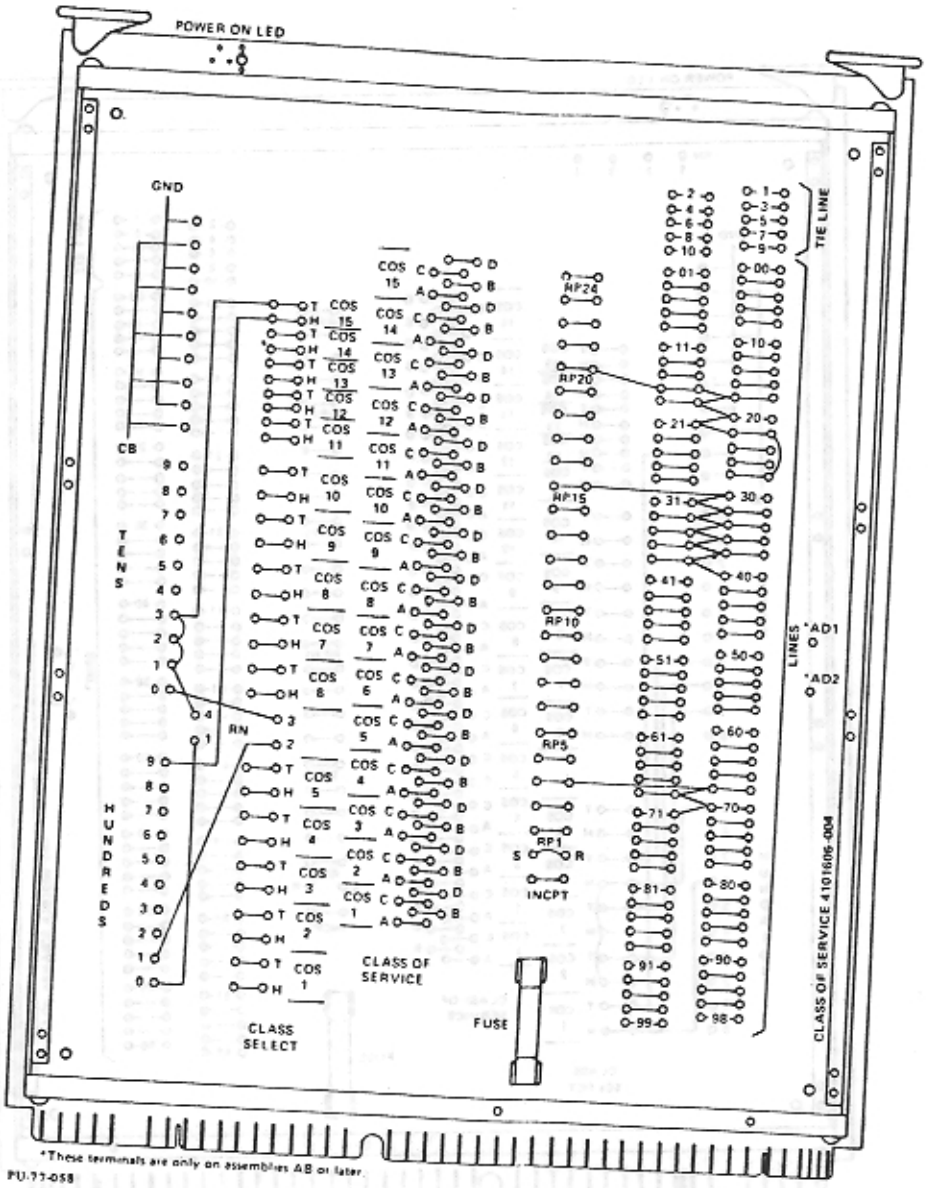

FIGURE 1.04 Class of Service PCB (TD-4101606-004) Strapped per Example C

4. Strap one of the RN (1-4) terminals to the TENS terminal 0.
   Strap the unused RN (1-4) terminal to a CB terminal.

EXAMPLE D: An example of strapping when the optional toll restrictor PCB is provided is shown in figure 1.05. In this example, calls via trunk group 91, from stations 00 and 01, are subject to toll restriction.

Day/night toll restriction. On the generation -005 class of service PCB, terminals E through L are provided for day/night toll restriction. This option, applicable with or without the optional toll restrictor PCB, is strapped as follows.

1. For toll restriction during night operation, but no toll restriction during day service,

   Strap terminal N to terminal S. Strap the RP terminal of the assigned station group to terminal G, I, K, or L.

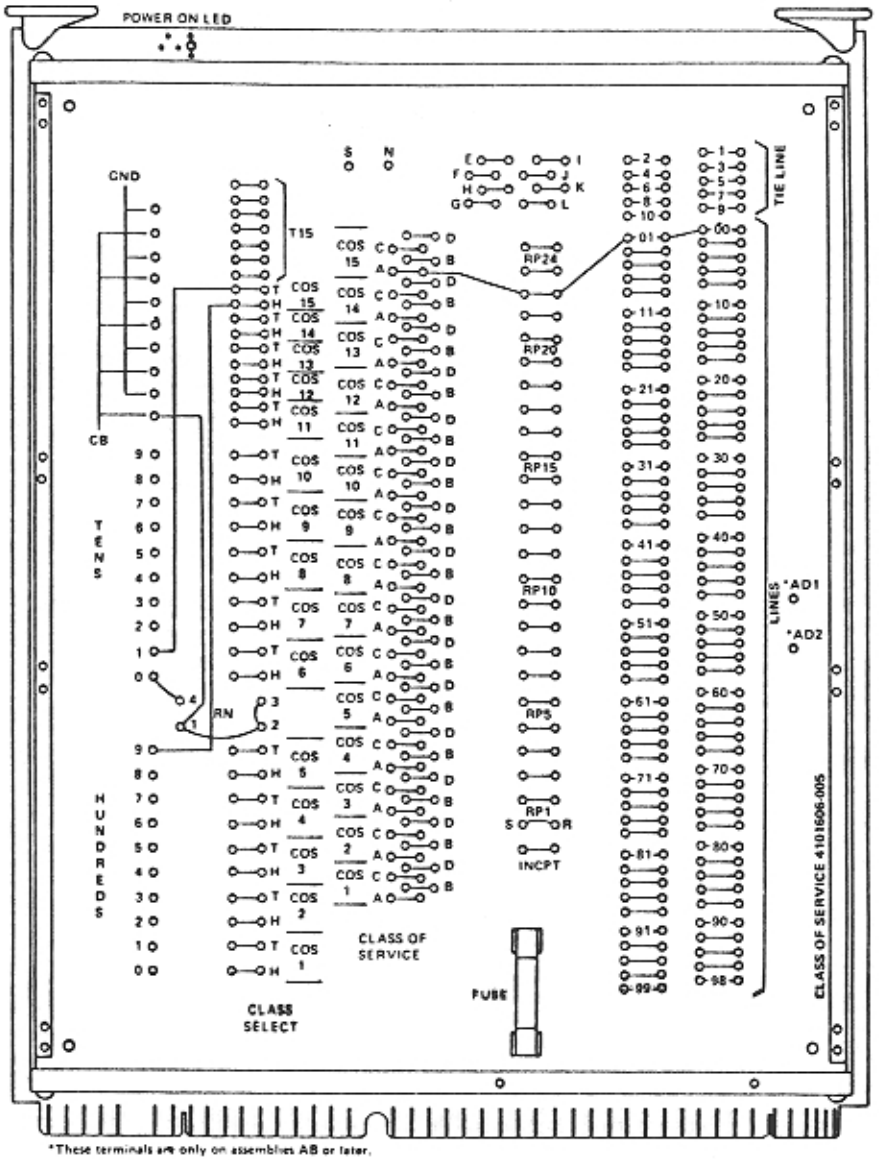

FIGURE 1.05 Class of Service PCB (TD-4101606-005) Strapped per Example D

2. For toll restriction during day service, but no toll restriction during the night operation,

   Strap terminal N to terminal S. Strap the RP terminal of the assigned station group to terminal E, F, H, or J.

3. If the toll restrictor CB is not equipped, strap the RN (1-4) terminals to the TENS and HUNDREDS terminals corresponding to the restricted digit(s), 0 and/or 1.

4. If the toll restrictor PCB is equipped, strap one of the RN (1-4) terminals to TENS terminal 0, then strap the remaining RN terminals to a CB terminal.

EXAMPLE E: An example of day/night toll restriction strapping is shown in figure 1.06. In this example, stations 40, 42, and 43 are arranged for

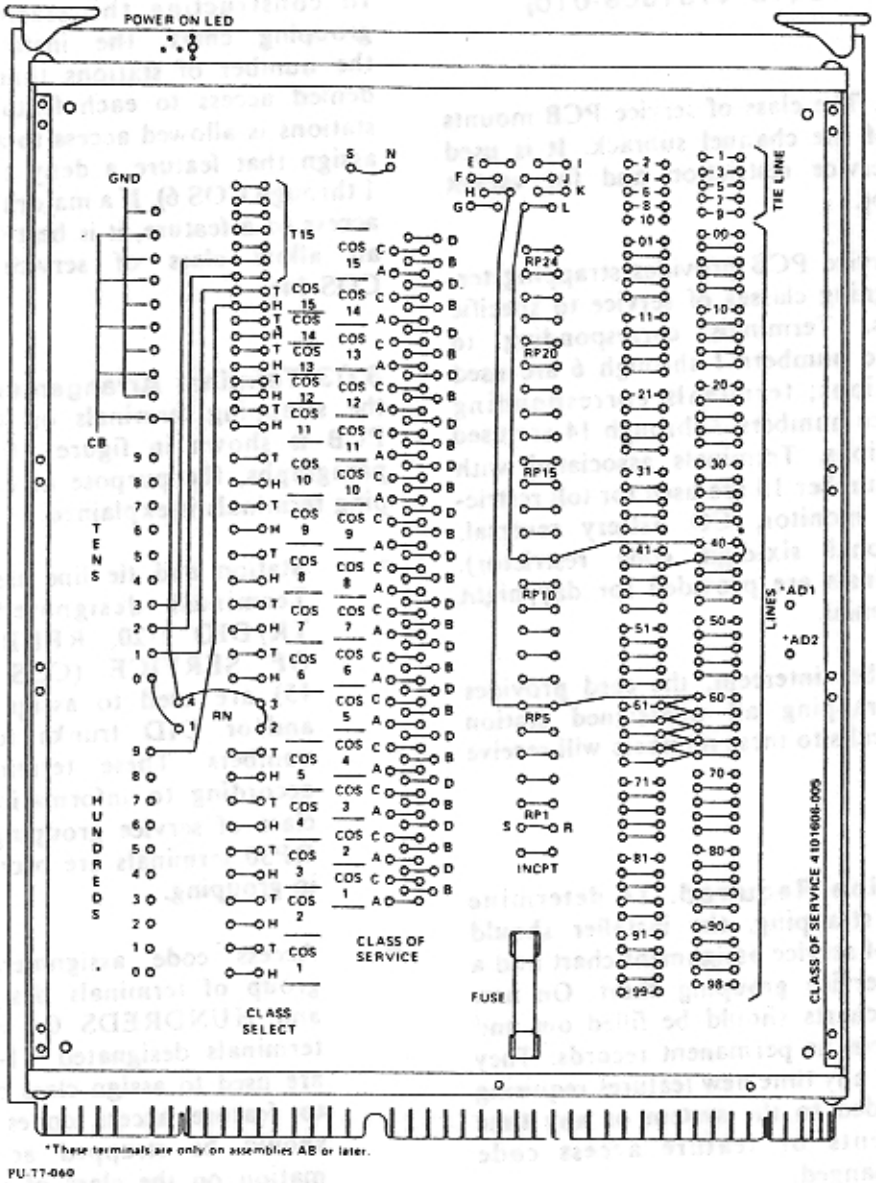

FIGURE 1.06 Class of Service PCB (TD-4101606-005) Strapped per Example E

toll restriction during night operation, but not during the day; stations 60 through 69 are arranged for toll restriction during the day, but not at night. Toll restriction applies to calls via trunk groups 91, 92, and 93.

k. Attendant access. On class of service PCB's, assembly AB or later, terminals AD1 and AD2 have been provided for attendant access. Where applicable, strap these terminals as follows:

1. If the attendant is permitted to dial access codes assigned to allow class of service numbers, strap terminal AD1 to AD2.

2. If the attendant is not permitted to dial allow access codes, no strap is required.

3. If the attendant is not permitted to dial a particular allow access code, strap terminal AD1 to the CLASS SELECT COS H terminal assigned to that access code.

3.00 STRAPPING (TD-4101606-010)

3.01 General. The class of service PCB mounts in position 7 of the channel subrack. It is used for class of service restriction and for vacant number intercept.

The class of service PCB provides strapping terminals for assigning classes of service to specific system features. Terminals corresponding to classes of service numbers 1 through 6 are used for deny functions; terminals corresponding to class of service numbers 7 through 14 are used for allow functions. Terminals associated with class of service number 15 are used for toll restriction (toll digit monitor, CO battery reversal, and an additional six-digit code restrictor). Additional terminals are provided for day/night restriction and denial.

For vacant number intercept, the card provides terminals for strapping all unassigned station numbers so that calls to these numbers will receive reorder tone.

3.02 Information Required. To determine class of service strapping, the installer should make up a class of service assignment chart and a station/class of service grouping chart. On new installations, the charts should be filled out and left with the system as permanent records. They should be updated any time new features requiring restriction are added to the system or any time station assignments or feature access code assignments are changed.

A typical class of service assignment chart is shown in figure 1.00. The chart shows all system features requiring access codes, the assigned one- or two-digit codes, and the respective class of service numbers.

An example of a station/class of service grouping chart is shown in figure 1.01. The chart shows one- and two-digit feature access codes, their assigned class of service numbers, station and tie line grouping and RP terminal assignments. The letters A, B, C, and D under class of service (COS) and access code numbers indicate the COS terminals to be strapped.

In constructing the station/class of service grouping chart, the installer must determine the number of stations that will be allowed or denied access to each feature. If a majority of stations is allowed access to a feature, it is best to assign that feature a deny class of service (COS 1 through COS 6). If a majority of stations is denied access to a feature, it is best to assign that feature an allow class of service (COS 7 through COS 14).

3.03 Terminal Arrangement. Arrangement of the strapping terminals on the class of service PCB is shown in figure 1.07. In the following paragraphs, the purpose of each group of strapping terminals is explained.

a. Station and tie line assignment terminals. Terminals designated LINES (0-99), TK/DID 1-20, RP1-RP30, and CLASS OF SERVICE (COS 1 through COS 15) are used to assign stations, tie lines and/or DID trunks to class of service numbers. These terminals are strapped according to information on the station/class of service grouping chart. The RP1-RP30 terminals are provided for flexibility in grouping.

b. Access code assignment terminals. The group of terminals designated TENS 0-9 and HUNDREDS 0-9 and the group of terminals designated T1-T15 and H1-H15 are used to assign class of service numbers to feature access codes. These terminals should be strapped according to information on the class of service assignment chart.

NOTE: All unused COS H1-H15 terminals must be strapped to a CB terminal; all unused COS T1-T15 terminals must be strapped to a CG terminal.

c. Miscellaneous terminals.

1. Day/night toll restriction terminals. Terminals N and T and terminals E, F, G, H, I, J, K, and L are provided for systems where specific groups of stations are toll restricted only during day operation, or only during

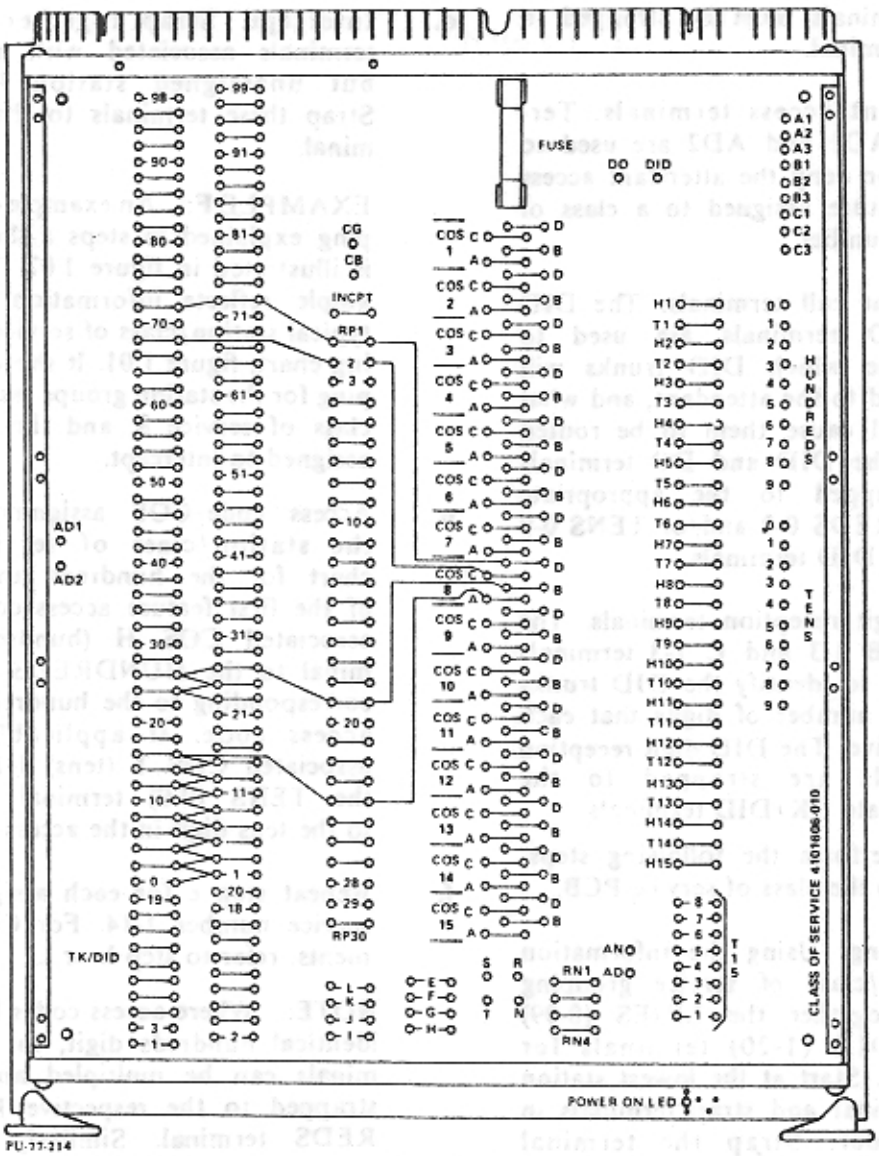

FIGURE 1.07 Class of Service PCB (TD-4101606-010) Strapped per Example F

night operation. The AN and AD terminals are also strapped for specialized day/night dialing restrictions.

2. Intercept terminals. The INCPT terminals are used for vacant number intercept. The LINES terminals representing all unassigned stations should be strapped to the INCPT terminals. It is not necessary to strap the LINES terminals of unequipped stations.

3. Toll restriction terminals. The R and S terminals are used when the system is arranged for one or two digit toll restriction.

4. Restrict number terminals. The RN1-RN4 terminals are used to identify a tens or hundreds digit to be toll restricted. They are strapped to the respective HUNDREDS (0-9) and TENS (0-9) terminals to identify the first or second digit of a restricted number. All unused

RN terminals must be strapped to a CB terminal.

5. Attendant access terminals. Terminals AD1 and AD2 are used to permit or deny the attendant access to a feature assigned to a class of service number.

6. Attendant call terminals. The DID and DO terminals are used to determine which DID trunks will be routed to the attendant, and what digit will cause them to be routed there. The DID and DO terminals are strapped to the appropriate HUNDREDS 0-9 and/or TENS 0-9 and TK/DID terminals.

7. DID digit reception terminals. The A 1-3, B 1-3 and C 1-3 terminals are used to identify the DID trunks and the number of digits that each will receive. The DID digit reception terminals are strapped to the appropriate RK/DID terminals.

3.04 Procedure. Perform the following steps, as applicable, to strap the class of service PCB.

a. Station grouping. Using the information in the station/class of service grouping chart, strap together the LINES (0-99) and/or TK/DID (1-20) terminals for the first group. Start at the lowest station or tieline terminal and strap terminals in ascending order. Strap the terminal associated with the highest station or tie line number in the RP terminal designated on the chart.

NOTE: The designated RP terminal should be the one closest to the highest station or tie line terminal number for that group.

b. RP/COS assignment. Strap the RP terminal to the A, B, C, or D terminal for the required class of service. Note that each set of A, B, C, and D terminals are multiples of the same point. Use the terminal indicated in the station/class of service grouping chart.

c. Repeat steps a and b for each station/tie line group.

d. Intercept. Strap together the LINES terminals associated with any equipped but unassigned station line circuits. Strap these terminals to the INCPT terminal.

EXAMPLE F: An example of strapping explained in steps a through d is illustrated in figure 1.07. This example reflects information on the typical station/class of service grouping chart, figure 1.01. It shows strapping for the station groups assigned to class of service 8, and the stations assigned to intercept.

e. Access code/COS assignment. Refer to the station/class of service grouping chart for the hundreds and tens digits of the first feature access code. Strap the associated COS H (hundreds) 1-14 terminal to the HUNDREDS (0-9) terminal corresponding to the hundreds digit in the access code. If applicable, strap the associated COS T (tens) 1-14 terminal to the TENS (0-9) terminal corresponding to the tens digit in the access code.

f. Repeat step e for each assigned class of service number 1-14. For COS 15 assignments, refer to step h or i.

NOTE: Where access codes have an identical hundreds digit, the H terminals can be multipled and then strapped to the respective HUNDREDS terminal. Similarly, where access codes have an identical tens digit, the T terminals can be multipled and strapped to the respective TENS terminal.

g. Strap all unassigned COS H 1-14 terminals to a CB terminal; strap all unassigned COS T 1-14 terminals to a CG terminal.

EXAMPLE G: Figure 1.08 illustrates access code/COS assignment strapping on the class of service PCB. The example reflects strapping of access codes 6, 91, 92, and 93 corresponding to the class of service assignments on the typical station/class of service grouping record chart, figure 1.01.

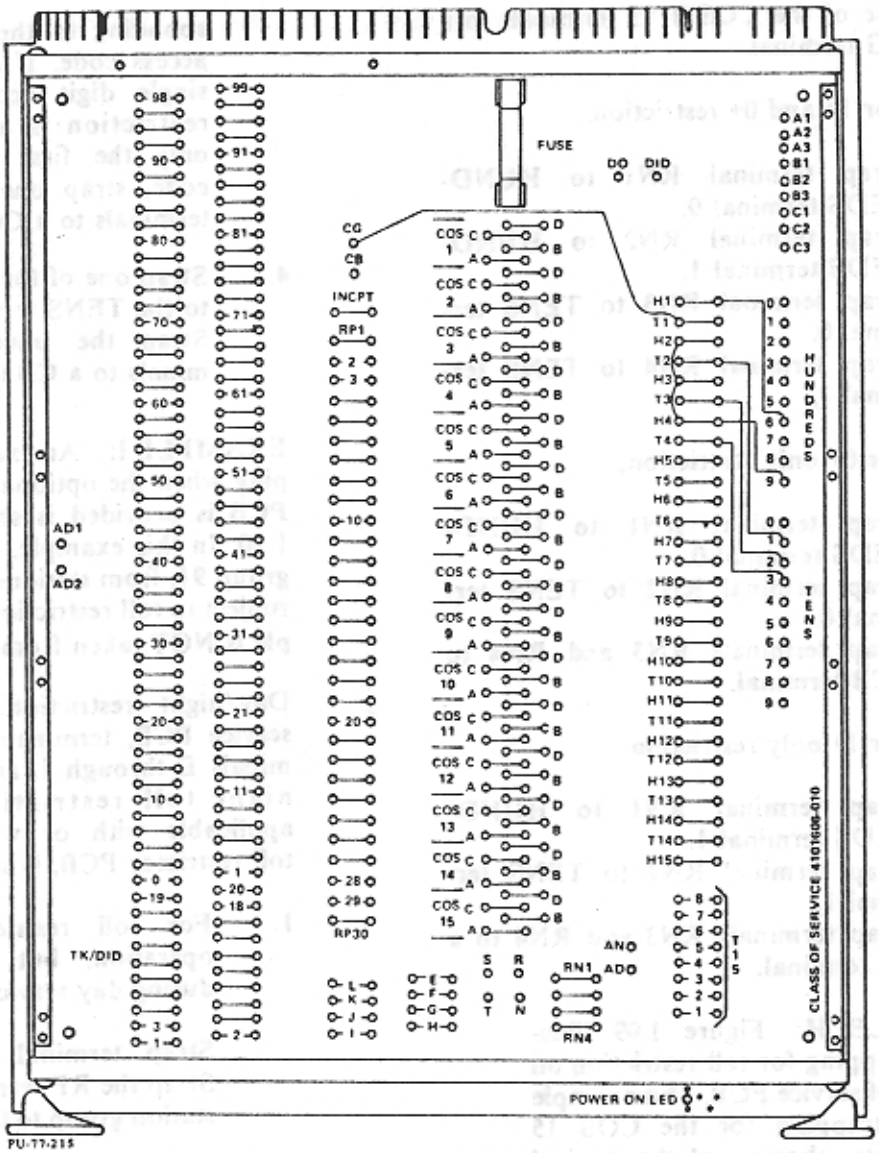

FIGURE 1.08 Class of Service PCB (TD-4101606-010) Strapped per Example G

h. One- or two-digit toll restriction. For one- or two-digit toll restriction using the register,

1. Strap the stations to be restricted to the CLASS OF SERVICE 15 terminal as described in steps a and b.

2. Strap terminal R to terminal S. Omit this step if restriction is accomplished by detecting loop reversal from the CO.

3. Strap the COS H (hundreds) 15 terminal to the HUNDREDS terminal corresponding to the first digit of the access code for the restricted trunk group.

4. If the restricted trunk group has a two-digit access code, strap one of the COS T (tens) 15 terminals to the TENS terminal(s) corresponding to the second digit in the access code. Repeat this step for the second digit of each restricted trunk group. If any trunk group has a single digit access code, or if restriction is accomplished using only the first digit of the trunk access code, strap

one of the COS T 15 terminals to a CG terminal.

5. For 1+ and 0+ restriction,

   Strap terminal RN1 to HUNDREDS terminal 0.
   Strap terminal RN2 to HUNDREDS terminal 1.
   Strap terminal RN3 to TENS terminal 0.
   Strap terminal RN4 to TENS terminal 1.

6. For 0+ only restriction,

   Strap terminal RN1 to HUNDREDS terminal 0.
   Strap terminal RN2 to TENS terminal 0.
   Strap terminals RN3 and RN4 to a CB terminal.

7. For 1+ only restriction,

   Strap terminal RN1 to HUNDREDS terminal 1.
   Strap terminal RN2 to TENS terminal 1.
   Strap terminals RN3 and RN4 to a CB terminal.

EXAMPLE H: Figure 1.09 illustrates strapping for toll restriction on the class of service PCB. This example reflects strapping for the COS 15 assignments shown in the typical station/class of service grouping chart, figure 1.01.

i. Toll restriction using the optional toll restrictor PCB. For toll restriction using the toll restrictor PCB,

1. Strap the stations to be restricted to the CLASS OF SERVICE 15 terminal as described in steps a and b.

2. Strap terminal R to terminal S.

3. Strap the COS H 15 and one of the COS T 15 terminals to the HUNDREDS and TENS terminals corresponding to the digits in the trunk access code. If a trunk group has single digit access code, or when restriction is accomplished using only the first digit of the access code, strap one of the COS T 15 terminals to a CG terminal.

4. Strap one of the RN1-RN4 terminals to the TENS terminal 0.
   Strap the unused RN1-RN4 terminals to a CB terminal.

EXAMPLE I: An example of strapping when the optional toll restrictor PCB is provided is shown in figure 1.10. In this example, calls via trunk group 91, from stations 00 and 01 are subject to toll restriction. (This example is NOT taken from figure 1.01.)

j. Day/night restriction. On the class of service PCB, terminals N and T, and terminals E through L are provided for day/night toll restriction. This option, applicable with or without the optional toll restrictor PCB, is strapped as follows.

1. For toll restriction during night operation, but no toll restriction during day service,

   Strap terminal N to terminal T.
   Strap the RP terminal of the assigned station group to terminal I, J, K, or L.

2. For toll restriction during day service, but no toll restriction during the night operation,

   Strap terminal N to terminal T.
   Strap the RP terminal of the assigned station group to terminal E, F, G, or H.

3. If the toll restrictor PCB is not equipped, strap the RN1-RN4 terminals as described in paragraph j, steps 5, 6, and 7.

4. If the toll restrictor PCB is equipped, strap one of the RN1-RN4 terminals to TENS terminal 0; strap

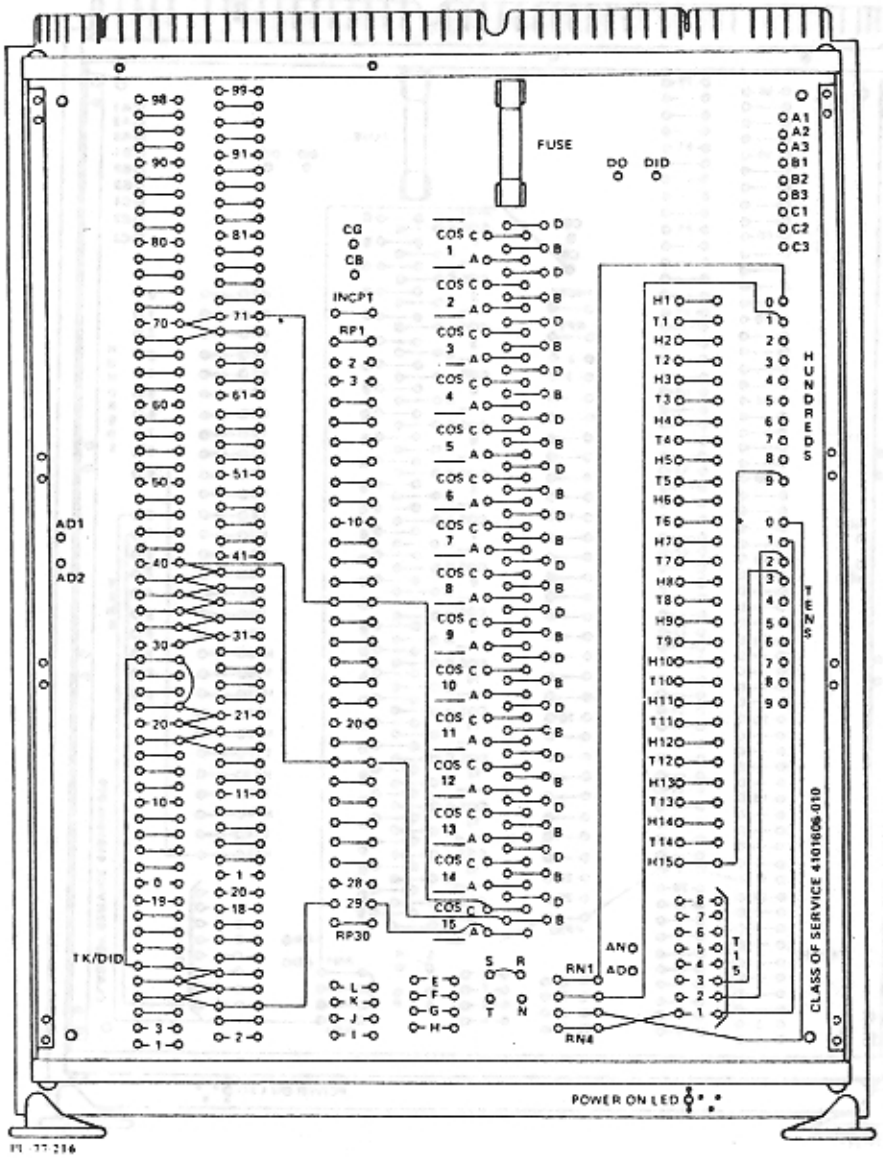

FIGURE 1.09 Class of Service PCB (TD-4101606-010) Strapped per Example H

the remaining RN terminals to a CB terminal.

5. Additional day/night dialing denial/ restriction is possible through the use of the AN and AD terminals. For toll restriction during day operation and access code denial during day service,

   Strap terminal N to terminal T. Strap the RP terminal of the assigned station group to terminal I, J, K, or L. Strap the appropriate COS terminals 1 through 6 (representing the access codes to be denied) to terminal AD.

   For toll restriction during night operation and access code denial during day service,

   Strap terminal N to terminal T. Strap the RP terminal of the assigned station group to terminal E, F, G, or H. Strap the appropriate COS terminals 1 through 6 (representing the access codes to be denied) to terminal AN.

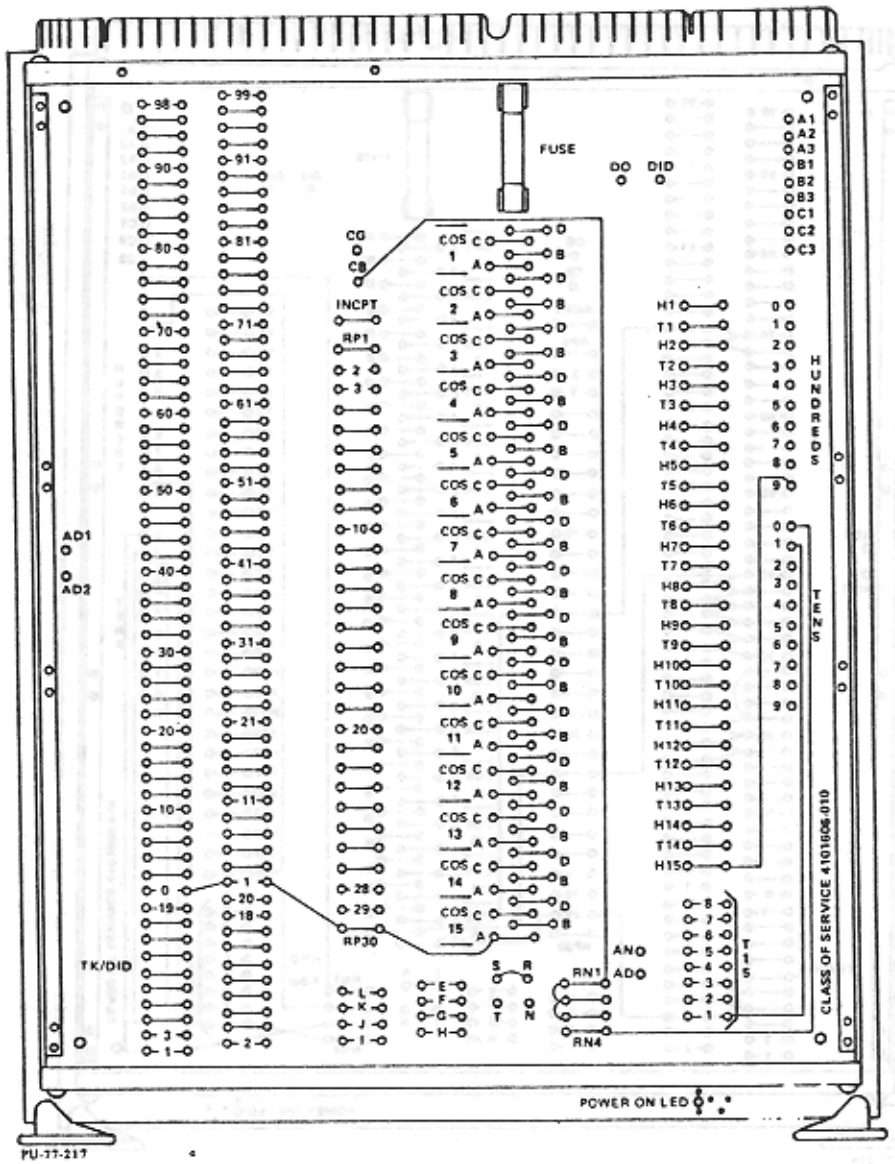

FIGURE 1.10 Class of Service PCB (TD-4101606-010) Strapped per Example I

EXAMPLE J: An example of day/night denial/restriction strapping is shown in figure 1.11. In this example, stations 40, 42, and 43 are arranged for toll restriction on trunk group 91 during day operation, and denied access during the night; stations 60 through 69 are arranged for access denial to trunk group 91 during the day, and toll restricted at night. Toll restriction is accomplished by the restrictor PCB, and applies to calls via trunk groups 91, 92, and 93. Stations 71 and 72 are restricted from dialing access code 5 during day service but allowed at night. (This example was NOT taken from figure 1.01.)

k. Digit reception terminals. The A 1-3, B 1-3 and C 1-3 terminals are strapped to indicate the number of digits received by each equipped DID trunk and are strapped as follows:

1. Identify and locate each equipped DID trunk that will receive 2 digit

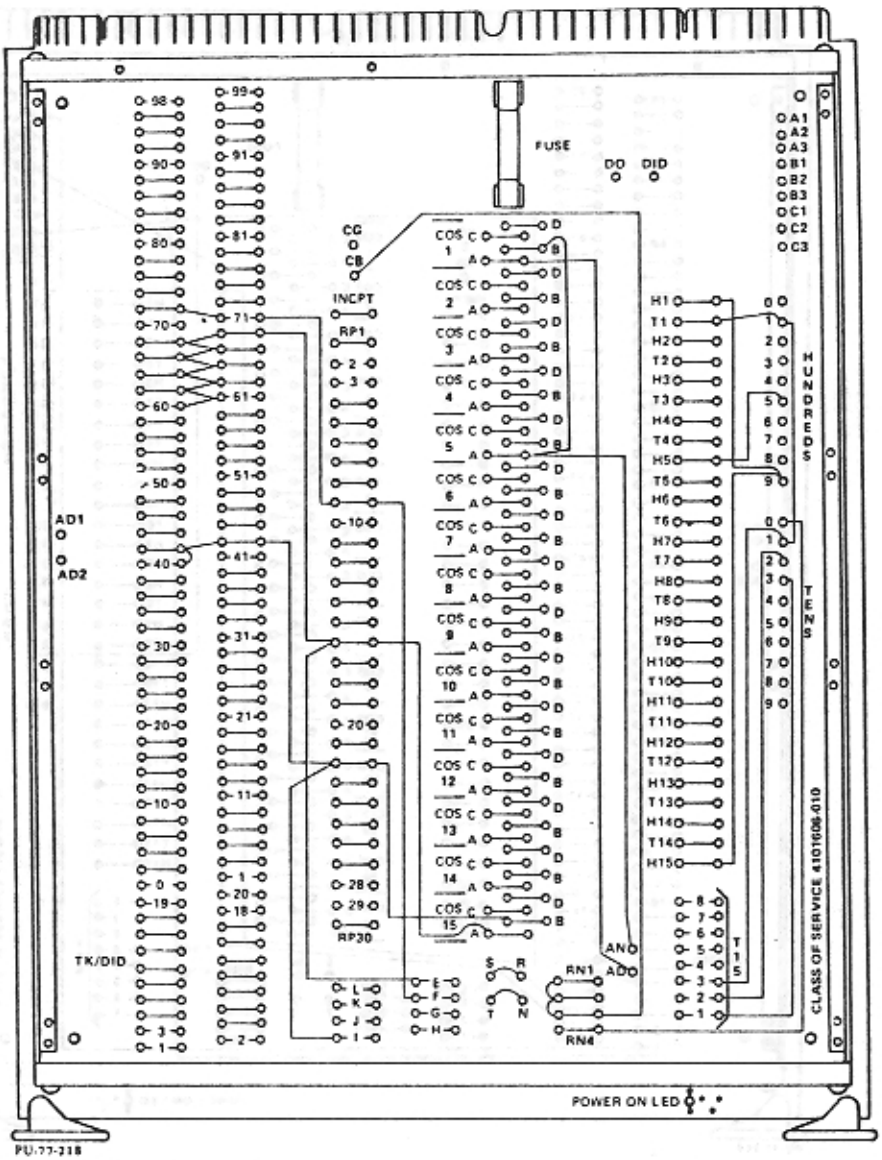

FIGURE 1.11 Class of Service PCB (TD-4101606-010) Strapped per Example J

from the CO. Strap the appropriate TK/DID 1-20 terminal to terminal A1, A2 or A3. Make certain there is no conflict with those trunks grouped in paragraph l below, or with the station groups as performed in step a.

2. Repeat step 1 for the 3-digit (B 1-3) and 4-digit (C 1-3) DID trunks.

l. DID attendant call terminals. The DID and DO terminals are strapped as follows:

1. Identify and locate all equipped DID trunks that may receive digits requiring that the call be routed to the attendant. Strap together the TK/DID 1-20 terminals associated with those trunks. Make certain there is no conflict with those trunks grouped in paragraph k above, or with the station grouping performed in step a.

2. Strap from the last TK/DID 1-20 terminal to the DID terminal.

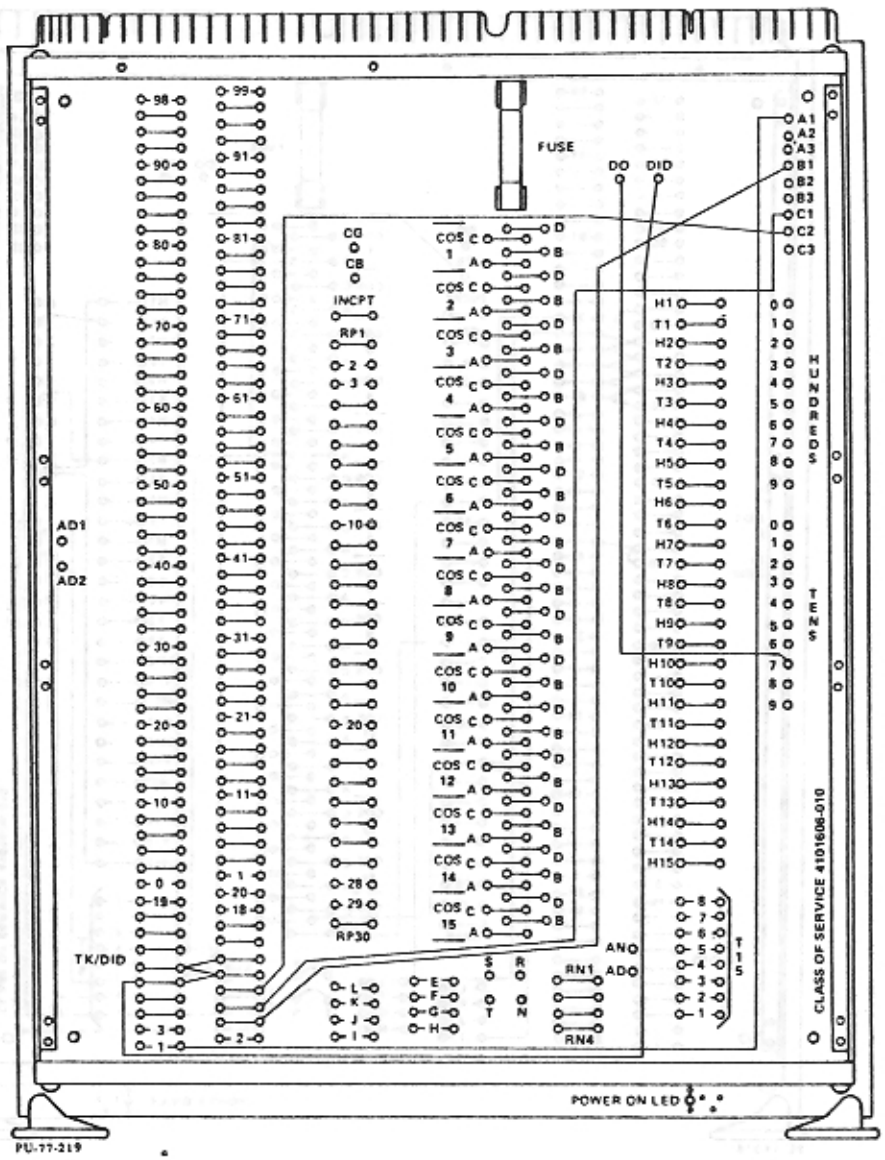

FIGURE 1.12 Class of Service PCB (TD-4101606-010) Strapped Example K

3. Determine the hundreds digit or the tens digit that is to be used to call the attendant whenever it is received via one of the DID trunks strapped in step 2.

4. Strap from the HUNDREDS 0-9 or TENS 0-9 terminal that corresponds to the digit selected in step 3 to the DO terminal.

EXAMPLE K: An example of strapping explained in steps k and l is illustrated in figure 1.12. This example shows a DID trunk in position 1 strapped to receive 2 digits; a DID trunk in position 4 strapped to receive 3 digits and DID trunks in positions 6 and 8 to receive 4 digits. It shows DID trunks in positions 9 through 12 strapped to be routed to the attendant on receipt of a 7 as the tens digit. (This example is NOT taken from figure 1.01.)

m. Attendant access. Terminals AD1 and AD2 have been provided for attendant access to features. Where applicable, strap these terminals as follows:

1. If the attendant is permitted to dial all access codes assigned to allow class of service numbers, strap terminal AD1 to terminal AD2.

2. If the attendant is not permitted to dial all allow access codes, no strap is required.

3. If the attendant is permitted to dial only a particular allow access code, strap terminal AD1 to the A, B, C, or D terminal for the required (allow) class of service.

4. If the attendant is not permitted to dial a particular deny access code, strap terminal AD1 to the A, B, C, or D terminal for the required (deny) class of service.

FEATURE STRAPPING
TD-100
MEMORY PCB (TD-4101616-003, -004, -005)

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1.02 Processor 2 PCB Strapping (TD-4101636-010) 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping of the TD-100 Memory PCB, TD-4101616. This information is applicable to memory PCB's TD-4101616-003, -004, and -005 and processor 2 PCB's TD-4101636-010. It should be referred to when strapping the memory for a new installation, or when replacing the memory in a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The memory PCB mounts in position 6 on the channel subrack. In systems equipped with channel motherboards TD-4101716-002 or -003, it is necessary to strap the memory PCB if the system is arranged for dial/directed call pickup.

Strapping may also be required on the memory PCB, TD-4101616-005, issue AZ or later, and the processor 2 PCB, TD-4101636-010 to provide camp-on busy tone operation. Refer to paragraphs 2.02 and 2.03.

2.02 Memory PCB Strapping (refer to figures 1.00 and 1.01). In systems equipped for dial/directed call pickup, strap:

Terminal 1 to terminal 2.

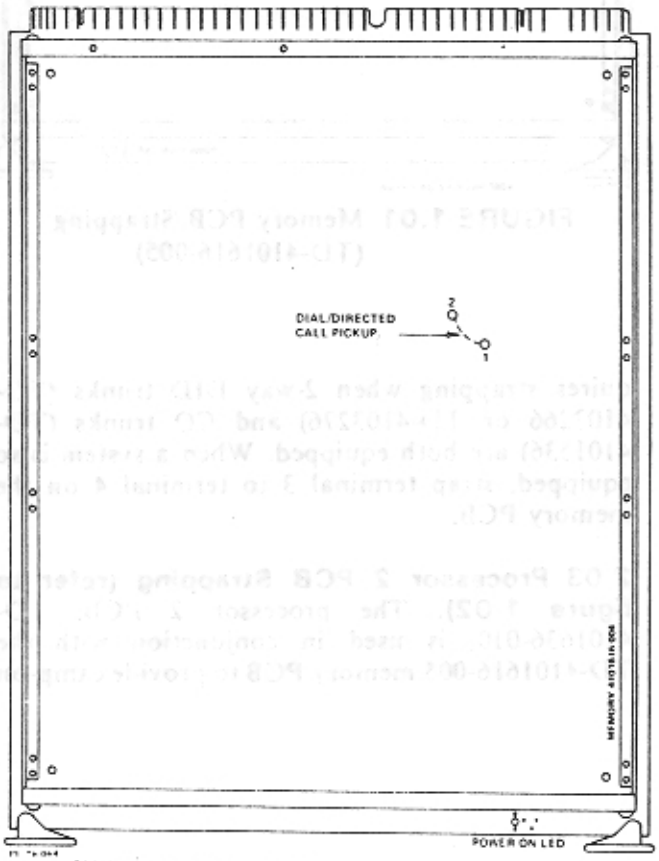

FIGURE 1.00 Memory PCB Strapping (TD-4101616-003/004)

For proper camp-on busy tone operation, the TD-4101616-005, issue AZ or later, PCB re-

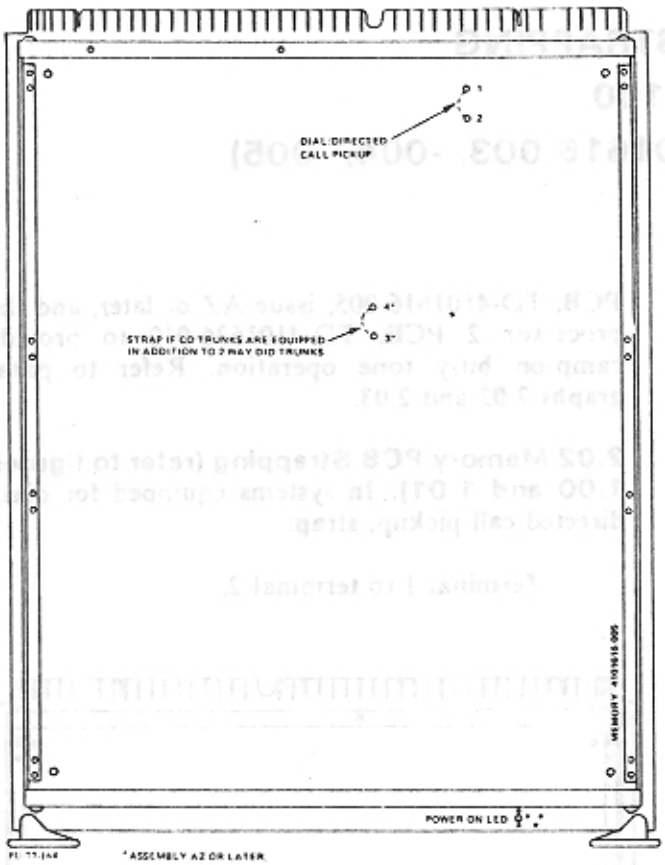

FIGURE 1.01 Memory PCB Strapping (TD-4101616-005)

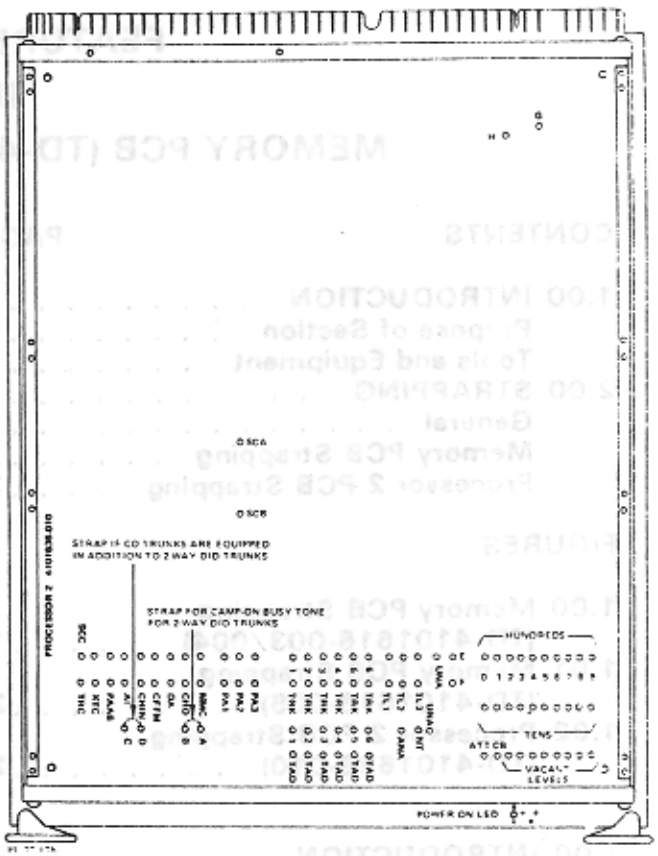

FIGURE 1.02 Processor 2 PCB Strapping (TD-4101636-010)

quires strapping when 2-way DID trunks (TD-4103266 or TD-4103276) and CO trunks (TD-4101536) are both equipped. When a system is so equipped, strap terminal 3 to terminal 4 on the memory PCB.

2.03 Processor 2 PCB Strapping (refer to figure 1.02). The processor 2 PCB, TD-4101636-010, is used in conjunction with the TD-4101616-005 memory PCB to provide camp-on busy tone to 2-way DID trunks (TD-4103266 or TD-4103276).

a. To provide camp-on busy tone to 2-way DID trunks, strap terminal A to terminal B on the processor 2 PCB.

b. If CO trunks (TD-4101536) are also equipped, strap terminal C to terminal D on the processor 2 PCB.

FEATURE STRAPPING
TD-100
PROCESSOR 1 PCB (TD-4101626-010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 processor 1 PCB. This information is applicable only to processor 1 assemblies numbered TD-4101626-010. It should be consulted when strapping the processor 1 -010 PCB for new installations of 24 AWG (tinned) wire are required.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a small quantity of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. Processor 1, one of the primary control boards of the TD-100 system, provides the decision-making circuits used in initiating and controlling the progress of a call. Processor 1 mounts in card position 8 of the channel subrack. The generation -010 PCB provides for selection of all channel circuits, such as registers, links, and trunk groups on an alternate seizure basis. With alternate seizure the processor 1 does not seize circuits in numerical order, for example, register 1, register 2, register 3, but in a random sequence. When alternate seizure is inhibited, the processor 1 seizes the first free channel circuit, as required.

Strapping on the board can inhibit all alternate seizure operation, allow full alternate seizure, or selectively inhibit alternate seizure of trunk circuits by trunk groups. These strapping options are explained in the following paragraphs and illustrated in figure 1.00.

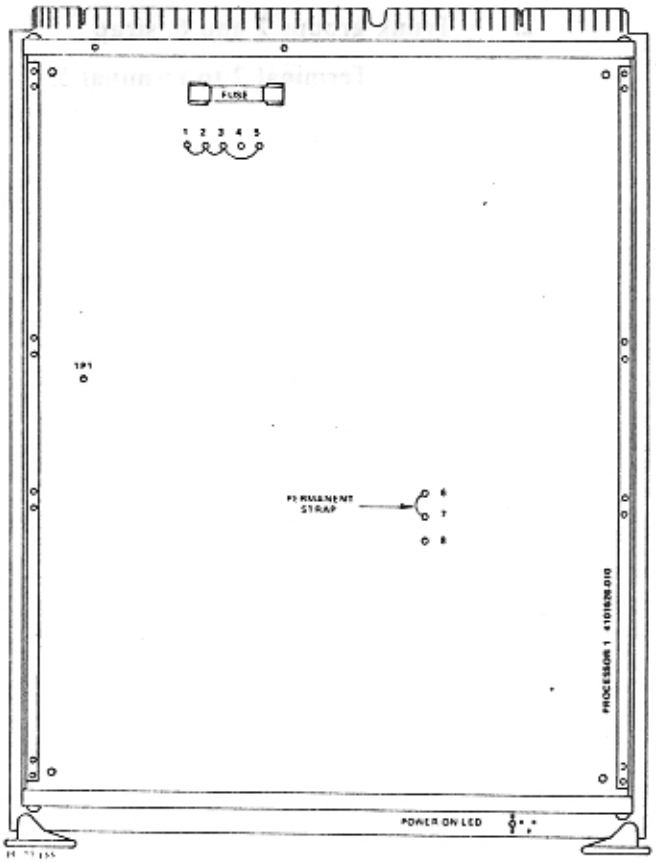

FIGURE 1.00 Processor 1 Strapping (TD-4101626-010)

2.02 Information Required. To strap the processor 1 PCB, the installer must determine if the system is to be provided alternate seizure of all channel circuits, such as registers, links, and trunk groups.

2.03 Processor 1 Strapping. Arrangement of strapping options on the generation -010 PCB is as follows:

a. To inhibit alternate seizure of all system channel circuits, strap

Terminal 4 to terminal 5.

b. To inhibit trunk group alternate seizure, strap as follows:

1. Trunk groups 1 and 5, strap

Terminal 1 to terminal 5.

2. Trunk groups 2 and 6, strap

Terminal 2 to terminal 5.

3. Trunk groups 3 and 4, strap

Terminal 3 to terminal 5.

c. The system will be provided with alternate seizure operation if no straps are installed between terminal 1 through 5.

d. The strap from terminal 6 to terminal 7 is factory-installed for future use.

EXAMPLE: Figure 1.00 illustrates the strapping to inhibit alternate seizure for trunk groups 1 through 6, and to allow all other channel circuits to be selected on an alternate basis.

FEATURE STRAPPING
TD-100
PROCESSOR 2 PCB (TD-4101636-003, -004, -005, -010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 processor 2 PCB. This information is applicable to processor 2 PCB's numbered TD-4101636-003, -004, -005, and -010. It should be consulted when strapping the processor 2 PCB for a new installation, when adding a new feature, or when replacing the processor 2 PCB in a working system.

Processor 2 strapping for various options is described in the following paragraphs. Each explanation is accompanied by an illustration depicting strapping for the applicable feature or the example cited. Paragraphs 2.00 through 2.12 deal with the -003, -004, and -005 PCB's; paragaraphs 3.00 through 3.15 cover the -010 assembly.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient quantity of 24 AWG (tinned) wire are required.

2.00 STRAPPING (TD-4101636-003, -004, -005)

2.01 General. The processor 2 PCB mounts in position 9 of the channel subrack. The PCB provides strapping terminals for assignment of most feature access codes. These strapping terminals allow flexibility in the system numbering plan, making the system readily adaptable to local operating requirements.

The following explanations and illustrations refer to strapping on the TD-4101636-005 processor 2 PCB. Strapping of the TD-4101636-003 and -004 PCB's is similar. Only a few terminal designations differ. For reference, terminal designations on the -003 and -004 processor 2 PCB's are shown in figures 1.00 and 1.01, respectively.

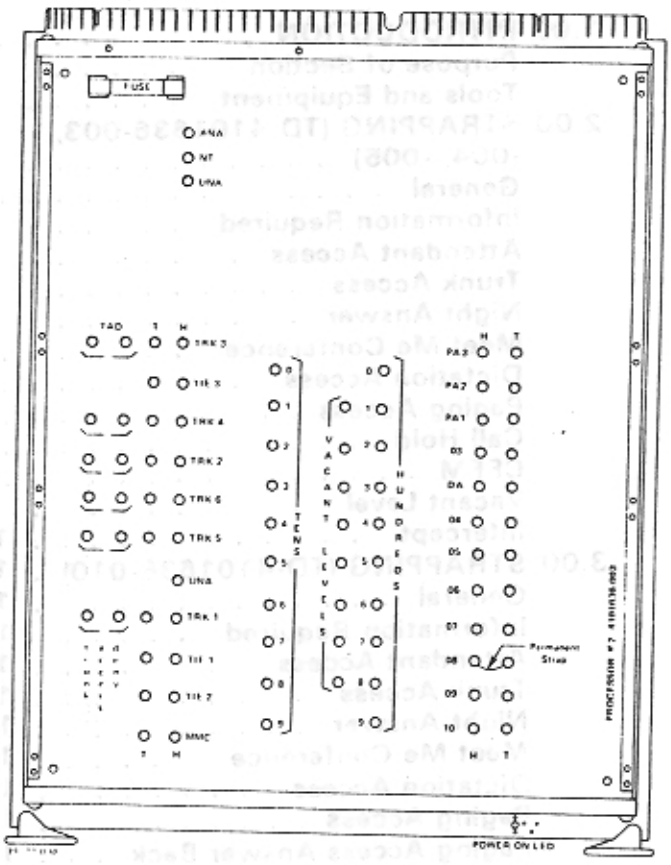

FIGURE 1.00 Processor 2 PCB (TD-4101636-003)

2.02 Information Required. To strap the processor 2 PCB, a chart similar to the one shown in figure 1.02 should be available. On new installations, such a chart should be filled out and left with the system as a permanent record. The chart should show all applicable processor 2 strapping information. It should be updated any time changes are made in processor strapping.

2.03 Attendant Access. With the attendant access feature, any single digit (0-9) can be assigned as the attendant access code. This feature is applicable to processor 2 PCB's assembly issue AK or later.

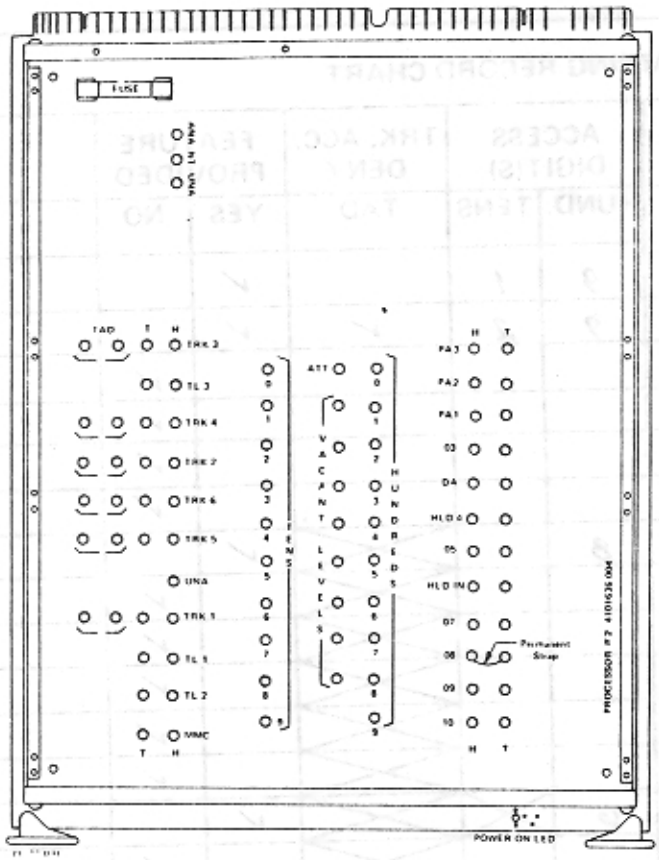

FIGURE 1.01 Processor 2 PCB (TD-4101636-004)

To assign the attendant access digit, strap terminal ATT to the HUNDREDS terminal (0-9) corresponding to the access digit.

EXAMPLE: Figure 1.03 shows strapping for assigning the digit "0" as the attendant access digit.

2.04 Trunk Access. Perform the following strapping, as required, to arrange the applicable outgoing trunk groups for one or two digit access, or attendant access only.

a. Single digit access. For single digit trunk or tie trunk access,

1. Strap the TRK or TL T (tens) and H (hundreds) terminals for the respective trunk group together.

2. Strap the TRK or TL H (hundreds) terminal to the HUNDREDS terminal that corresponds to the access digit.

EXAMPLE: Figure 1.04 shows single digit access strapping for one tie trunk group. The trunk access digit is 9; the tie trunk access digit is 8.

b. Two digit access. For two digit trunk or tie trunk access, strap the processor 2 PCB as follows:

1. In systems equipped with three or less tie trunk groups,

(a) Strap the TRK or TL H (hundreds) terminal, for the respective trunk group, to the HUNDREDS terminal that corresponds to the first digit of the access code.

(b) Strap the TRK or TL T (tens) terminal, for the respective trunk group, to the TENS terminal that corresponds to the second digit of the access code.

EXAMPLE: Figure 1.05 shows an example of this strapping. CO trunk groups 1, 2, and 3 are assigned access codes 91, 92, and 93; tie trunk groups 1, 2, and 3 are assigned access codes 81, 82, and 83.

2. In systems equipped with more than three tie trunk groups, the TD-4101636-005 processor 2 PCB must be provided. On this PCB, the TRK 1, TRK 2, and TRK 3 terminals can be used as assignment terminals for CO trunk groups 1, 2, and 3, or tie trunk groups 4, 5, and 6. Strapping is as follows:

(a) Strap the TRK or TL H (hundreds) terminal, for the respective trunk group, to the HUNDREDS terminal that corresponds to the first digit of the access code.

PROCESSOR STRAPPING RECORD CHART

FEATURE	ACCESS DIGIT(S)		TRK. ACC. DENY	FEATURE PROVIDED		
	HUND.	TENS	TAD	YES	NO	
(TRK. 1)	9	1		✓		
(TRK. 2)	9	2	✓	✓		
(TRK. 3)					✓	
(TRK. 4)					✓	
(TRK. 5)					✓	
(TRK. 6)					✓	
p 1 (TIE LINE 1)	8			✓		
p 2 (TIE LINE 2)					✓	
p 3 (TIE LINE 3)					✓	
p 4 (TRK. 1)					✓	
p 5 (TRK. 2)					✓	
p 6 (TRK. 3)					✓	
ht Answer (UNA)	6			✓		
ence (MMC)					✓	
PA1)	3	1		✓		
PA2)	3	2		✓		
	3	4		✓		
PA3)	3	3		✓		
(DA)	7	3		✓		
Answer (ANA)					✓	
	5	1		✓		
	5	2		✓		
ndant				✓		
Tone					✓	
Follow Me	4	1		✓		
	0			✓		

FIGURE 1.02 Typical Processor 2 Strapping Record Chart

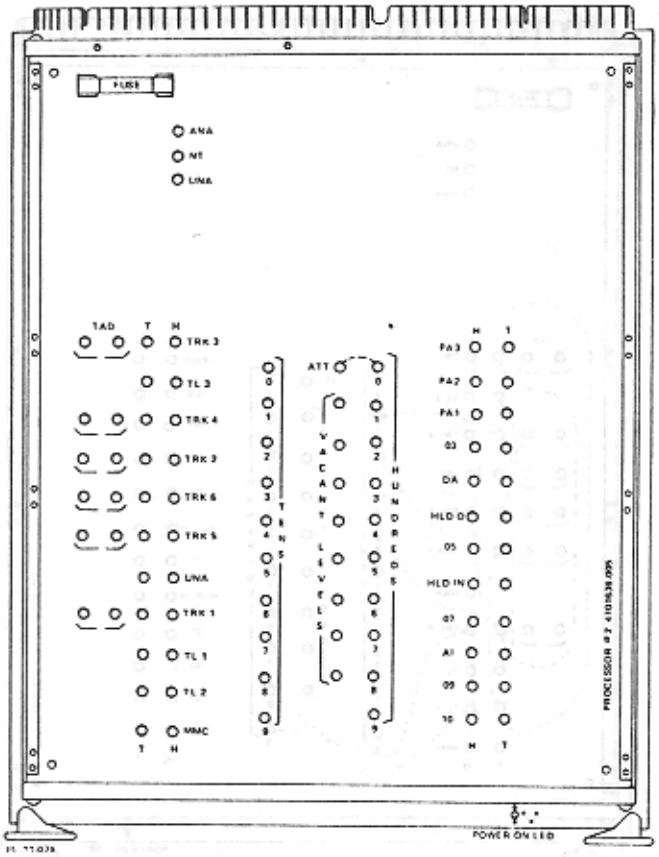

FIGURE 1.03 Attendant Access Strapping (TD-4101636-005)

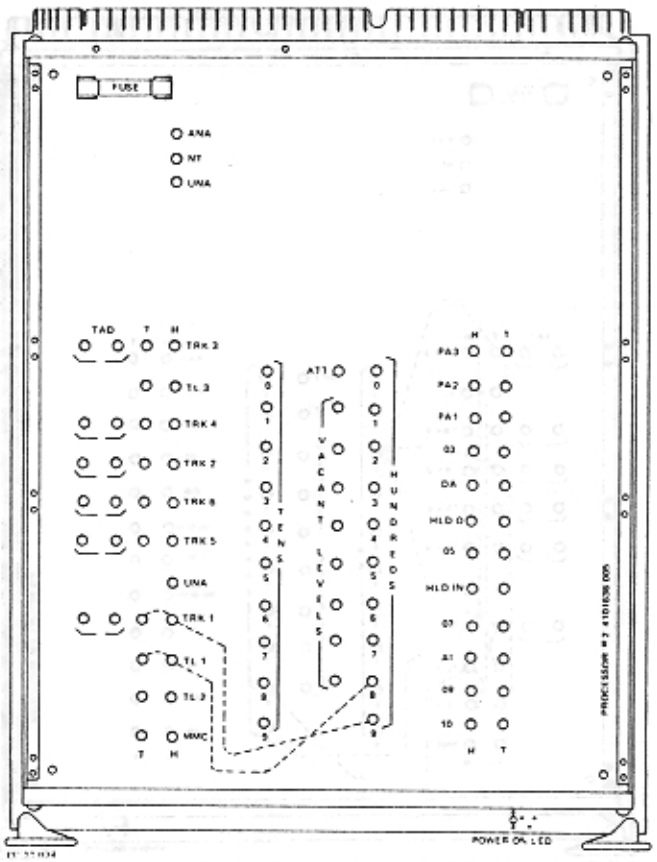

FIGURE 1.04 Single Digit Trunk Access Strapping (TD-4101636-005)

(b) Strap the TRK or TL T (tens) terminal, for the respective trunk group, to the TENS terminal that corresponds to the second digit of the access code.

EXAMPLE: Figure 1.06 shows strapping for four CO trunk groups and four tie trunk groups. CO trunk groups 1, 4, 5, and 6 are assigned access codes 91, 92, 93, and 94; tie trunk groups 1, 2, 3, and 6 are assigned access codes 81, 82, 83, and 84.

c. Deny access. With this feature, only the attendant is permitted to access selected outgoing trunk groups or tie trunk groups. Station access to these trunk groups is only by way of the attendant. One trunk group or any number of trunk groups can be strapped for this feature.

To deny access to a specific trunk or tie group, strap the corresponding TAD terminals together.

EXAMPLE: Figure 1.07 shows strapping for denying station access to trunk group 1 (access code 91) and trunk group 2 (access code 92).

NOTE: For additional information refer to sections OB-410-153, CO Trunk Strapping, OB-410-164, Loop Tie Trunk Strapping, and OB-410-172, E & M Tie Trunk Strapping.

2.05 Night Answer. (Refer to figure 1.08.) Perform the strapping in paragraph a, b, or c, to arrange for ANA (assigned night answer), UNA (unassigned night answer), or combined UNA/ANA service.

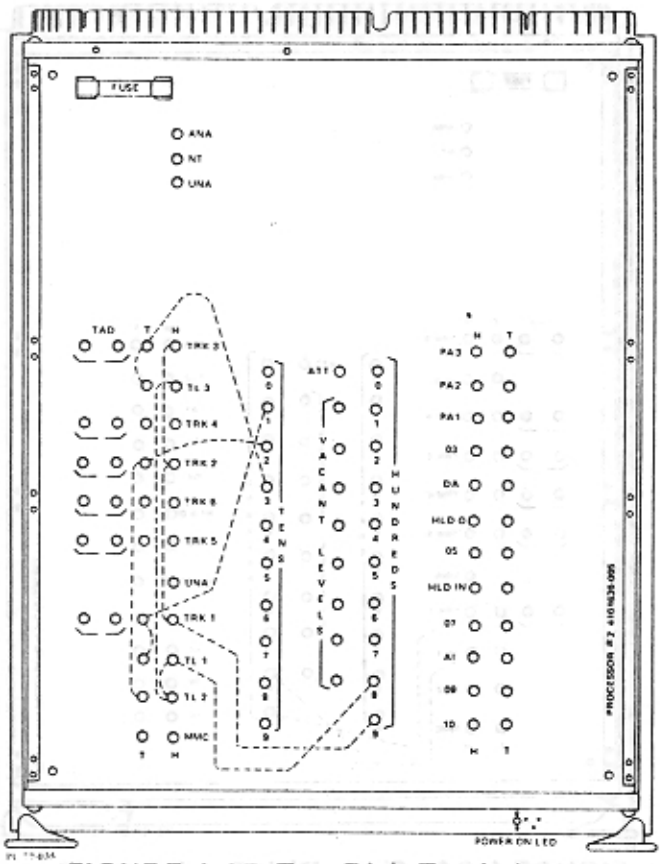

FIGURE 1.05 Two Digit Trunk Access Strapping, Example 1 (TD-4101636-005)

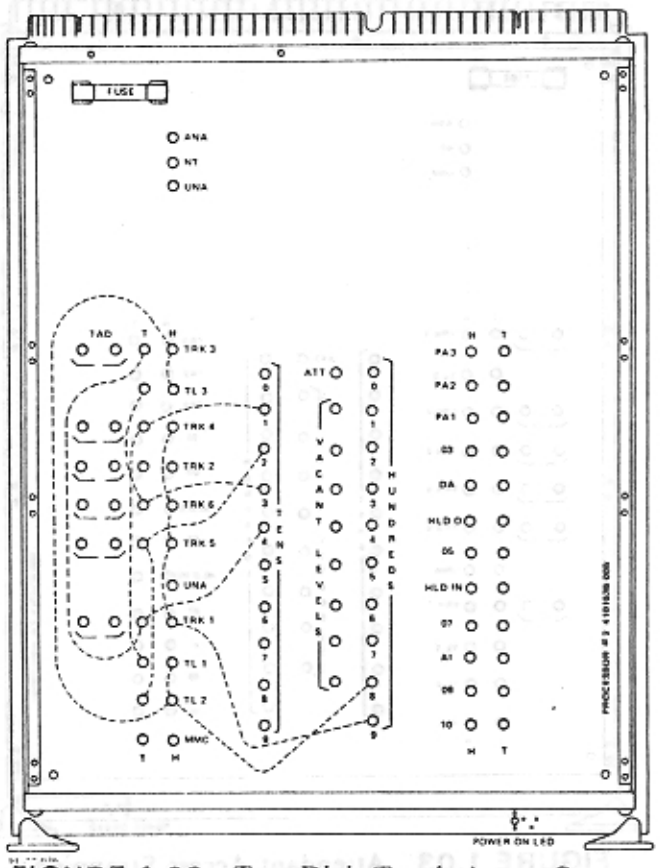

FIGURE 1.06 Two Digit Trunk Access Strapping, Example 2 (TD-4101636-005)

a. ANA strapping. For ANA service, strap terminal ANA to terminal NT.

b. UNA strapping. For UNA service,

1. Strap terminal UNA to terminal NT.
2. Strap the H (hundreds) UNA terminal to the HUNDREDS terminal (0-9) that corresponds to the UNA access code.

c. UNA/ANA strapping. For combined UNA/ANA service,

1. Strap terminal UNA to terminal NT.
2. Strap terminal ANA to terminal NT.
3. Strap the UNA H (hundreds) terminal to the HUNDREDS terminal (0-9) that corresponds to the UNA access code.

NOTE: Refer to section OB-410-155, ANA Strapping, for additional information.

2.06 Meet Me Conference. For the optional meet me conference feature, strap the desired one or two digit meet me conference access code on the processor.

a. Single digit access. For single digit access,

1. Strap the MMC (meet me conference) H (hundreds) and T (tens) terminals together.
2. Strap the MMC H terminal to the HUNDREDS terminal that corresponds to the desired code.

EXAMPLE: Figure 1.09 shows strapping for single digit access using the digit 5.

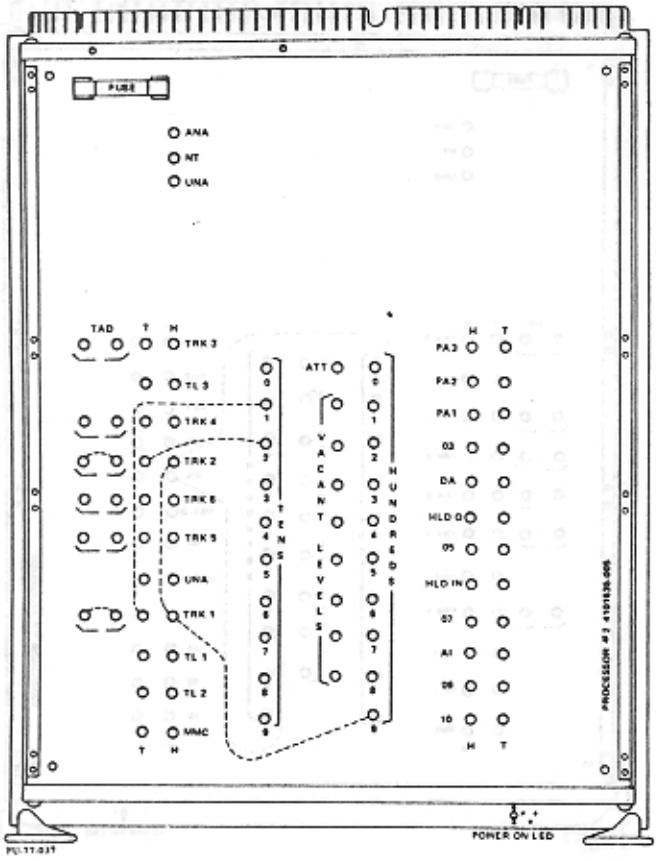

FIGURE 1.07 Deny Access Strapping (TD-4101636-005)

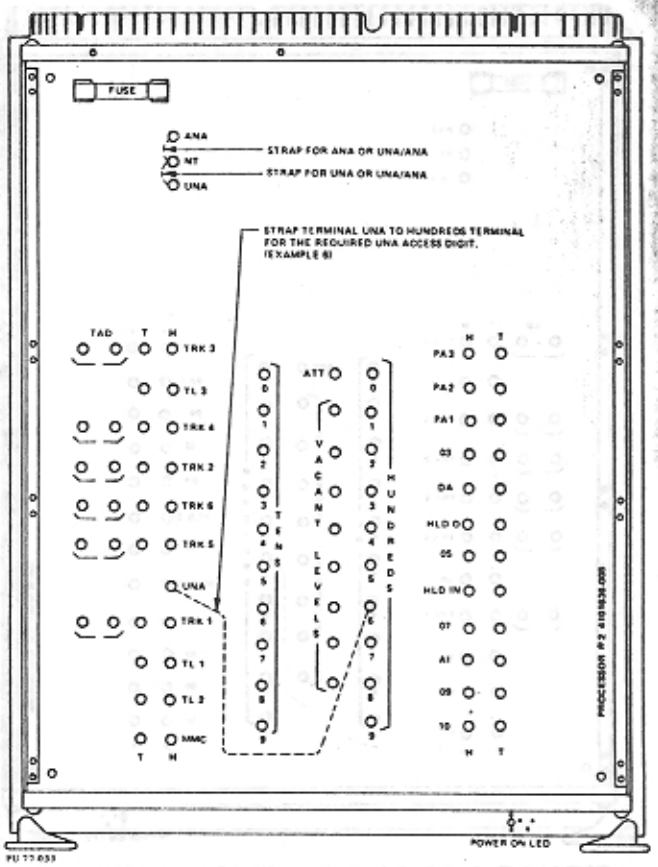

FIGURE 1.08 Night Answer Strapping (TD-4101636-005)

b. Two digit access. For two digit access,

1. Strap the MMC H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.
2. Strap the MMC T (tens) terminal to the TENS terminal that corresponds to the second digit in the access code.

NOTE: Consult section OB-410-157, Conference Service Strapping, for additional information.

2.07 Dictation Access. For optional dictation access service, strap the desired one or two digit access code on the processor 2 PCB.

a. Single digit access. For single digit access.

1. Strap the DA (dictation access) H (hundreds) and T (tens) terminals together.
2. Strap the DA H terminal to the HUNDREDS terminal that corresponds to the desired access code.

b. Two digit access. For two digit access.

1. Strap the DA H terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.
2. Strap the DA T terminal to the TENS terminal that corresponds to the second digit in the access code.

EXAMPLE: An example of dictation access strapping is shown in figure 1.10. The illustration shows strapping for assigning the two digit access code 73.

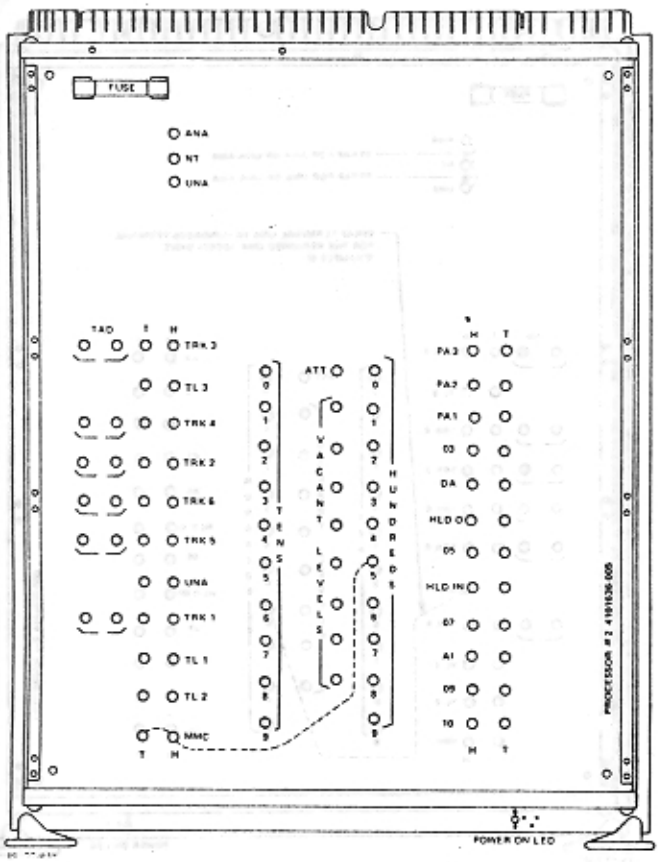

FIGURE 1.09 Meet Me Conference Strapping (TD-4101636-005)

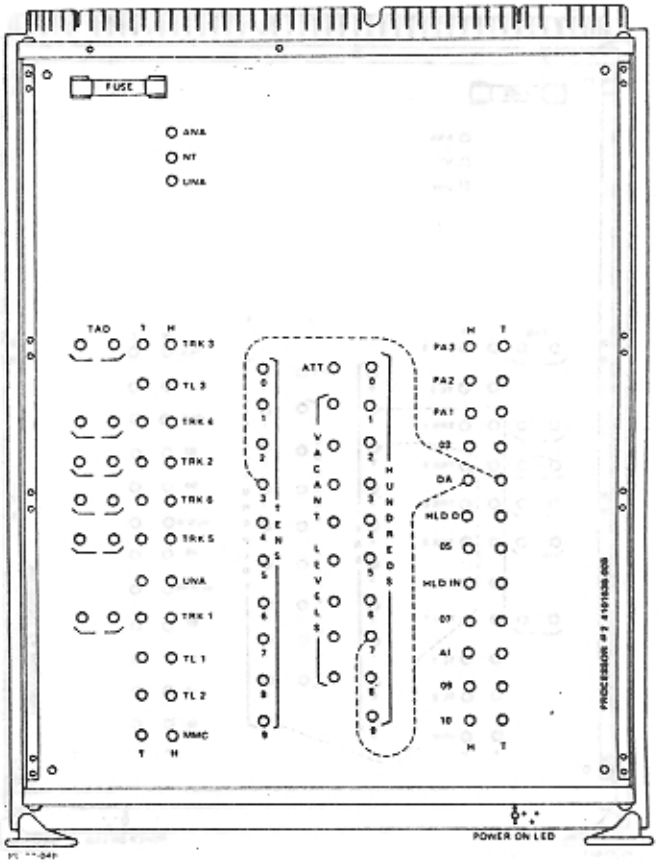

FIGURE 1.10 Dictation Access Strapping (TD-4101636-005)

2.08 Paging Access. When the system is arranged for paging access, the one or two digit paging access code must be strapped on the processor 2 PCB. The paging access code is assigned by strapping the PA1, PA2, and PA3 H (hundreds) and T (tens) terminals to the HUNDREDS and TENS terminals that correspond to the access code. If a single digit is used for paging access, strap only the hundreds digit. If two digit access is required, both the hundreds and tens digits must be strapped.

An example of stapping for two digit access is shown in figure 1.11. The illustration shows strapping for a system with three paging circuits, where the access codes are 31, 32, and 33. The hundreds digit for all three paging circuits is 3, therefore the PA1, PA2, and PA3 H terminals are multiplied and strapped to HUNDREDS terminal 3. The tens digit for the first paging circuit is 1, therefore the PA T terminal is strapped to TENS terminal 1. Similarly, the PA2 and PA3 T terminals are strapped to TENS terminals 2 and 3, respectively.

2.09 Call Hold. The call hold feature allows a station user to place an incoming trunk call on hold by dialing a one or two digit call hold "enter" code. This frees the line and allows the station user to make a local or trunk call. A call hold "exit" code allows the station user to return to the call on hold. The enter and exit codes are strapped on the processor 2 PCB as follows.

a. Single digit access. For single digit access,

1. Strap the HLD O H (hundreds) terminal and the HLD O T (tens) terminal to the HUNDREDS terminal that corresponds to the enter code.

2. Strap the HLD IN H (hundreds) terminal and the HLD IN T (tens) terminal to the HUNDREDS terminal that corresponds to the exit code.

b. Two digit access. For two digit access,

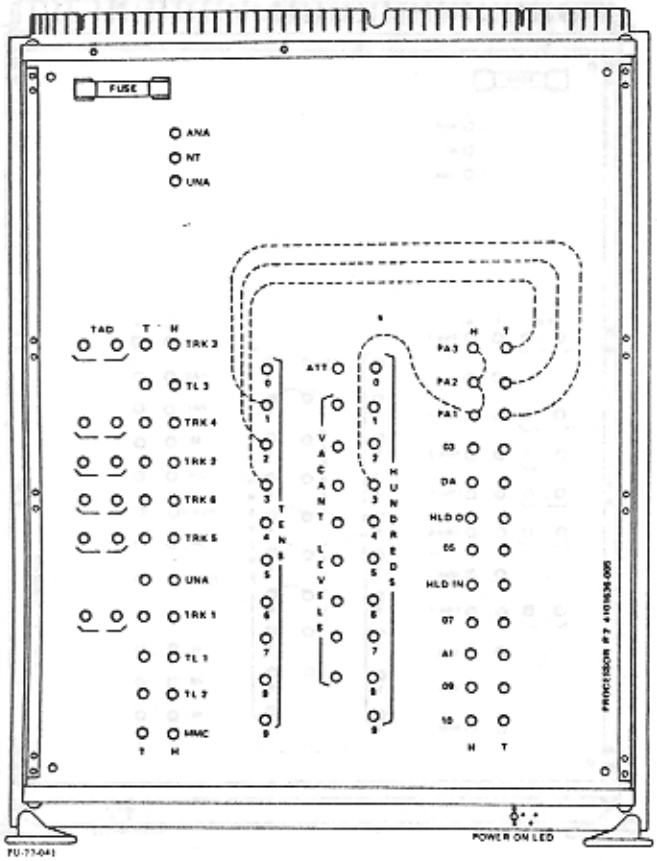

FIGURE 1.11 Paging Access Strapping (TD-4101636-005)

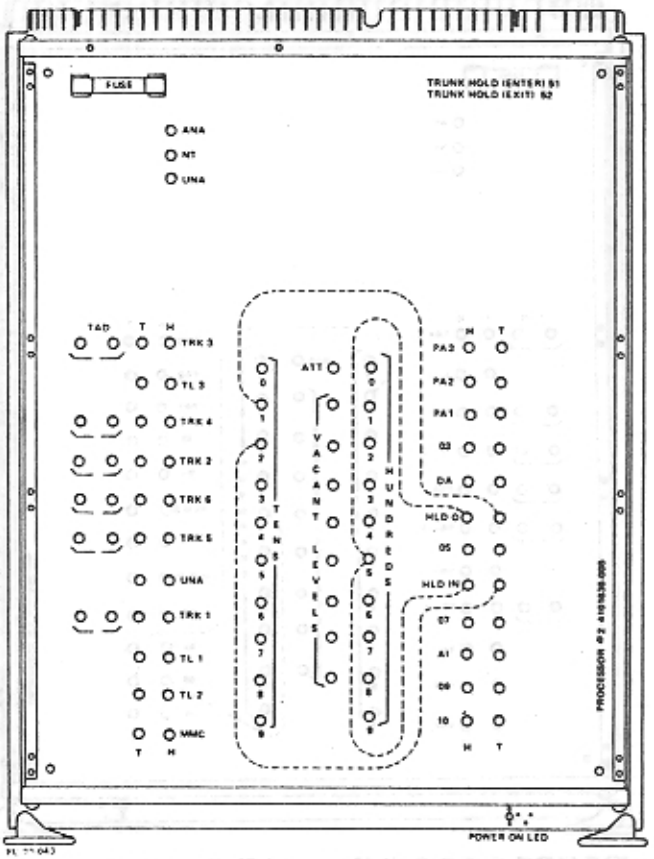

FIGURE 1.12 Call Hold Strapping (TD-4101636-005)

1. Strap the HLD O H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the enter code.

2. Strap the HLD O T (tens) terminal to the TENS terminal that corresponds to the second digit in the enter code.

3. Strap the HLD IN H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the exit code.

4. Strap the HLD IN T (tens) terminal to the TENS terminal that corresponds to the second digit in the exit code.

EXAMPLE: Figure 1.12 illustrates call hold strapping for a system using 51 as the enter code and 52 as the exit code.

2.10 CFFM. The access codes for call forward follow me (CFFM) service are strapped on the processor 2 PCB as follows:

a. Strap the H (hundreds) 09 terminal to the HUNDREDS terminal that corresponds to the first digit in the CFFM access code.

b. Strap the T (tens) 09 terminal to the TENS terminal that corresponds to the second digit of the CFFM access code.

EXAMPLE: Figure 1.13 illustrates strapping for a system where the CFFM access code is 41.

2.11 Vacant Level. All unassigned HUNDREDS terminals, except terminal 0 and the terminal corresponding to the station hundreds digit, must be strapped to VACANT LEVEL terminals. Figure 1.14 shows vacant level strapping for HUNDREDS digits 1, 4, 5, and 6.

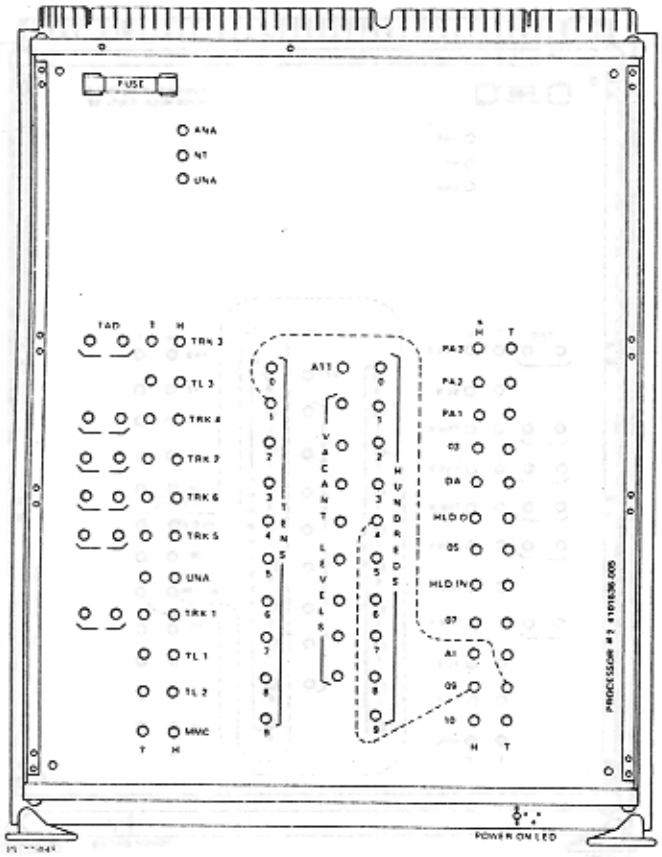

FIGURE 1.13 Call Forward Follow Me Strapping (TD-4101636-005)

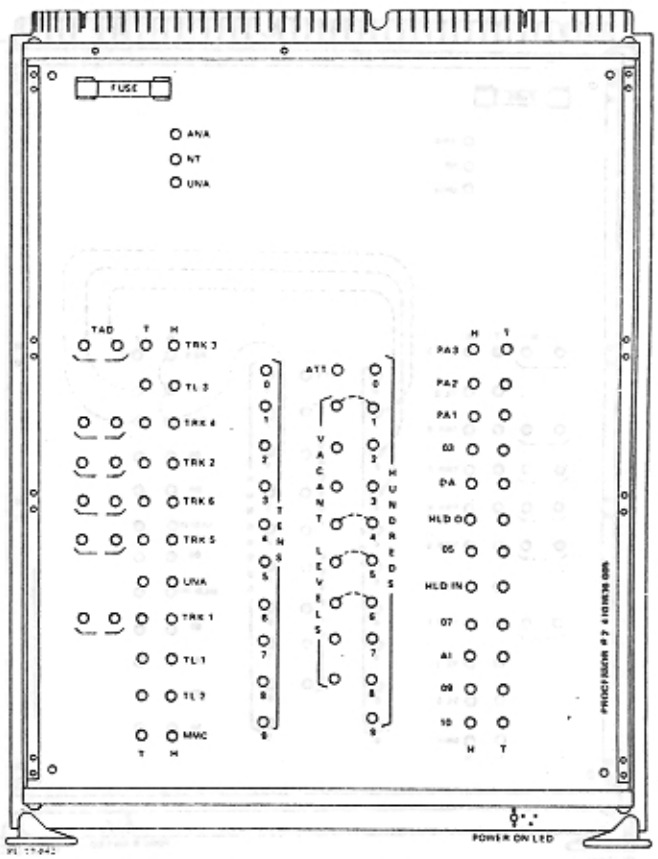

FIGURE 1.14 Vacant Level Strapping (TD-4101636-005)

2.12 Intercept. On the processor 2 PCB (TD-4101636-005), strapping terminals are provided for routing intercept calls (vacant code, vacant number, or deny trunk group access) to reorder tone. This strapping is not necessary if such calls are to be routed to the attendant. To route intercept calls to reorder tone, strap the AI H (hundreds) terminal to the AI T (tens) terminal as shown in figure 1.15.

3.00 STRAPPING (TD-4101636-010)

3.01 General. The processor 2 PCB mounts in position 9 of the channel subrack. The PCB provides strapping terminals for assignment of most feature access codes. These strapping terminals allow flexibility in the system numbering plan, making the system readily adaptable to local operating requirements. The following explanations and illustrations refer to strapping on the TD-4101636 -010 processor 2 PCB.

3.02 Information Required. To strap the processor 2 PCB, a chart similar to the one shown in figure 1.02 should be available. On new installations, such a chart should be filled out and left with the system as a permanent record. The chart should show all applicable processor 2 strapping information. It should be updated any time changes are made in processor strapping.

3.03 Attendant Access. Any single digit (0-9) can be assigned as the attendant access code. To assign the attendant access digit, strap terminal ATT to the HUNDREDS terminal (0-9) corresponding to the access digit.

EXAMPLE: Figure 1.16 shows strapping for assigning the digit "0" as the attendant access digit.

When no attendant's console is provided, strap terminal G to terminal H.

3.04 Trunk Access. Perform the following strapping, as required, to arrange the applicable out-

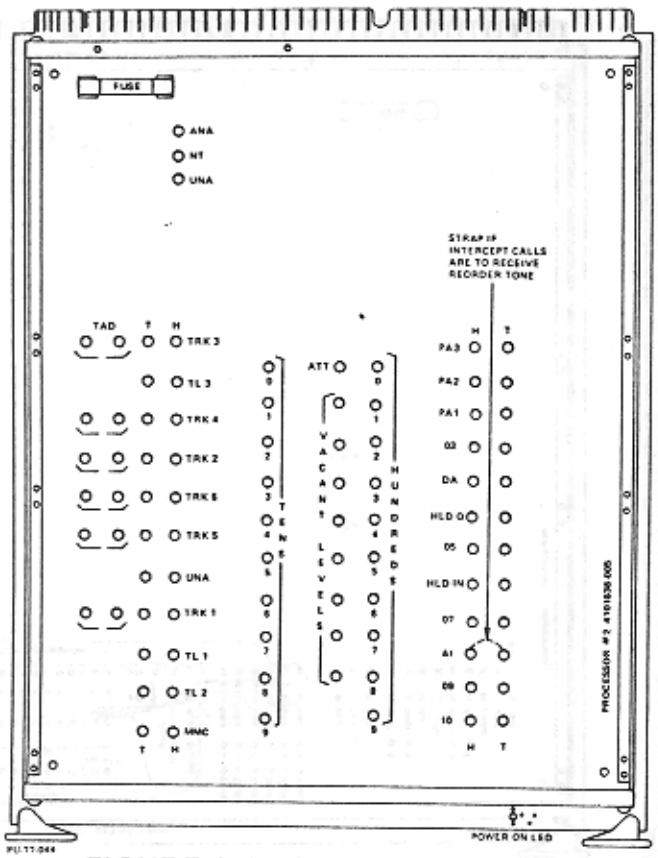

FIGURE 1.15 Intercept Strapping (TD-4101636-005)

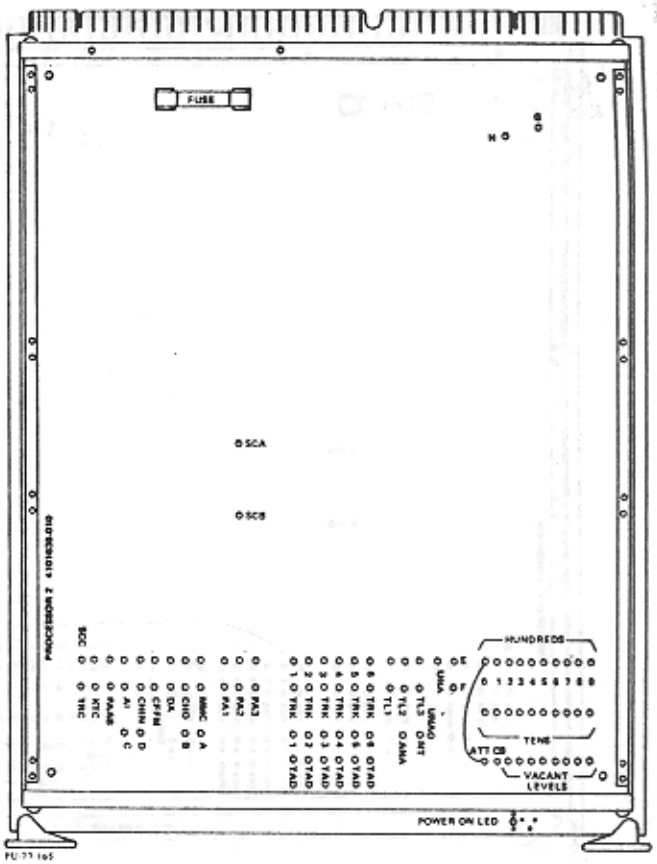

FIGURE 1.16 Attendant Access Strapping (TD-4101636-010)

going trunk groups for one or two digit access, or attendant only access.

a. Single digit access. For single digit trunk or tie trunk access,

1. Strap the TRK or TL T (tens) and H (hundreds) terminals for the respective trunk group together.

2. Strap the TRK or TL H (hundreds) terminal to the HUNDREDS terminal that corresponds to the access digit.

EXAMPLE: Figure 1.17 shows single digit access strapping for one trunk group and one tie trunk group. The trunk access digit is 9; the tie trunk access digit is 8.

b. Two digit access. For two digit trunk or tie trunk access, strap the processor 2 PCB as follows:

1. In system equipped with three or less tie trunk groups,

(a) Strap the TRK or TL H (hundreds) terminal, for the respective trunk group, to the HUNDREDS terminal that corresponds to the first digit of the access code.

(b) Strap the TRK or TL T (tens) terminal, for the respective trunk group, to the TENS terminal that corresponds to the second digit of the access code.

EXAMPLE: Figure 1.18 shows an example of this strapping. CO trunk groups 1, 2, and 3 are assigned access codes 91, 92, and 93; tie trunk groups 1, 2, and 3 are assigned access codes 81, 82, and 83.

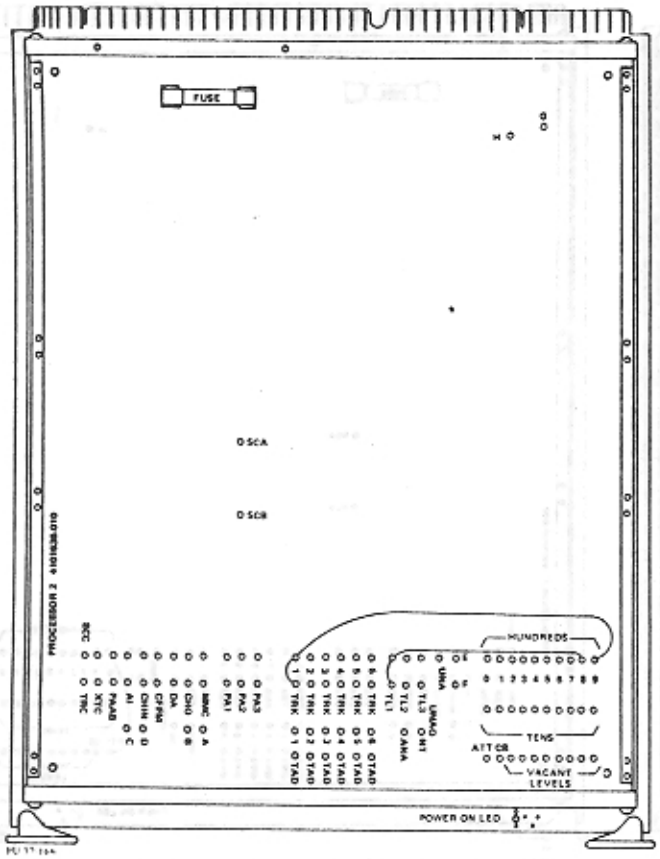

FIGURE 1.17 Single Digit Trunk Access Strapping (TD-4101636-010)

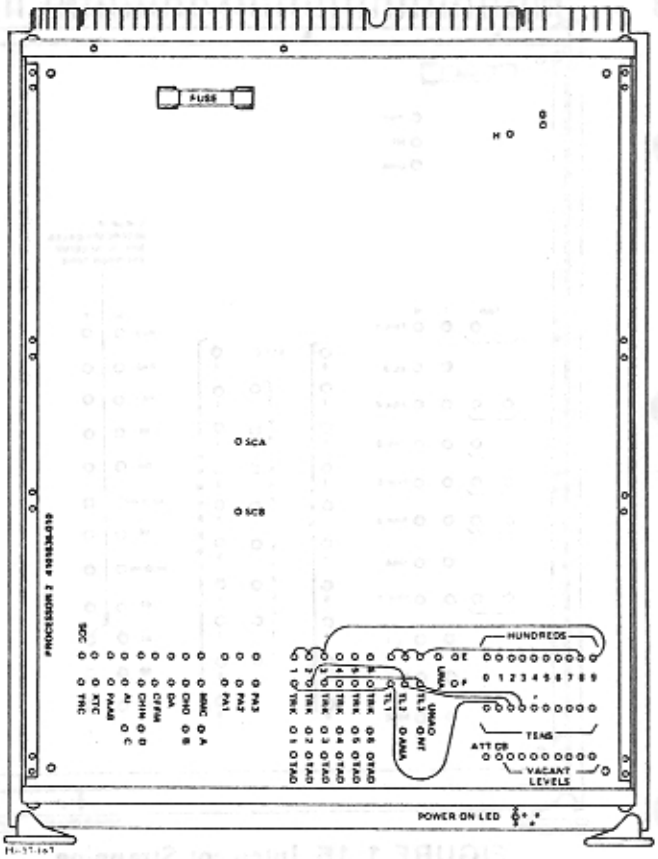

FIGURE 1.18 Two Digit Trunk Access Strapping, Example 1 (TD-4101636-010)

2. In systems equipped with more than three tie trunk groups, the TRK 1, TRK 2, and TRK 3 terminals can be used as assignment terminals for CO trunk groups 1, 2, and 3, or tie trunk groups 4, 5, and 6. Strapping is as follows.

   (a) Strap the TRK or TL H (hundreds) terminal for the respective trunk group, to the HUNDREDS terminal that corresponds to the first digit of the access code.

   (b) Strap the TRK or TL T (tens) terminal, for the respective trunk group, to the TENS terminal that corresponds to the second digit of the access code.

   EXAMPLE: Figure 1.19 shows strapping for four CO trunk groups and four tie trunk groups. CO trunk groups 1, 4, 5, and 6 are assigned access codes 91, 92, 93, and 94; tie trunk groups 1, 2, 3, and 6 are assigned access codes 81, 82, 83, and 84.

c. Deny access. With this feature, only the attendant is permitted to access selected outgoing trunk groups or tie trunk groups. Station access to these trunk groups is only by way of the attendant. One trunk group or any number of trunk groups can be strapped for this feature.

   To deny access to a specific trunk or tie trunk group, strap the corresponding TAD terminals together.

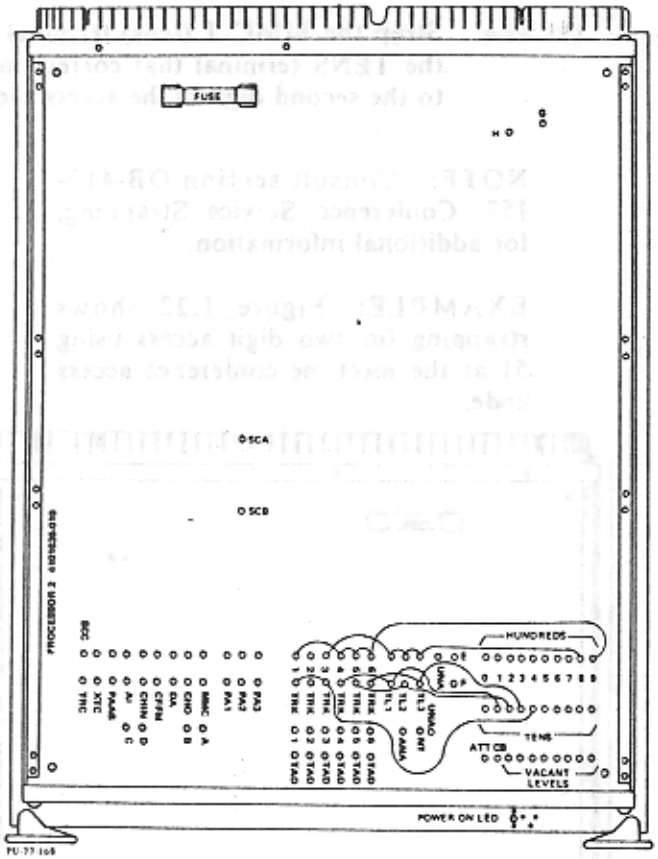

FIGURE 1.19 Two Digit Trunk Access Strapping, Example 2 (TD-4101636-010)

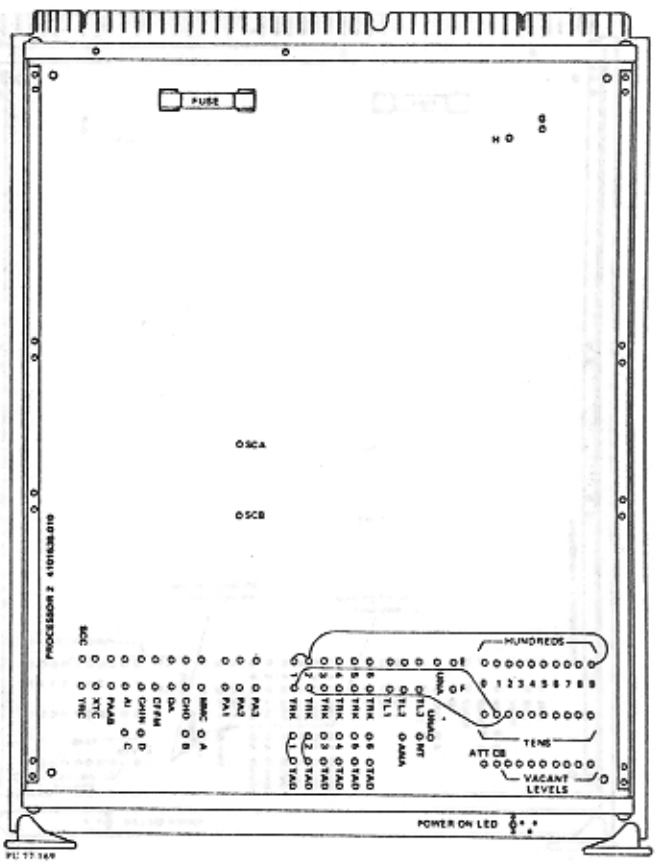

FIGURE 1.20 Deny Access Strapping (TD-4101636-010)

EXAMPLE: Figure 1.20 shows strapping for denying station access to trunk group 1 (access code 91) and trunk group 2 (access code 92).

NOTE: For additional information, refer to sections OB-410-153, CO Trunk Strapping; OB-410-164, Loop Tie Trunk Strapping; and OB-410-172, E & M Tie Trunk Strapping.

3.05 Night Answer. (Refer to figure 1.21.) Perform the strapping in paragraph a, b, or c to arrange for ANA (assigned night answer), UNA (unassigned night answer), or combined UNA/ANA service.

a. ANA strapping. For ANA service, strap terminal ANA to terminal NT.

b. UNA strapping. For UNA service,

1. Strap terminal UNA to terminal NT.
2. Strap the H (hundreds) UNA terminal to the HUNDREDS terminal (0-9) that corresponds to the UNA access code.

c. UNA/ANA strapping. For combined UNA/ANA service,

1. Strap terminal ANA to terminal NT.
2. Strap terminal UNA to terminal NT.
3. Strap the UNA H (hundreds) terminal to the HUNDREDS terminal (0-9) that corresponds to the UNA access code.

NOTE: Refer to section OB-410--155, ANA Strapping, for additional information.

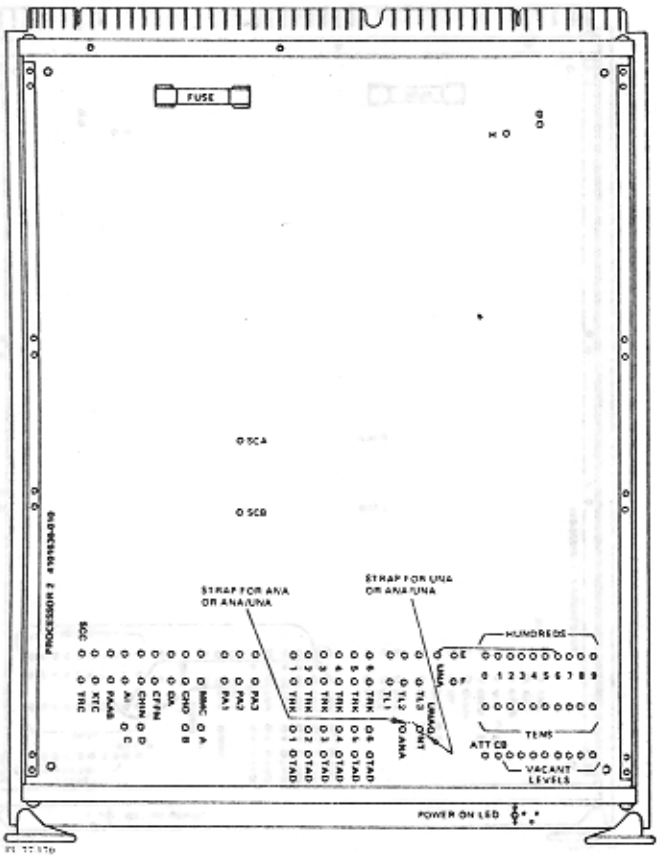

FIGURE 1.21 Night Answer Strapping (TD-4101636-010)

3.06 Meet Me Conference. For the optional meet me conference feature, strap the desired one or two digit meet me conference access code on the processor.

a. Single digit access. For single digit access,

1. Strap the MMC (meet me conference) H (hundreds) and T (tens) terminals together.

2. Strap the MMC H terminal to the HUNDREDS terminal that corresponds to the desired code.

b. Two digits access. For two digit access,

1. Strap the MMC H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.

2. Strap the MMC T (tens) terminal to the TENS terminal that corresponds to the second digit in the access code.

NOTE: Consult section OB-410-157, Conference Service Strapping, for additional information.

EXAMPLE: Figure 1.22 shows strapping for two digit access using 51 as the meet me conference access code.

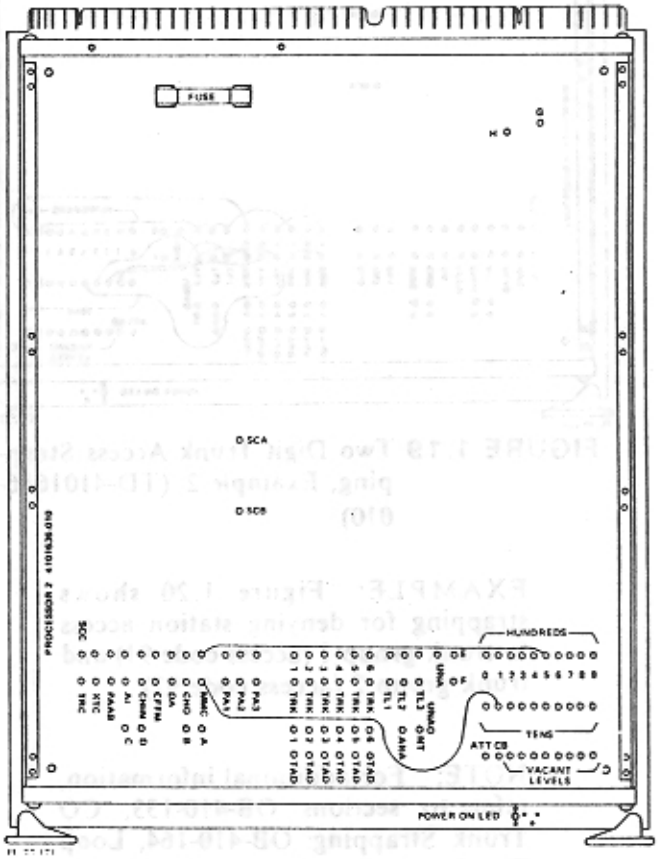

FIGURE 1.22 Meet Me Conference Strapping (TD-4101636-010)

3.07 Dictation Access. For optional dictation access service, strap the desired one or two digit access code on the processor 2 PCB.

a. Single digit access. For single digit access,

1. Strap the DA (dictation access) H (hundreds) and T (tens) terminals together.

2. Strap the DA H terminal to the HUNDREDS terminal that corresponds to the desired access code.

b. Two digit access. For two digit access,

1. Strap the DA H terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.

2. Strap the DA T terminal to the TENS terminal that corresponds to the second digit in the access code.

EXAMPLE: An example of dictation access strapping is shown in figure 1.23. The illustration shows strapping for assigning the two digit access code 73.

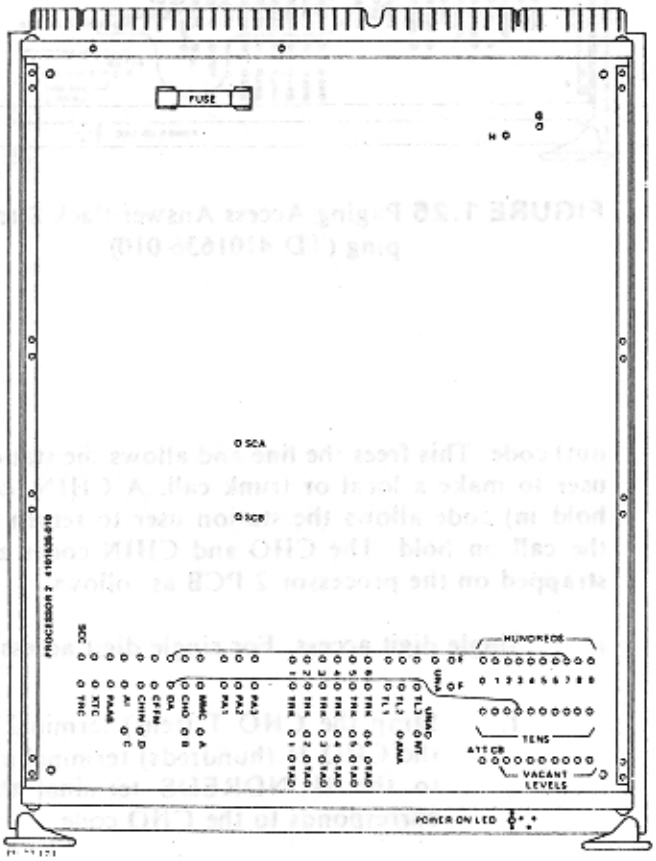

FIGURE 1.23 Dictation Access Strapping (TD-4101636-010)

3.08 Paging Access. When the system is arranged for paging access, the one or two digit paging access code must be strapped on the processor 2 PCB. The paging access code is assigned by strapping the PA1, PA2, and PA3 H (hundreds) and T (tens) terminals to the HUNDREDS and TENS terminals that correspond to the access code.

a. Single digit access. For single digit access,

1. Strap the PA 1, 2, or 3 (paging access 1, 2, or 3) H (hundreds) and corresponding T (tens) terminals together.

2. Strap the PA H 1, 2, or 3 terminal to the HUNDREDS terminal that corresponds to the desired access code.

3. Repeat steps 1 and 2 for each paging zone.

b. Two digit access. For two digit access,

1. Strap the PA H 1, 2, or 3 terminal to the HUNDREDS terminal that corresponds to the first digit in the access code.

2. Strap the corresponding PA T terminal to the TENS terminal that corresponds to the second digit in the access code.

3. Repeat steps 1 and 2 for each paging zone.

An example of strapping for two digit access is shown in figure 1.24. The illustration shows strapping for a system with three paging circuits, where the access codes are 31, 32, and 33. The hundreds digit for all three paging circuits is 3, therefore the PA1, PA2, and PA3 H terminals are multipled and strapped to HUNDREDS terminal 3. The tens digit for the first paging circuit is 1, therefore the PA1 T terminal is strapped to TENS terminal 1. Similarly, the PA2 and PA3 terminals are strapped to TENS terminals 2 and 3, respectively.

3.09 Paging Access Answer Back. For paging access answer back service, the access code must be strapped on the processor 2 PCB.

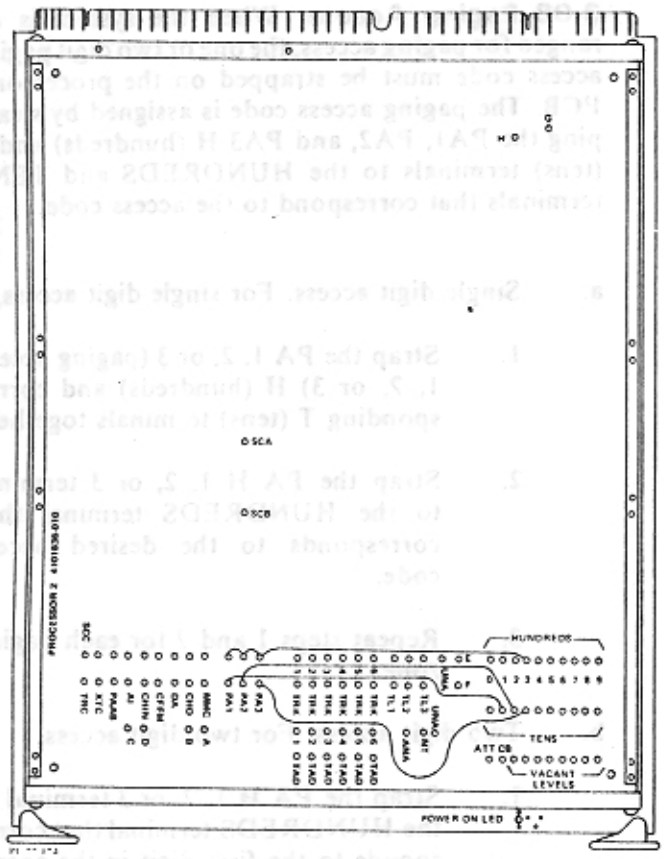

FIGURE 1.24 Paging Access Strapping (TD-4101636-010)

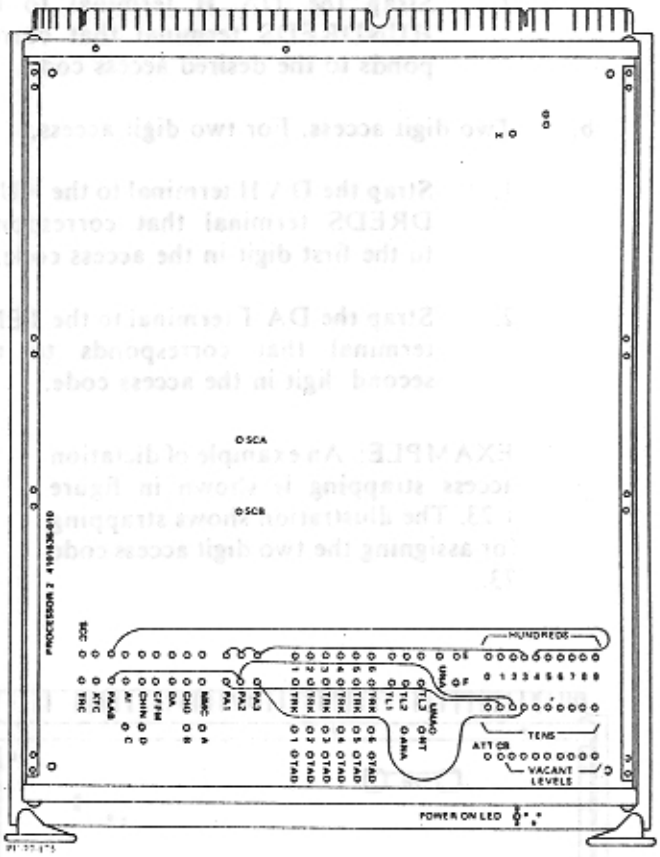

FIGURE 1.25 Paging Access Answer Back Strapping (TD-4101636-010)

a. Strap the PAAB (paging access answer back) H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first of the PAAB access code.

b. Strap the PAAB T (tens) terminal to the TENS terminal that corresponds to the second digit of the PAAB access code.

EXAMPLE: Figure 1.25 illustrates strapping for a system where the PAAB access code is 42.

3.10 Call Hold. The call hold feature allows a station user to place an incoming trunk call on hold by dialing a one or two digit CHO (call hold out) code. This frees the line and allows the station user to make a local or trunk call. A CHIN (call hold in) code allows the station user to return to the call on hold. The CHO and CHIN codes are strapped on the processor 2 PCB as follows.

a. Single digit access. For single digit access,

1. Strap the CHO T (tens) terminal to the CHO H (hundreds) terminal and to the HUNDREDS terminal that corresponds to the CHO code.

2. Strap the CHIN T (tens) terminal to the CHIN H (hundreds) terminal and to the HUNDREDS terminal that corresponds to the CHIN code.

b. Two digit access. For two digit access,

1. Strap the CHO H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the CHO code.

2. Strap the CHO T (tens) terminal to the TENS terminal that corresponds to the second digit in the CHO code.

3. Strap the CHIN H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the CHIN code.

4. Strap the CHIN T (tens) terminal to the TENS terminal that corresponds to the second digit in the CHIN code.

EXAMPLE: Figure 1.26 illustrates call hold strapping for a system using 51 as the CHO code and 52 as the CHIN code.

3.11 CFFM. The access codes for call forward follow me (CFFM) service are strapped on the processor 2 PCB as follows:

a. Strap the CFFM H (hundreds) terminal to the HUNDREDS terminal that corresponds to the first digit in the CFFM access code.

b. Strap the CFFM T (tens) terminal to the TENS terminal that corresponds to the second digit of the CFFM access code.

EXAMPLE: Figure 1.27 illustrates strapping for a system where the CFFM access code is 41.

3.12 Vacant Level. All unassigned HUNDREDS terminals, except terminal 0 and the terminal corresponding to the station hundreds digit, must be strapped to VACANT LEVEL terminals.

Figure 1.28 shows vacant level strapping for HUNDREDS digits 1, 4, 5, and 6.

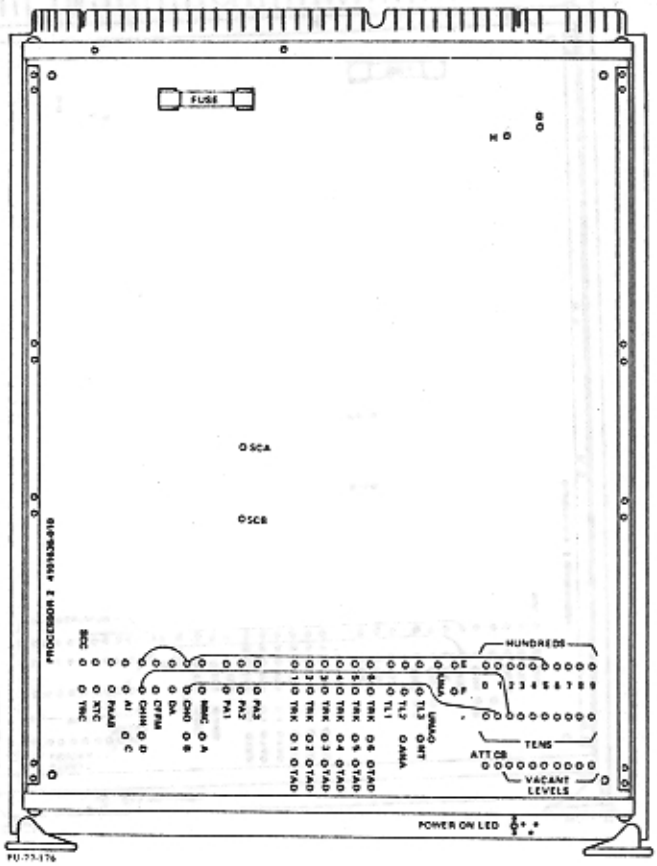

FIGURE 1.26 Call Hold Strapping (TD-4101636-010)

3.13 Intercept. Strapping terminals are provided for routing intercept calls (vacant code, vacant number, or deny trunk group access) to reorder tone. This strapping is not necessary if such calls are to be routed to the attendant. To route intercept calls to reorder tone, strap the AI H (hundreds) terminal to the AI T (tens) terminal as shown in figure 1.29.

3.14 Camp-on Busy Tone. When systems are equipped with 2-way DID trunks (TD-4103266 or TD-4103276), strapping is required to provide camp-on busy tone to those trunks.

a. To provide camp-on busy tone to 2-way DID trunks, strap terminal A to terminal B.

b. If CO trunks (TD-4101536) are also provided, strap terminal C to terminal D.

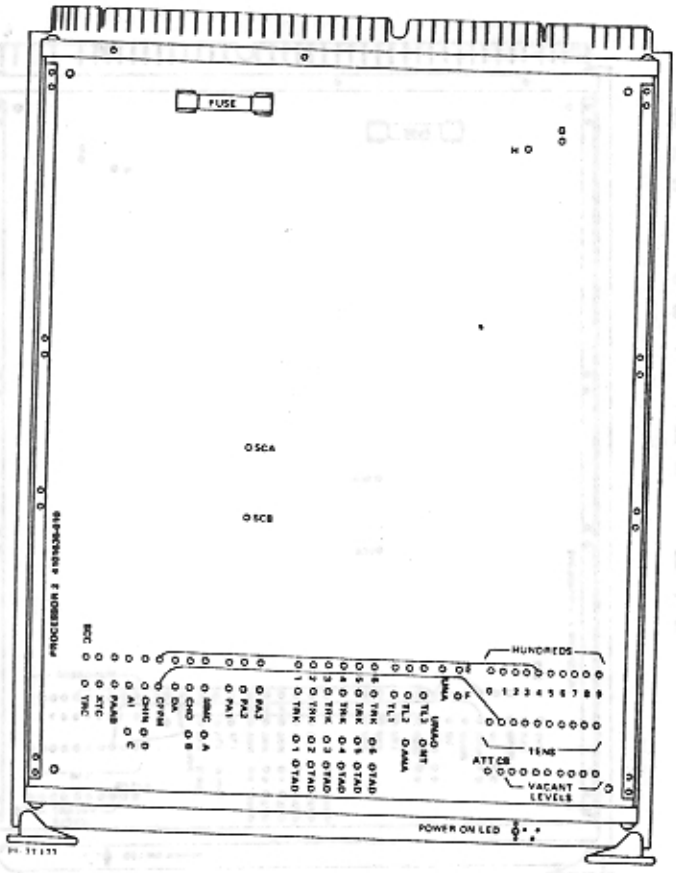

FIGURE 1.27 Call Forward Follow Me Strapping (TD-4101636-010)

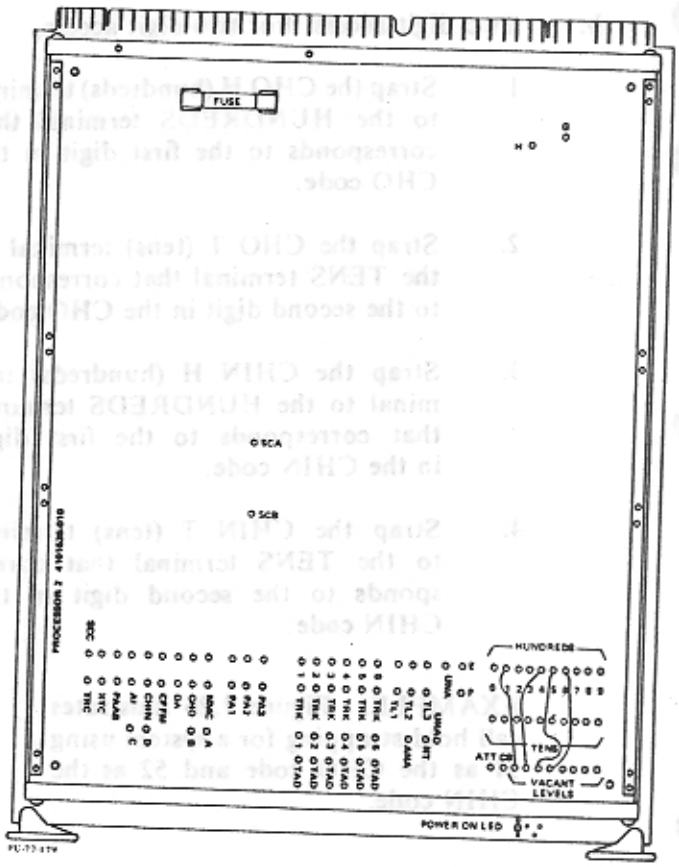

FIGURE 1.28 Vacant Level Strapping (TD-4101636-010)

NOTE: When terminal C is strapped to terminal D, a strap must also be installed on the memory PCB (TD-4101616) from terminal 3 to terminal 4. (See OB-410-161.)

Figure 1.30 shows the strapping required in systems equipped with 2-way DID trunks and CO trunks.

3.15 Unused Terminals. Terminals SCA, SCB, SCC and TRC are reserved for future use and are not strapped at this time.

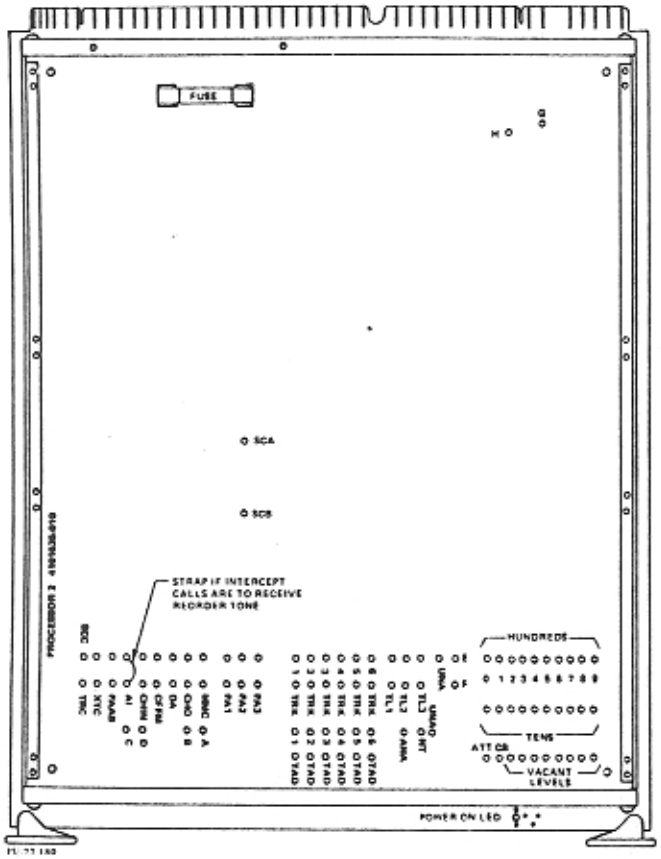

FIGURE 1.29 Intercept Strapping (TD-4101636-010)

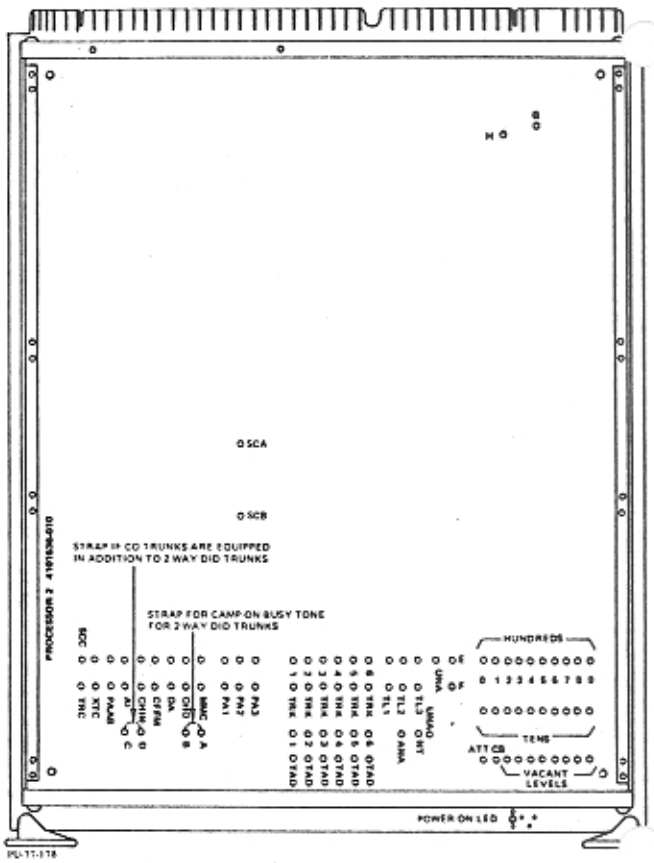

FIGURE 1.30 Camp-on Busy Tone Strapping (TD 4101636-010)

FEATURE STRAPPING
TD-100
LOOP TIE TRUNK (TD-4101646-001, -002, -010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 loop tie trunk TD-4101646. This information is applicable to loop tie trunk PCB's TD-4101646-001, -002, and -010. It should be referred to when strapping a loop tie trunk for a new installation, or when adding or replacing a loop tie trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to loop tie trunk strapping can be found in the following documents.

a. OB-410-160 Class of Service PCB Strapping.

b. OB-410-163 Processor 2 PCB Strapping.

c. OB-410-228 Toll Restrictor PCB Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrap tool, a wire stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. In the standard wired trunk subrack, the loop tie trunk mounts in card positions 15 through 24. In specially wired trunk subracks equipped with trunk motherboard TD-4101506-003 and the memory PCB, TD-4101616-005, it can be optionally mounted in positions 1 through 10 and 15 through 24.

Each loop tie trunk provides strapping terminals for a variety of features. These strapping options are explained in the following paragraphs. Pin locations and straps are shown in the accompanying illustrations.

2.02 Information Required. The following information is required to strap the loop tie trunk.

a. Type of start pulsing signal.

b. Group to which the tie trunk is assigned.

c. Miscellaneous features required.

It should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The chart should show all applicable trunk features. It should be updated any time trunks are replaced, changed, or added to the system.

2.03 Loop Tie Trunk, TD-4101646-001. Perform the following steps, as required, to arrange the generation -001 loop tie trunk to meet local operating requirements. (Refer to figure 1.01.)

TRUNK RECORD CHART
LOOP TIE TRUNK TD-4101646

Incoming Access Digits	71	71	71	71	71	71									7	7	7							
Outgoing Access Digits	71	71	71	71	71	71									73	73	73							
Card Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Loop Signaling	✓	✓	✓	✓	✓	✓																		
Battery & Ground Signaling															✓	✓	✓							
Immediate Start	✓	✓	✓	✓	✓	✓									✓	✓	✓							
Delay Dial																								
Wink Start																								
Trunk Group (1-6)	1	1	1	1	1	1									3	3	3							
Enable Release Timing (8, 16, or 32 seconds)	16	16	16	16	16	16									16	16	16							
Distant Office Release Timing (200, 300, 400, 500, or 600 ms).	500	500	500	500	500	500									300	300	300							
Distant Office Make Busy	✓	✓	✓	✓	✓	✓									✓	✓	✓							
Answer Supervision	✓	✓	✓	✓	✓	✓									✓	✓	✓							
No Answer Supervision																								
Intercept – Attendant																								
Intercept – Busy Tone	✓	✓	✓	✓	✓	✓									✓	✓	✓							
Incoming Calls to Attendant																								
Outgoing Dial																								
2dB Insertion Loss															✓	✓	✓							
Trunk Reservation	✓	✓	✓	✓	✓	✓																		
Attendant Recall	✓	✓	✓	✓	✓	✓																		
Inhibit Attendant Recall																								
600-ohm Termination																								
900-ohm Termination	✓	✓	✓	✓	✓	✓									✓	✓	✓							

PU-77-211

FIGURE 1.00 Typical Trunk Record Chart

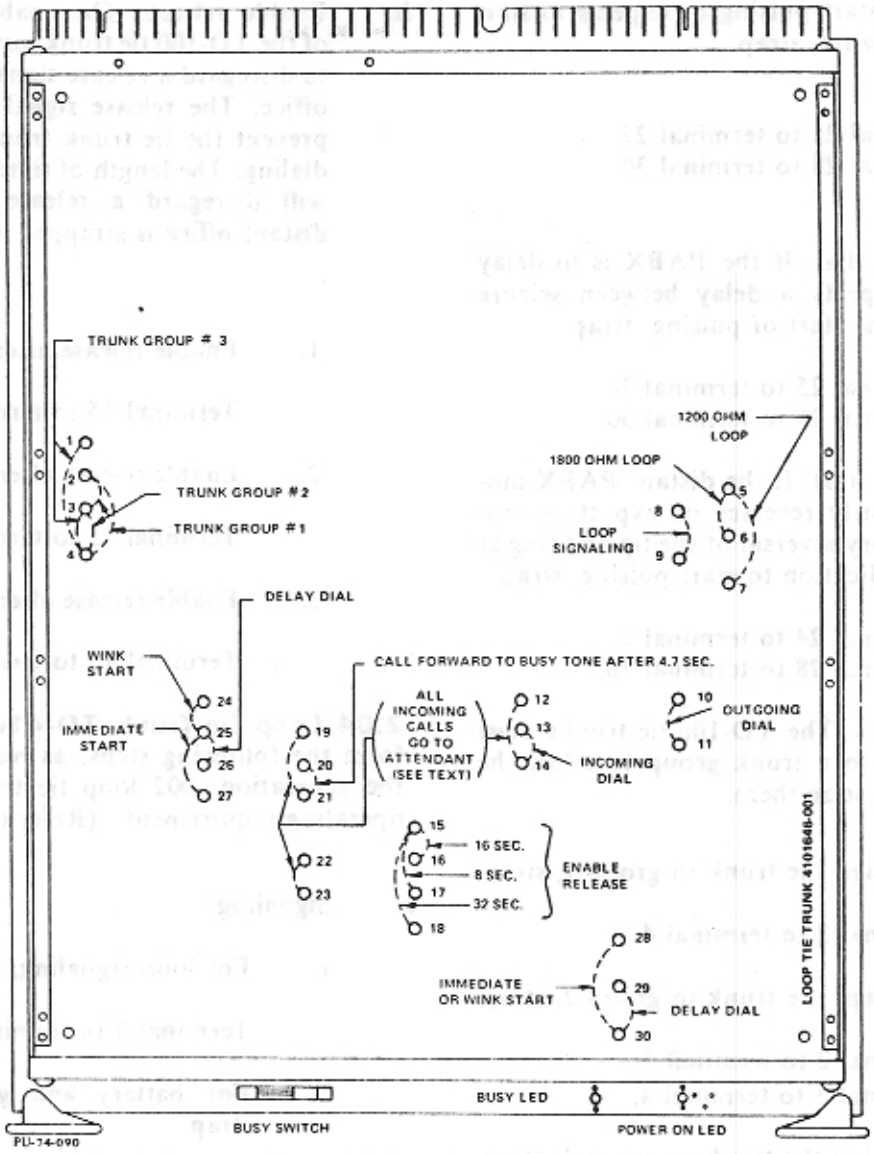

FIGURE 1.01 Loop Tie Trunk Strapping (TD-4101646-001)

a. If all incoming calls are to go directly to the attendant, strap

Terminal 19 to terminal 21
Terminal 22 to terminal 23
Terminal 12 to terminal 14.

b. If incoming tie trunk calls are to have dialing capabilities in the TD-100, strap

Terminal 13 to terminal 14.

c. If, on an incoming call, the tie trunk is not set to a register in 4.7 seconds, the call will go to the attendant. If such a call is to receive busy tone instead, strap

Terminal 20 to terminal 21.

d. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap

Terminal 10 to terminal 11.

e. Type of start pulsing signal.

1. Immediate start. If the distant PABX

is to start pulsing or expects to start on seizure, strap

Terminal 25 to terminal 27
Terminal 28 to terminal 30.

2. Delay dial. If the PABX is to delay or expects a delay between seizure and the start of pulsing, strap

Terminal 25 to terminal 26
Terminal 29 to terminal 30.

3. Wink start. If the distant PABX momentarily reverses or expects a momentary reversal of the tip and ring as an indication to start pulsing, strap

Terminal 24 to terminal 25
Terminal 28 to terminal 30.

f. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor to seize them.

1. To assign the trunk to group 1, strap

Terminal 2 to terminal 4.

2. To assign the trunk to group 2, strap

Terminal 2 to terminal 3
Terminal 3 to terminal 4.

3. To assign the trunk to group 3, strap

Terminal 1 to terminal 4
Terminal 3 to terminal 4.

g. Loop resistance.

1. If the loop resistance for the TD-100 tie trunk is 1200 ohms or less, strap

Terminal 5 to terminal 7.

2. If the loop resistance is more than 1200 ohms but less than 1800 ohms, strap:

Terminal 5 to terminal 6.

h. Enable release. The enable release feature of the TD-100 tie trunk instructs the tie trunk to disregard a release signal from the distant office. The release signal is disregarded to prevent the tie trunk from releasing during dialing. The length of time that the tie trunk will disregard a release signal from the distant office is strapped as follows:

1. Enable release after 8 seconds, strap

Terminal 15 to terminal 17.

2. Enable release after 16 seconds, strap

Terminal 15 to terminal 16.

3. Enable release after 32 seconds, strap

Terminal 15 to terminal 18.

2.04 Loop Tie Trunk, TD-4101646-002. Perform the following steps, as required, to arrange the generation -002 loop tie trunk to meet local operating requirements. (Refer to figure 1.02.)

a. Signaling:

1. For loop signaling, strap

Terminal 9 to terminal 33.

2. For battery and ground signaling, strap

Terminal 8 to terminal 9
Terminal 33 to terminal 50.

b. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor to seize them.

1. To assign the tie trunk to group 1, strap

Terminal 2 to terminal 4.

2. To assign the trunk to group 2, strap

Terminal 2 to terminal 3
Terminal 3 to terminal 4.

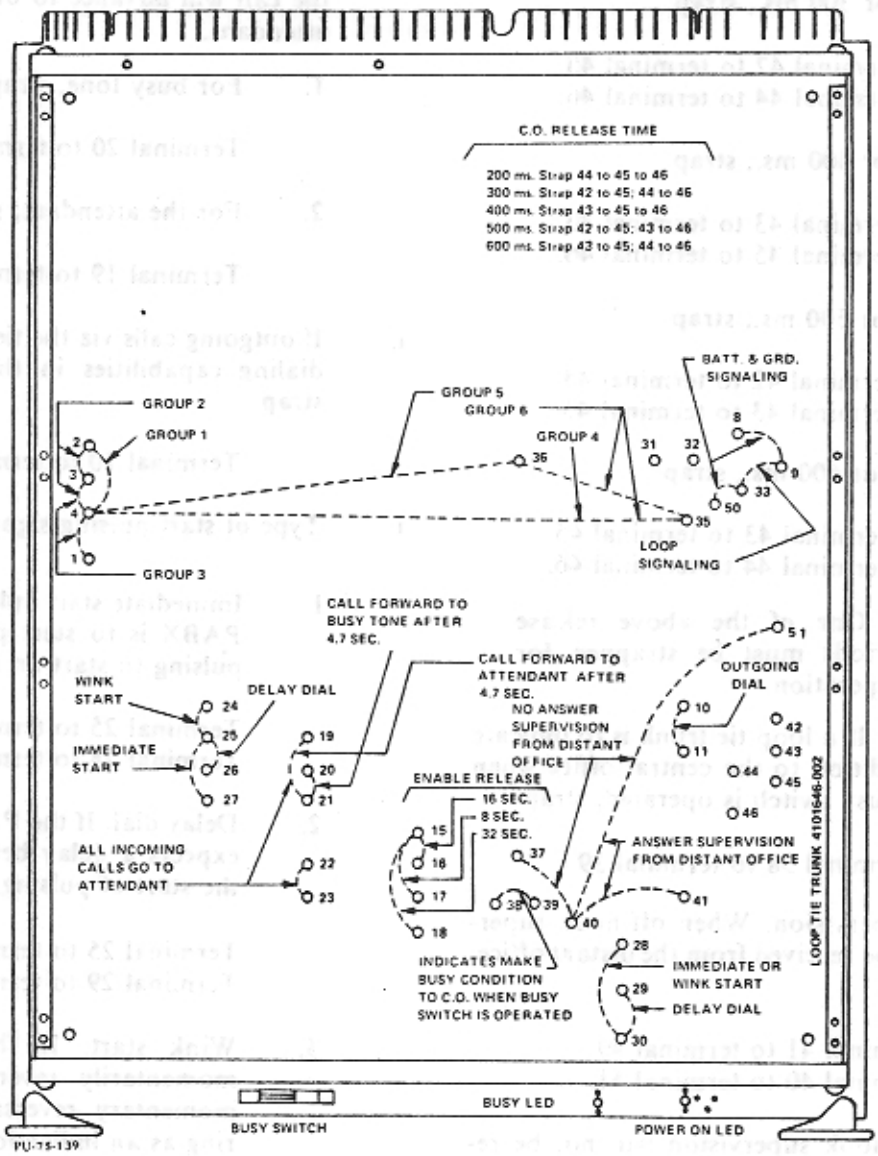

FIGURE 1.02 Loop Tie Trunk Strapping (TD-4101646-002)

3. To assign the trunk to group 3, strap

   Terminal 1 to terminal 4
   Terminal 4 to terminal 3.

4. To assign the trunk to group 4, strap

   Terminal 4 to terminal 35.

5. To assign the trunk to group 5, strap

   Terminal 4 to terminal 36.

6. To assign the trunk to group 6, strap

   Terminal 4 to terminal 35
   Terminal 35 to terminal 36.

c. Release time. When the trunk is to disregard a momentary release signal from the distant office, determine the time period, then strap one of the following:

1. For 200 ms., strap

   Terminal 44 to terminal 45
   Terminal 45 to terminal 46.

2. For 300 ms., strap

   Terminal 42 to terminal 45
   Terminal 44 to terminal 46.

3. For 400 ms., strap

   Terminal 43 to terminal 45
   Terminal 45 to terminal 46.

4. For 500 ms., strap

   Terminal 42 to terminal 45
   Terminal 43 to terminal 46.

5. For 600 ms., strap

   Terminal 43 to terminal 45
   Terminal 44 to terminal 46.

NOTE: One of the above release time periods must be strapped for proper operation.

d. Make busy. If a loop tie trunk is to indicate a busy condition to the central office when the make busy switch is operated, strap

   Terminal 38 to terminal 39.

e. Answer supervision. When off-hook supervision will be received from the distant office, strap

   Terminal 41 to terminal 40
   Terminal 40 to terminal 51.

f. When off-hook supervision will not be received from the distant office, strap

   Terminal 37 to terminal 40
   Terminal 40 to terminal 51.

(When strapped for this feature, the tie trunk will not tandem with CHD or loop start trunks.)

g. If all incoming calls are to go directly to the attendant, strap

   Terminal 19 to terminal 21
   Terminal 22 to terminal 23.

h. Incoming dial. On incoming dial calls, if the tie trunk is not set to a register in 4.7 seconds, the call will advance to busy tone or to the attendant.

1. For busy tone, strap

   Terminal 20 to terminal 21.

2. For the attendant, strap

   Terminal 19 to terminal 21.

i. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap

   Terminal 10 to terminal 11.

j. Type of start pulsing signal.

1. Immediate start pulsing. If the distant PABX is to start pulsing or expects pulsing to start on seizure, strap

   Terminal 25 to terminal 27
   Terminal 28 to terminal 30.

2. Delay dial. If the PABX is to delay or expects a delay between seizure and the start of pulsing, strap

   Terminal 25 to terminal 26
   Terminal 29 to terminal 30.

3. Wink start. If the distant PABX momentarily reverses or expects a momentary reversal of the tip and ring as an indication to start pulsing, strap

   Terminal 24 to terminal 25
   Terminal 28 to terminal 30.

k. Enable release. The enable release feature instructs the tie trunk to disregard a release signal from the distant office. The release signal is disregarded to prevent the tie trunk from releasing during dialing. The length of time that the tie trunk will disregard a release signal from the distant office is strapped as follows:

1. Enable release after 8 seconds, strap

   Terminal 15 to terminal 17.

2. Enable release after 16 seconds, strap

   Terminal 15 to terminal 16.

3. Enable release after 32 seconds, strap

   Terminal 15 to terminal 18.

2.05 Loop Tie Trunk, TD-4101646-010. Perform the following steps, as required, to arrange the generation -010 loop tie trunk to meet local operating requirements. (Refer to figure 1.03.)

a. Signaling:

   1. For loop signaling, strap

      Terminal 9 to terminal 33.

   2. For battery and ground signaling, strap

      Terminal 8 to terminal 9
      Terminal 33 to terminal 50.

b. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor to seize them.

   1. To assign the tie trunk to group 1, strap

      Terminal 2 to terminal 4.

   2. To assign the tie trunk to group 2, strap

      Terminal 2 to terminal 3
      Terminal 3 to terminal 4.

   3. To assign the tie trunk to group 3, strap

      Terminal 1 to terminal 4
      Terminal 4 to terminal 3.

   4. To assign the tie trunk to group 4, strap

      Terminal 4 to terminal 35.

   5. To assign the tie trunk to group 5, strap

      Terminal 4 to terminal 36.

   6. To assign the tie trunk to group 6, strap

      Terminal 4 to terminal 36
      Terminal 35 to terminal 36.

c. Release Time. When the distant office is to disregard a momentary release signal from the trunk, determine the time period, then strap one of the following:

   1. For 200 ms., strap

      Terminal 44 to terminal 45
      Terminal 45 to terminal 40.

   2. For 300 ms., strap

      Terminal 42 to terminal 45
      Terminal 44 to terminal 40.

   3. For 400 ms., strap

      Terminal 43 to terminal 45
      Terminal 45 to terminal 40.

   4. For 500 ms., strap

      Terminal 42 to terminal 45
      Terminal 43 to terminal 40.

   5. For 600 ms., strap

      Terminal 43 to terminal 45
      Terminal 44 to terminal 40.

   NOTE: One of the above release time periods must be strapped for proper operation.

d. Make busy. If a loop tie trunk is to indicate a busy condition to the central office when the make busy switch is operated, strap

   Terminal 38 to terminal 39.

e. Answer Supervision. When off-hook supervision will be received from the distant office, strap

   Terminal 46 to terminal 41
   Terminal 46 to terminal 51.

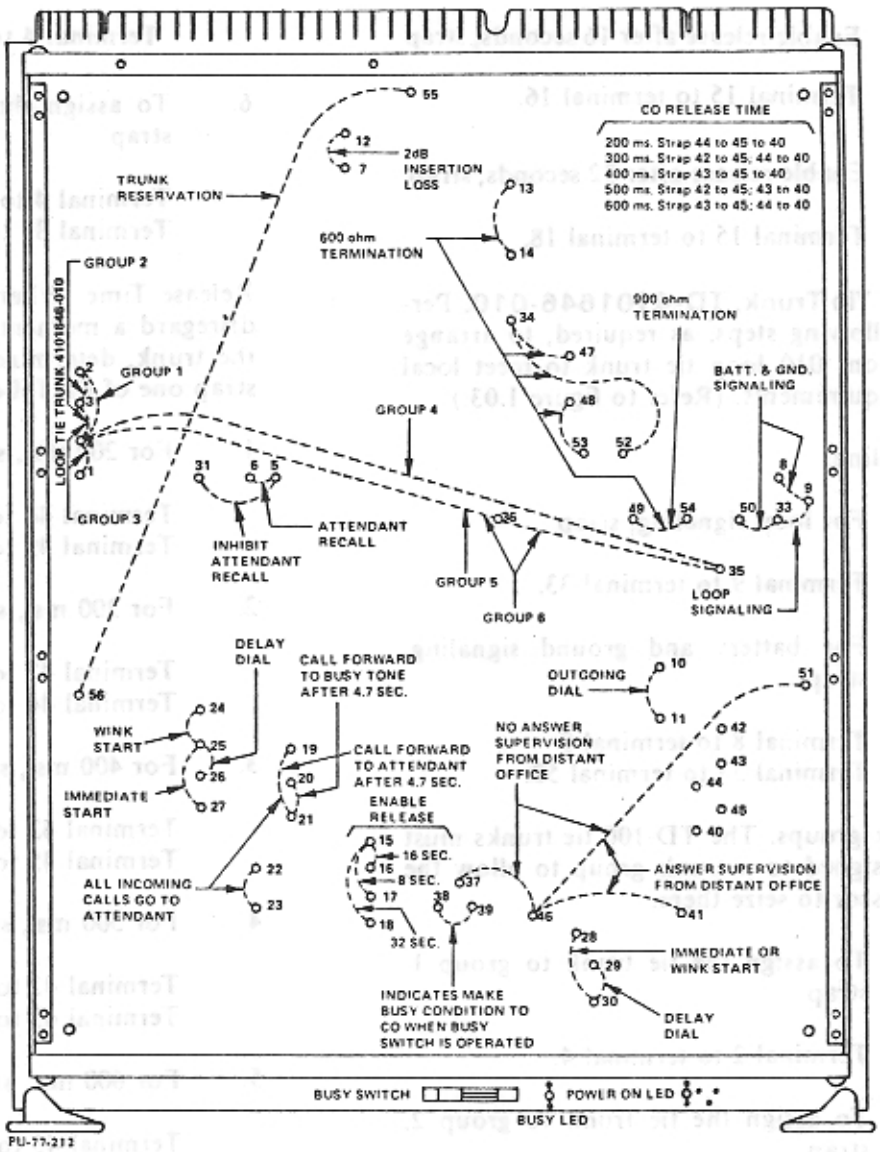

FIGURE 1.03 Loop Tie Trunk Strapping (TD-4101646-010)

f. When off-hook supervision will not be received from the distant office, strap

Terminal 37 to terminal 46
Terminal 46 to terminal 51.

(When strapped for this feature, the tie trunk will not tandem with CHD or loop start trunks.)

g. If all incoming calls are to go directly to the attendant, strap

Terminal 19 to terminal 21
Terminal 22 to terminal 23.

h. Incoming dial. On incoming dial calls, if the tie trunk is not set to a register in 4.7 seconds, the call will advance to busy tone or to the attendant.

1. For busy tone, strap

Terminal 20 to terminal 21.

2. For the attendant, strap

Terminal 19 to terminal 21.

i. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap

Terminal 10 to terminal 11.

j. Type of start pulsing signal.

1. Immediate start pulsing. If the distant PABX is to start pulsing or expects pulsing to start on seizure, strap

Terminal 25 to terminal 27
Terminal 28 to terminal 30.

2. Delay dial. If the PABX is to delay or expects a delay between seizure and the start of pulsing, strap

Terminal 25 to terminal 26
Terminal 29 to terminal 30.

3. Wink start. If the distant PABX momentarily reverses or expects a momentary reversal of the tip and ring as an indication to start pulsing, strap

Terminal 24 to terminal 25
Terminal 28 to terminal 30.

k. Enable release. The enable release feature instructs the tie trunk to disregard a release signal from the distant office. The release signal is disregarded to prevent the tie trunk from releasing during dialing. The length of time that the tie trunk will disregard a release signal from the distant office is strapped as follows:

1. Enable release after 8 seconds, strap

Terminal 15 to terminal 17.

2. Enable release after 16 seconds, strap

Terminal 15 to terminal 16.

3. Enable release after 32 seconds, strap

Terminal 15 to terminal 18.

l. 2 dB insertion loss. To provide 2 dB insertion loss on a tandem call connecting to an outgoing central office trunk or tie trunk, strap

Terminal 7 to terminal 12.

m. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap

Terminal 55 to terminal 56.

n. Attendant recall allows the station user to recall the attendant.

1. To allow attendant recall, strap

Terminal 5 to terminal 6.

2. To inhibit attendant recall, strap

Terminal 5 to terminal 31.

o. To provide 600-ohm termination, strap

Terminal 13 to terminal 14
Terminal 34 to terminal 47
Terminal 34 to terminal 52
Terminal 48 to terminal 53
Terminal 49 to terminal 54.

p. To provide 900-ohm termination, strap

Terminal 49 to terminal 54.

FEATURE STRAPPING
TD-100
STATION HUNT PCB 4101656 (-002,-004,-010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the feature strapping for the TD-100 station hunt printed circuit board (PCB) TD-4101656-002, -003, -004, and -010. It should be referred to when strapping an E&M tie trunk for a new installation, or when adding or replacing a station hunt PCB in a working system.

1.02 Tools and Equipment. The tools and equipment required to strap the station hunt PCB is a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG insulated wire (tinned).

2.00 STRAPPING

2.01 General. The station hunt PCB provides the strapping fields for implementation of the station hunting feature. The station hunting feature enables a call to be routed to an idle station line in a prearrangd hunt group when a busy master station line is dialed. The master-slave principle is used, with one station assigned as the master (to start the hunting sequence) in each group and the remaining stations in the group being slaves.

The TD-100 EPABX is arranged to accommodate up to two station hunt PCB's. They are mounted in card positions 4 and/or 5 of the channel subrack. Each station hunt PCB can be strapped to provide:

a. A maximum of eight hunt groups with a master and three slave station lines in each group.

b. A single hunt group with a master and 24 (maximum) slave station lines.

c. Any combination within a and b.

2.02 Information Required. Before strapping the station hunt PCB, a strapping chart similar to the one shown in figure 1.00 should be made up. Thereafter, the strapping chart should be revised to include all changes.

2.03 Terminal Arrangement. Arrangement of the strapping terminals on the station hunt PCB is shown in figures 1.01 through 1.06. The terminals are arranged in two strapping fields, designated A and B.

The A strapping field includes UNITS A 0-9 terminals, TENS A 0-9 terminals, and two vertical groups of terminals designated TENS and UNITS, which serve as the master, slave, and last assign-

STATION HUNT RECORD CHART

HUNT GROUP	MASTER STATION	SLAVE STATIONS	LAST SLAVE STATION	ASSIGNMENT TERMINAL
1	00			M1
1		01		S1-1
1		23		S1-2
1			58	L1
2	02			M2
2		03		S2-1
2		04		S2-2
2				L2
2		05		M3
2		06		S3-1
2		07		S3-2
2			08	L3

PU-77-047

FIGURE 1.00 Typical Station Hunt Record Chart

ment terminals. These assignment terminals are arranged to form eight hunt groups, each having one master station and up to three slave stations. Where larger groups are required, these groups can be interconnected to form the required size group.

The B strapping field includes UNITS 0-9, TENS 0-9, and two vertical groups of terminals designated UNITS B and TENS B. The UNITS and TENS terminals are strapped to the UNITS B and TENS B terminals to identify stations assigned as slave and last stations.

Terminals N1 and N2 are for use in systems arranged for assigned night answer (ANA) service. When a system is so arranged, and a station assigned as a master hunt station is also an ANA station, terminal N1 is strapped to N2 to prevent hunting during night answer operation when the master station is busy.

2.04 Procedure for Strapping TD4101656-002 PCB. Examples of station hunt strapping for the TD-4101656-002 PCB is described in the following paragraphs and illustrated in figures 1.01 through 1.03.

> NOTE: Although the terminal arrangement for the TD-4101656-002 is the same as for -003, -004, and -010 PCB's, schematic differences dictate that the -002 be strapped differently when a hunt group is comprised of five or more stations.

a. Figure 1.01 shows the strapping for one hunt group with four stations. In this example, the master station is 00; stations 14 and 29 are the first and second slaves; and station 01 is the last station in the hunting group.

b. Figure 1.02 shows the strapping for the station hunt arrangement listed in the typical station hunt record chart (figure 1.00). In this example there are two hunt groups. The first group includes four

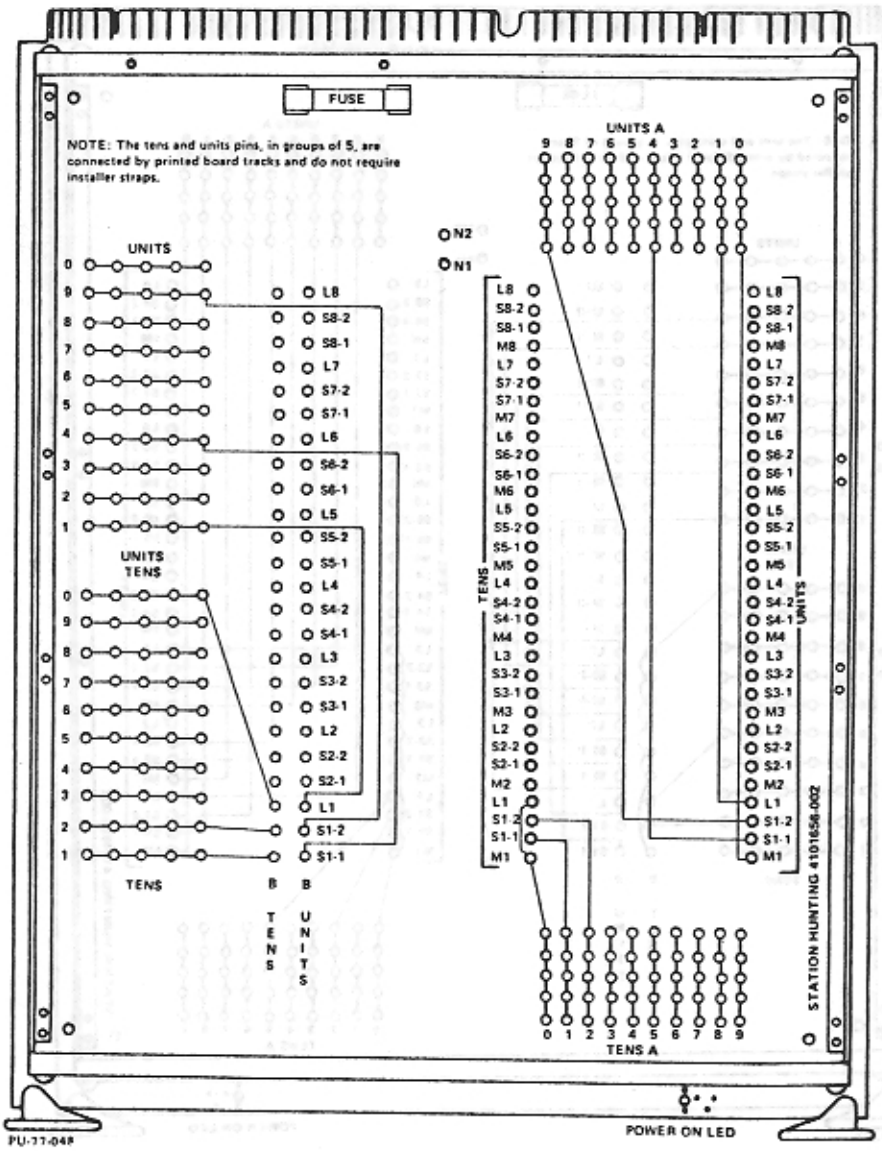


FIGURE 1.01 Station Hunt Strapping (4101656-002)

stations, the master station is 00, the slave stations are 01 and 23, and the last station is 58. The second hunt group includes seven stations, master station 02, slave stations 03 through 07, and last station 08.

c. Figure 1.03 shows the strapping for one hunt group of 24 stations. In this example, the master station is 40, the slave stations are 00 through 22, and 23 is the last station in the hunt group. Master station 40 is also an ANA station, therefore, to prevent station hunting during the night answer mode of operation when the master station is busy, terminal N1 is strapped to terminal N2.

2.05 Procedure for Strapping TD-4101656-003/-004/-010 PCB's. Examples of station hunt PCB strapping for TD-4101656-003/-004/-010 PCB's are described in the following paragraphs and illustrated in figures 1.04 through 1.06. As indicated in the following text, strapping for PCB generations -003 and -004 is the same as described for the -010 PCB.

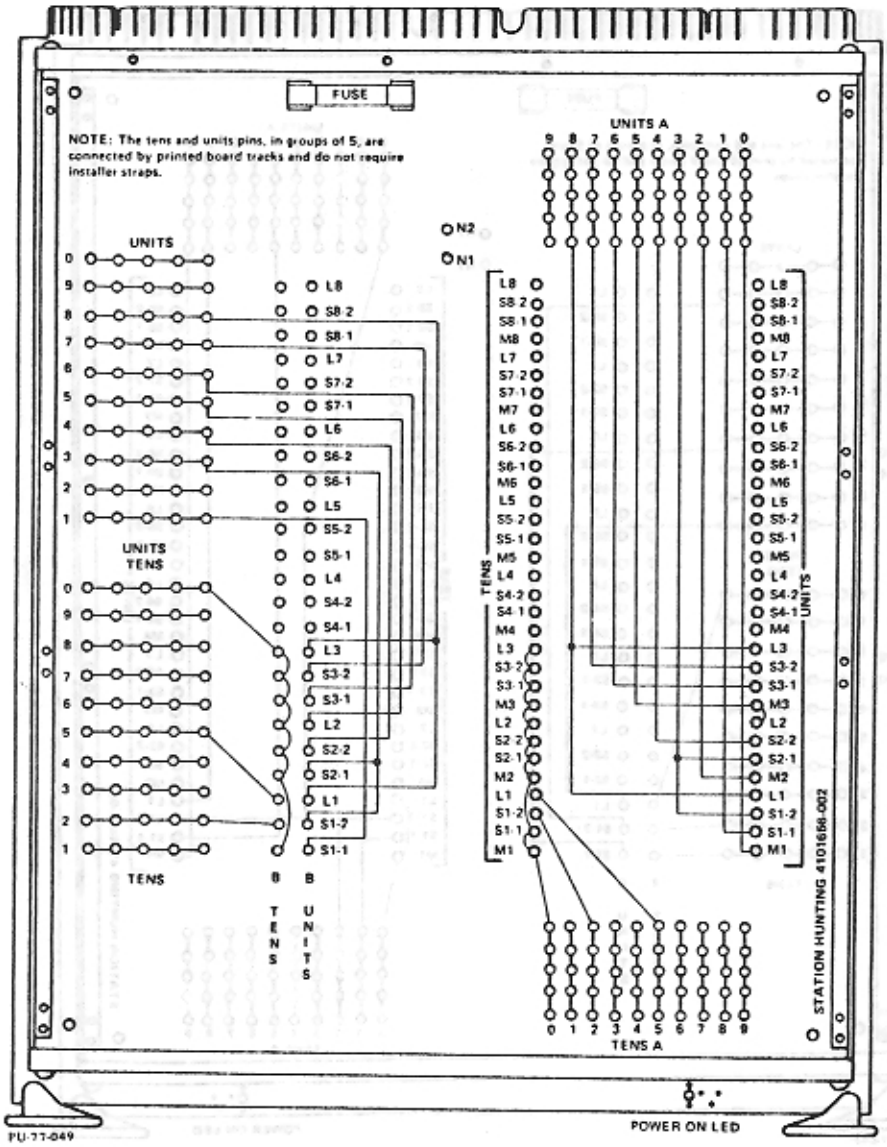


FIGURE 1.02 Two Hunt Groups (4101656-002)

a. Figure 1.04 shows the strapping for the station hunt arrangement listed in the station hunt record chart (figure 1.00). In this example there are two hunt groups. The first group includes four stations, the master station is 00, the slave stations are 01 and 23, and the last station is 58. The second hunt group includes seven stations, master station 02, slave stations 03 through 07, and last station 08.

b. Figure 1.05 is an example of strapping for one hunt group of 24 stations. In this example, the master station is 40, the slave stations are 00 through 22, and 23 is the last station in the hunt group. Master station 40 is also an ANA station, therefore, to prevent ANA calls during the night service mode of operation from hunting off of the master station, terminals N1 and N2 are strapped.

c. Figure 1.06 is an example of strapping the station hunt PCB for hunt groups of less than four stations. The terminals associated with hunt group 1 are strapped

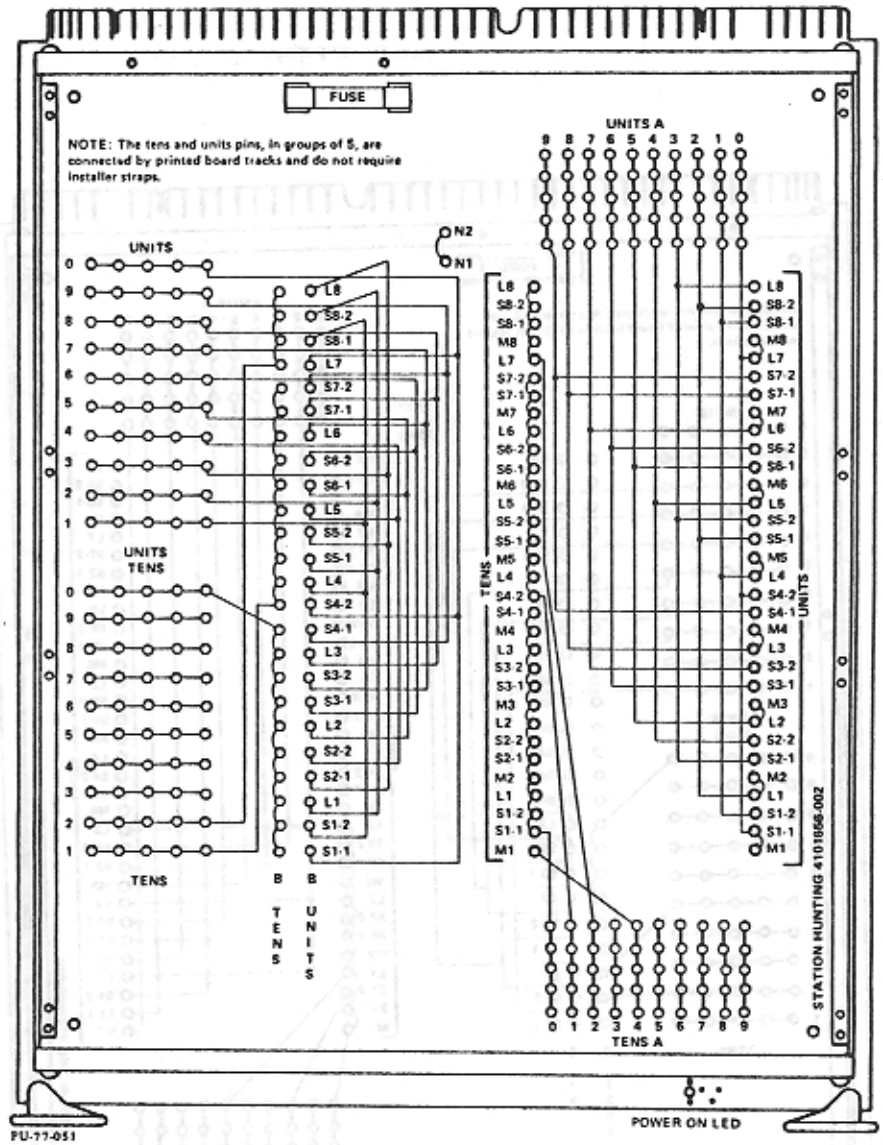


FIGURE 1.03 24 Station Hunt Groups (4101656-002)

for a two station group (stations 00 and 01); the terminal associated with hunt group 6 are strapped for a three station hunt group (stations 24, 25, and 26).

In addition to figures 1.04 through 1.06, examples 1 through 6 are presented to further illustrate strapping for TD-4101656-003, -004, and -010 station hunt PCB's.

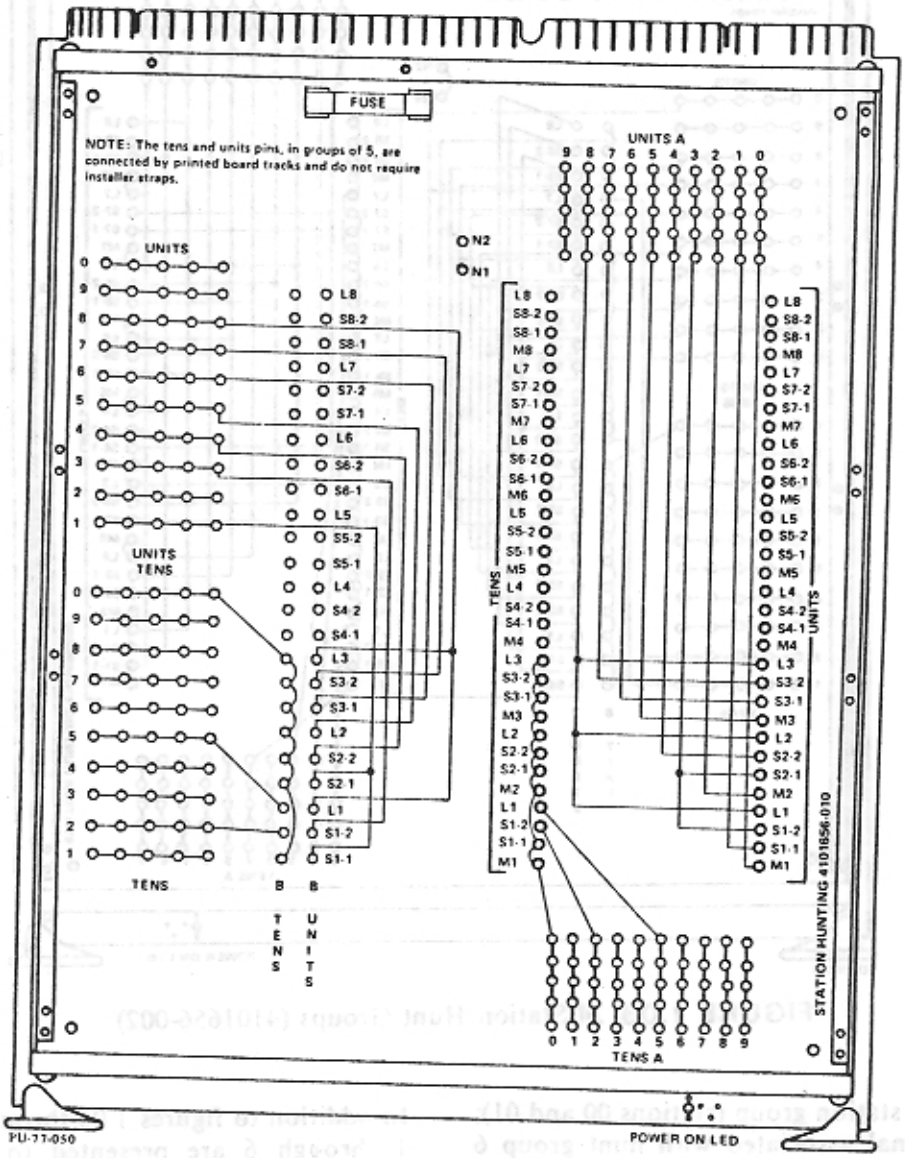


FIGURE 1.04 Two Hunt Groups (4101656-003/-004/-010)

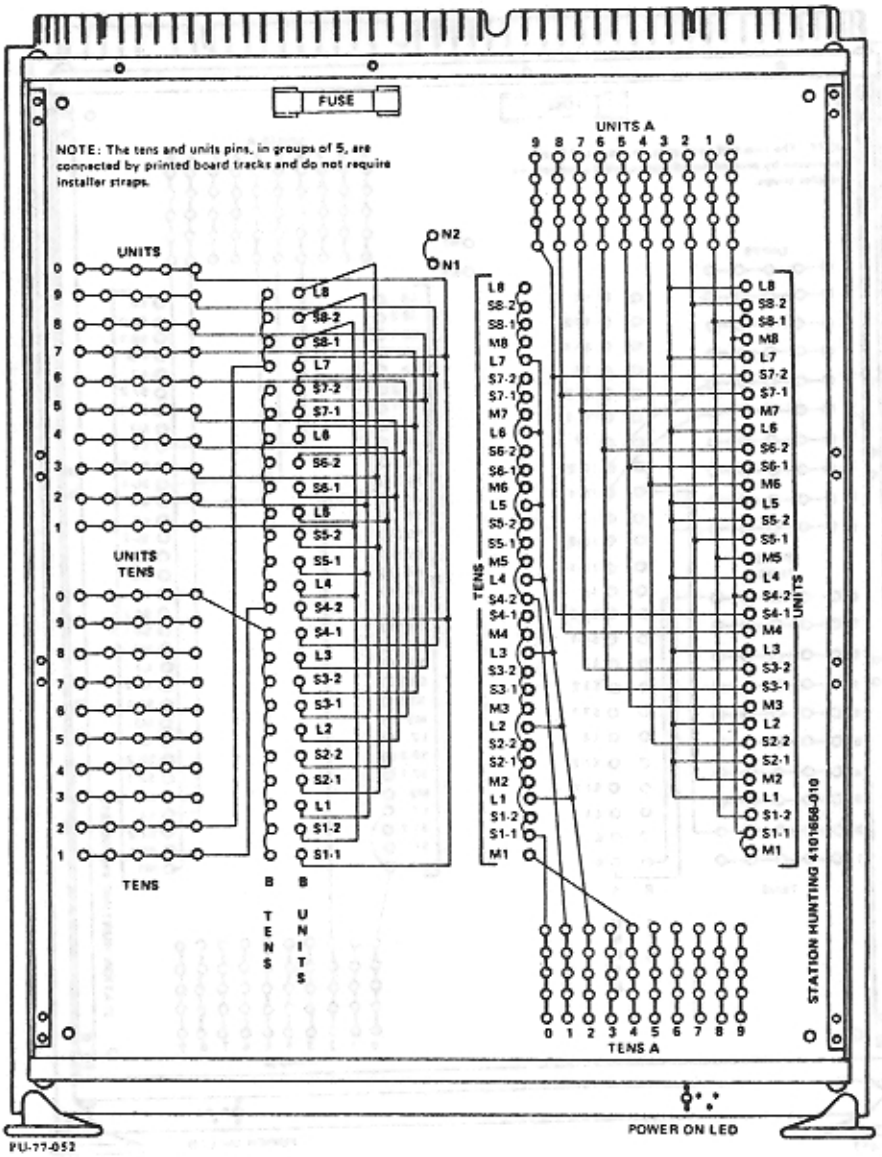


FIGURE 1.05 24 Station Hunt Group (4101656-003/-004/-010)

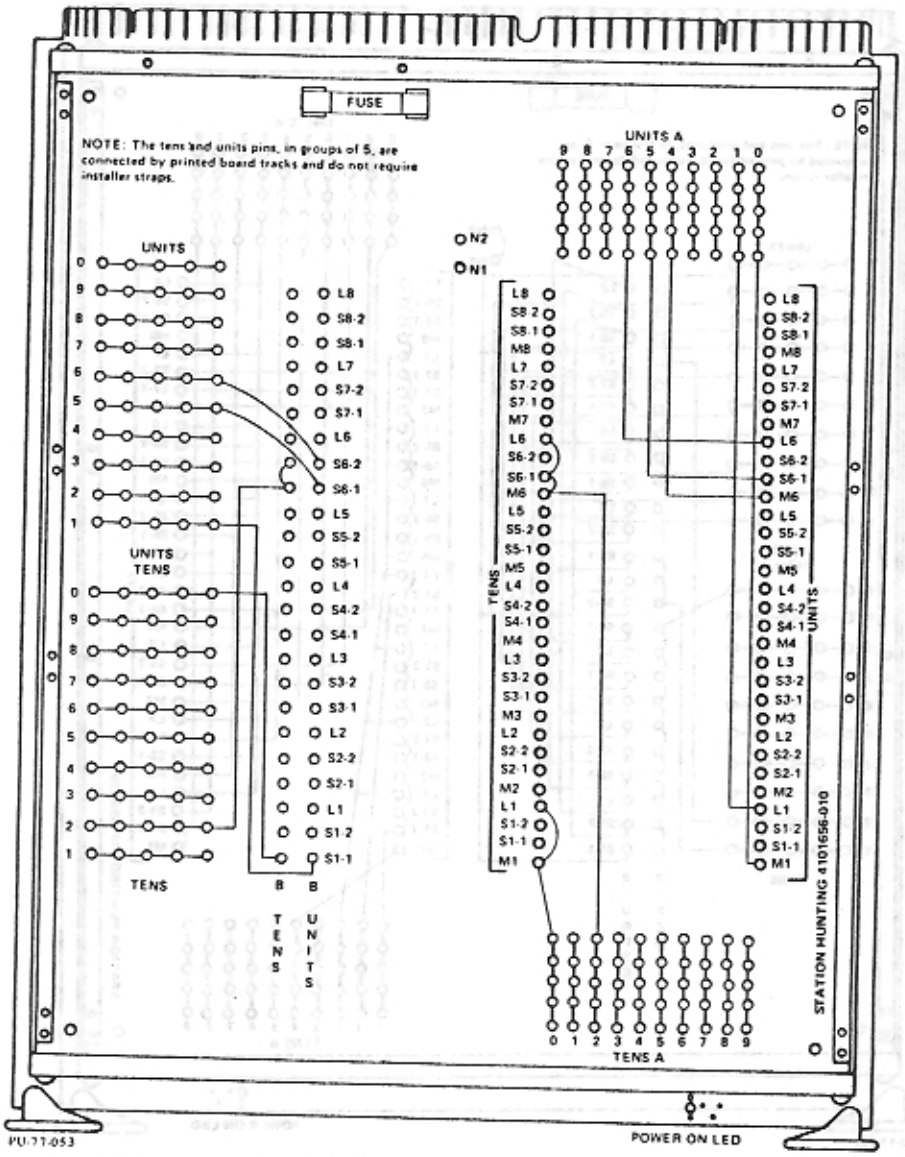
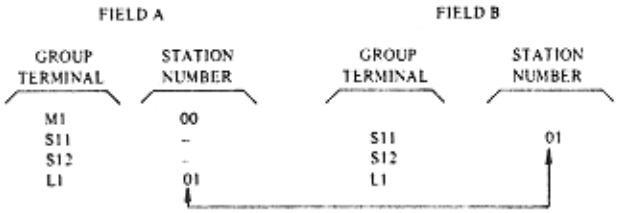
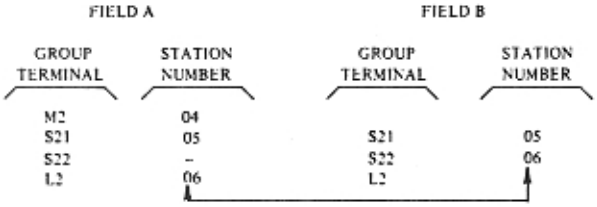


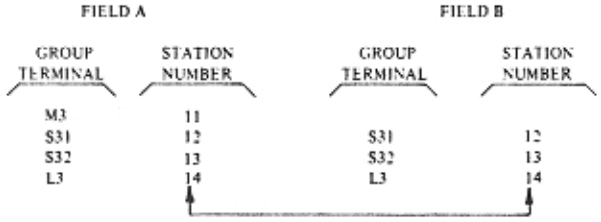
FIGURE 1.06 Partial Hunt Groups (4101656-003/-004/-010)



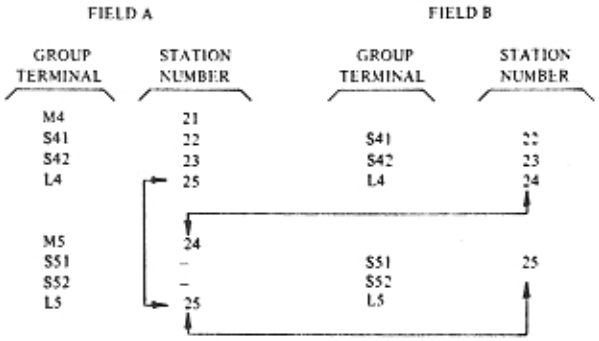
EXAMPLE 1. Two-station Hunt Group (Station 00/01)



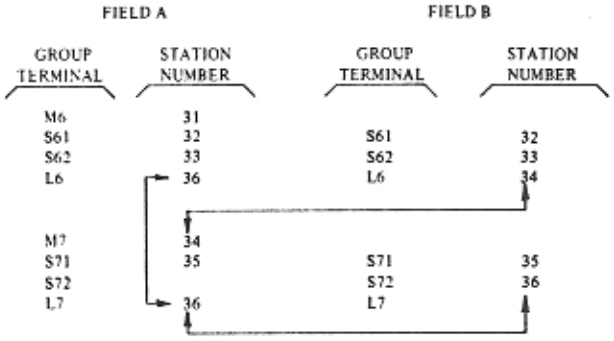
EXAMPLE 2. Three-station Hunt Group (Station 04/06)



EXAMPLE 3. Four-station Hunt Group (Station 11/14)

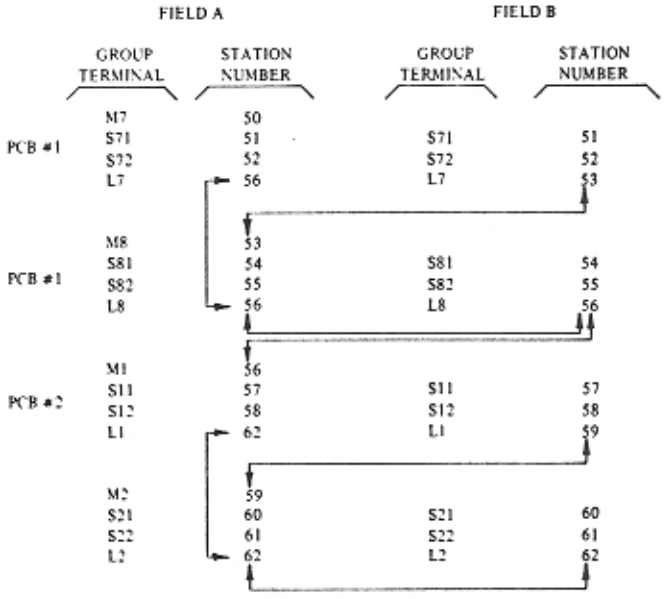


EXAMPLE 4. Five-station Hunt Group (Station 21/25)



EXAMPLE 5. Six-station Hunt Group (Station 31/36)

The following is an example of the strapping required when a hunt group extends one group to another group and from the first station hunting PCB to the second station hunting PCB.



EXAMPLE 6. 13-station Hunt Group (Station 50/62)

FEATURE STRAPPING
TD-100
REGISTER PCB 4101666

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1.01 Register Strapping (4101666-005 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 register PCB, 4101666. This information is applicable to register PCB's 4101666-004 and -005, and TEL TOUCH® register assemblies which use the -004 and -005 register PCB's. This document should be referred to when strapping the register PCB for a new installation, or when adding or replacing a register in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The register PCB mounts in the register 1 through 4 positions (card slots 15 - 18), or the option 1 through 5 positions (card slots 10 - 14) of the channel shelf. Strapping options for this PCB are explained in the following paragraphs. Pin locations and straps are shown in the accompanying illustrations.

2.02 Register PCB 4101666-004. On the generation -004 register PCB, strapping terminals are provided for register timeout. Refer to figure 1.00 and strap these terminals as follows.

a. For 8 second timeout, strap terminal T to terminal T8.

b. For 16 second timeout, strap terminal T to terminal T16

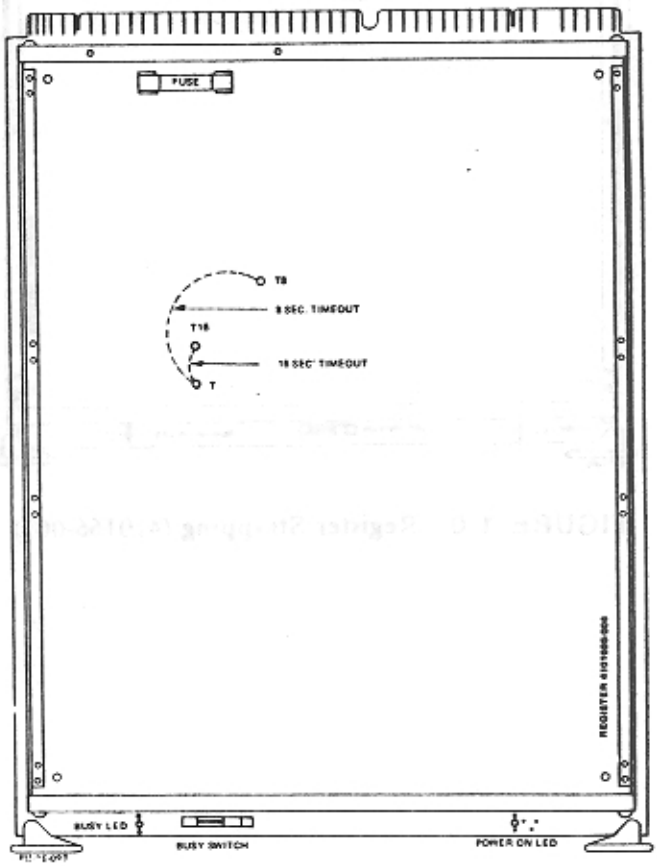

FIGURE 1.00 Register Strapping (4101666-004)

2.03 Register PCB 4101666-005. On the generation -005 register PCB, strapping terminals are provided for register timeout and for checking the hundreds digit of local 3-digit EPABX station numbers. Refer to figure 1.01 and strap these terminals as follows.

a. Register timeout

1. For 8 second timeout, strap terminal T to terminal T8.

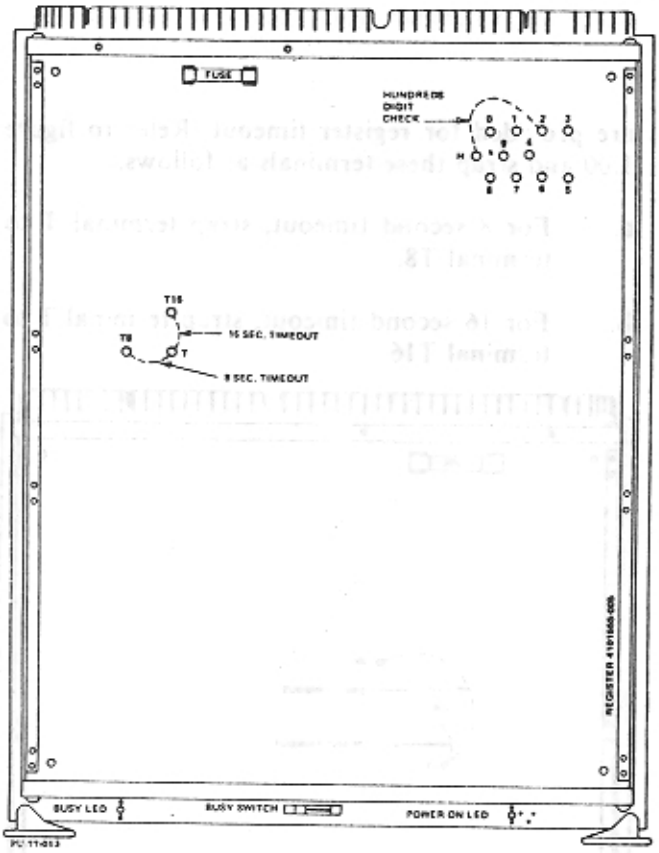

FIGURE 1.01 Register Strapping (410166-005)

2. For 16 second timeout, strap terminal T to terminal T16.

b. Hundreds check digit. The hundreds check digit feature provides pre-translation when three digit numbers are used for TD-100 station numbers. To provide the hundreds check digit feature, strap terminal H to the terminal that corresponds to the hundreds digit of the station numbers. Figure 1.01 shows strapping for a system where the digit "2" is assigned as the station hundreds digit.

NOTE: In systems equipped with a room number translator, where stations are assigned different hundreds digits, the terminals (0 - 9) corresponding to the assigned hundreds digits must all be strapped to terminal H.

EXAMPLE: When 2XX, 3XX, and 4XX are assigned as station numbers, strap terminals 2, 3, and 4 together, then strap terminal 4 to terminal H.

FEATURE STRAPPING
TD-100
LOCAL/CONFERENCE LINKS PCB (TD-4101686-001, -002, -003, -010)

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1.00 Local Links/Conference Links PCB Strapping 1

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 Links PCB. This information is applicable to links PCB's numbered TD-4101686-001, -002, -003 and -010. It should be referred to when strapping a links PCB for a new installation, or when adding or replacing a local or conference links PCB in a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The local/conference links PCB may be used for either application. One strap converts the four links circuits on the board for local or conference link operation. When strapped as a local links PCB, it mounts in positions 19-21 of the channel subrack. When strapped as a conference links PCB, it mounts in position 23 of the channel subrack.

2.02 Procedure. Refer to figure 1.00. If the links are to be used as local links, strap terminal A to terminal C. If the links are to be used as conference links, strap terminal B to terminal C. (Never install straps from both A to C and B to C.)

NOTE: Consult section OB-410-157 for additional information concerning conference strapping.

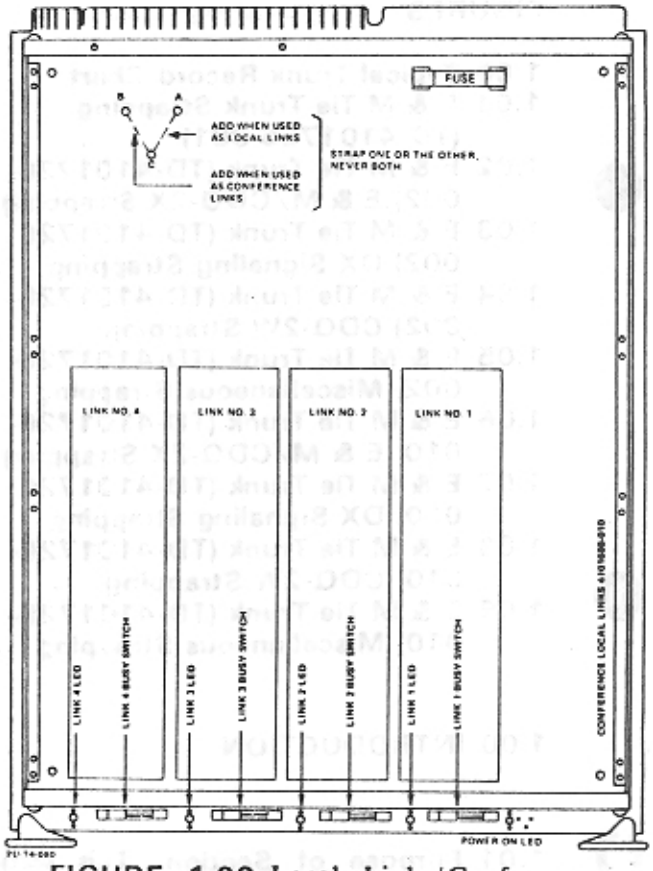

FIGURE 1.00 Local Links/Conference Links PCB Strapping

FEATURE STRAPPING
TD-100
E & M TIE TRUNK (TD-4101726-001, -002, -010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 E & M tie trunk TD-4101726. This strapping is applicable to the E & M tie trunk PCB's 4101726-001, -002, and -010. It should be referred to when strapping an E & M tie trunk for a new installation, or when adding or replacing an E & M tie trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to E & M tie trunk strapping can be found in the following documents.

a. OB-410-160 - Class of Service PCB Strapping.

b. OB-410-163 - Processor II Strapping.

c. OB-410-228 - Toll Restrictor PCB Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply fo 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. In the standard wired trunk shelf, the E & M tie trunks mount in card positions 15 through 24. In specially wired trunk shelves equipped with trunk motherboard 4104506-003, the trunks can optionally be mounted in card positions 1 through 10 and 15 through 24.

Each E & M tie trunk provides strapping terminals for a variety of features. These strapping options are explained in the following paragraphs. Pin locations and straps are shown in the accompanying illustrations.

2.02 Information Required. The following information is required to strap the E & M tie trunk.

a. Type of start pulsing signal.

b. Group to which the tie trunk is assigned.

c. Miscellaneous features required.

It should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The chart should show all applicable trunk features. It should be updated any time trunks are replaced, changed, or added to the system.

2.03 E & M Tie Trunk 4101726-001. Perform the following steps, as required, to arranged the TD-4101726-001 E & M tie trunk to meet local operating requirements. (Refer to figure 1.01).

a. If all incoming calls are to go directly to the attendant, strap:

Terminal 19 to terminal 21.
Terminal 22 to terminal 23.
Terminal 12 to terminal 14.

b. If incoming tie trunk calls are to have dialing capabilities in the TD-100, strap:

Terminal 13 to terminal 14.

c. Intercept. If, on an incoming call, the tie trunk is not set to a register in 4.7 seconds, the call will advance to busy tone or to the attendant, depending upon strapping.

1. If the call is to advance to busy tone, strap:

Terminal 20 to terminal 21.

2. If the call is to be routed to the attendant, strap:

Terminal 19 to terminal 21.

d. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap:

Terminal 10 to terminal 11.

e. Type of start pulsing signal.

1. Immediate start. If the distant PABX is to start pulsing or expects pulsing to start on seizure, strap:

Terminal 25 to terminal 27.
Terminal 28 to terminal 30.

2. Delay dial. If the distant PABX is to delay or expects a delay between seizure and the start of pulsing, strap:

Terminal 25 to terminal 26.
Terminal 29 to terminal 30.

3. Wink start. If the distant PABX momentarily reverses or expects a momentarily reversal of the tip and ring as an indication to start pulsing, strap:

Terminal 24 to terminal 25.
Terminal 28 to terminal 30.

f. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor the seize them.

1. To assign the trunk to group 1, strap:

Terminal 2 to terminal 4.

2. To assign the trunk to group 2, strap:

Terminal 2 to terminal 3.
Terminal 3 to terminal 4.

3. To assign the trunk to group 3, strap:

Terminal 1 to terminal 4.
Terminal 3 to terminal 4.

g. Interface.

1. If the trunk is to interface directly with the signaling equipment (no interconnect device), strap:

Terminal 6 to terminal 7.
Terminal 8 to terminal 9.

2. If the trunk is to operate with a CDQ-2X or CDQ-2W interconnect device, strap:

Terminal 5 to terminal 7.
Terminal 8 to terminal 31.

TRUNK RECORD CHART
E & M TIE TRUNK TD-4101726

Incoming Access Digits	71	71	71			8	8								73 →									
Outgoing Access Digits	71	71	71			72	72								73 →									
Card Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tie Trunk Groups (1-6)	1	1	1			2	2								3	3	3	3	3					
E & M Signaling	✓	✓	✓			✓	✓								✓	✓	✓	✓	✓					
DX Signaling																								
CDQ-2W Operation																								
Incoming to Attendant Only																								
Intercept - Busy Tone	✓	✓	✓			✓	✓								✓	✓	✓	✓	✓					
Intercept - Attendant																								
Outgoing Dial																								
Immediate Start	✓	✓	✓			✓	✓								✓	✓	✓	✓	✓					
Wink Start																								
Delay Dial																								
Distant Office Release Timing (200, 300, 400, 600 ms)	600	600	600			600	600								300	300	300	300	300					
Enable Release Timing (8, 16, or 32 seconds)	16	16	16			16	16								16	16	16	16	16					
Attendant Recall	✓	✓	✓			✓	✓								✓	✓	✓	✓	✓					
Inhibit Attendant Recall																								
Trunk Reservation															✓	✓	✓							
2dB Insertion Loss																								
600-ohm Termination																								
900-ohm Termination	✓	✓	✓			✓	✓								✓	✓	✓	✓	✓					

PU-77-230

FIGURE 1.00 Typical Trunk Record Chart

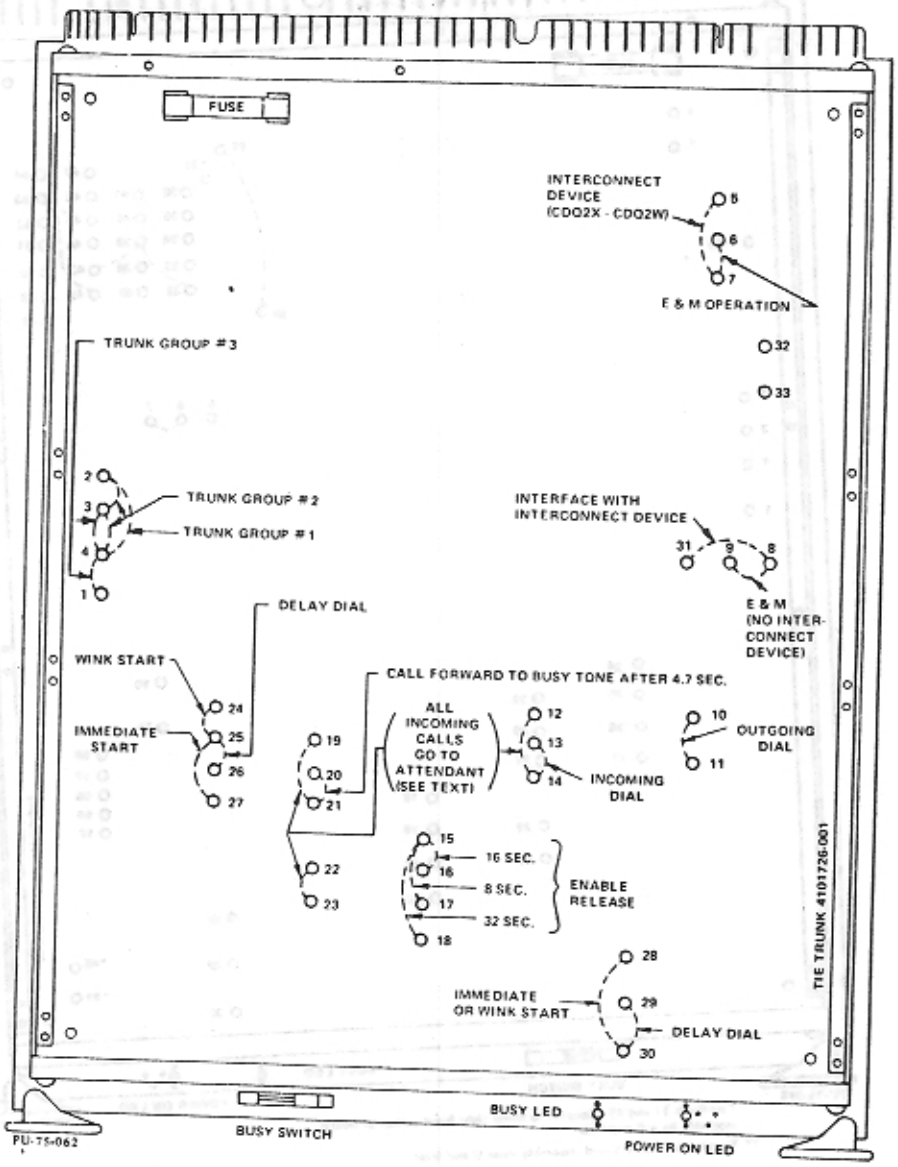


FIGURE 1.01 E & M Tie Trunk Strapping (TD-4101726-001)

h. Enable release. The enable release feature permits the tie trunk to disregard a release signal from the distant office during dialing. Enable release timing is strapped as follows:

1. For release after 8 seconds, strap:

   Terminal 15 to terminal 17.

2. For release after 16 seconds, strap:

   Terminal 15 to terminal 16.

3. For release after 32 seconds, strap:

   Terminal 15 to terminal 18.

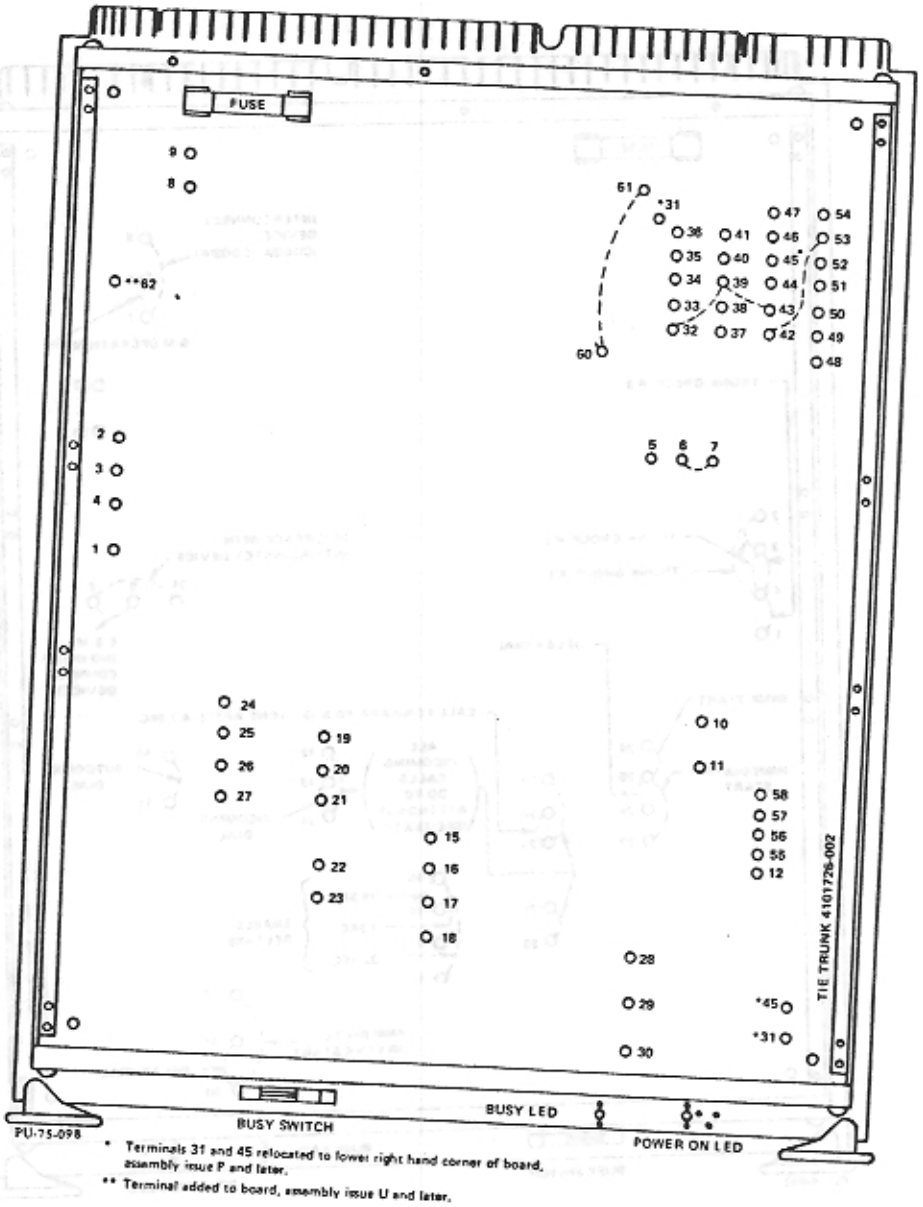


FIGURE 1.02 E & M Tie Trunk (TD-4101726-002) E & M/CDQ-2X Strapping

2.04 E & M Tie Trunk 4101726-002. Perform the following steps as required, to arrange the TD-4101726-002 tie trunk to meet local operating requirements.

a. E & M signaling. (Refer to figure 1.02.)

1. If the trunk is to operate with E & M signaling equipment, or with a CDQ-2X interconnect device, strap:

   Terminal 6 to terminal 7.
   Terminal 32 to terminal 39.
   Terminal 39 to terminal 43.
   Terminal 42 to terminal 53.
   Terminal 60 to terminal 61.

2. If the signaling equipment requires ground on the M lead and battery on the E lead when idle, and battery on the M lead and ground on the E lead

when seized, strap the following in addition to the straps in step 1.

Terminal 35 to terminal 38.
Terminal 38 to terminal 54.
Terminal 40 to terminal 41.
Terminal 46 to terminal 48.
Terminal 51 to terminal 52.

3. If the signaling equipment requires battery on the M lead and an open E lead when idle, and ground on the M lead and battery on the E lead when seized, strap the following in addition to the straps in step 1.

Terminal 35 to terminal 37.
Terminal 37 to terminal 40.
Terminal 41 to terminal 54.
Terminal 46 to terminal 51.
Terminal 48 to terminal 52.

b. DX signaling (Refer to figure 1.03.) If DX signaling capabilities are required, strap:

Terminal 6 to terminal 7.
Terminal 31 to terminal 45.
Terminal 34 to terminal 41.
Terminal 41 to terminal 54.
Terminal 35 to terminal 40.
Terminal 37 to terminal 38.
Terminal 38 to terminal 44.
Terminal 42 to terminal 43.
Terminal 43 to terminal 32.
Terminal 46 to terminal 48.
Terminal 51 to terminal 52.

c. CDQ-2W operation. (Refer to figure 1.04.) If the tie trunk is to operate with a CDQ-2W type interconnect device, strap:

Terminal 5 to terminal 7.
Terminal 32 to terminal 39.
Terminal 36 to terminal 48.

d. Miscellaneous strapping. (Refer to figure 1.05.)

1. If all incoming calls are to go directly to the attendant, strap:

Terminal 19 to terminal 21.
Terminal 22 to terminal 23.

2. Intercept. If, on an incoming call, the tie trunk is not set to a register in 4.7 seconds, the call will advance to busy tone or to the attendant, depending upon strapping.

(a) If the call is to advance to busy tone, strap:

Terminal 20 to terminal 21.

(b) If the call is to be routed to the attendant, strap:

Terminal 19 to terminal 21.

3. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap:

Terminal 10 to terminal 11.

4. Type of start pulsing signal.

(a) Immediate start. If the distant PABX is to start pulsing or expects pulsing to start on seizure, strap:

Terminal 25 to terminal 27.
Terminal 28 to terminal 30.

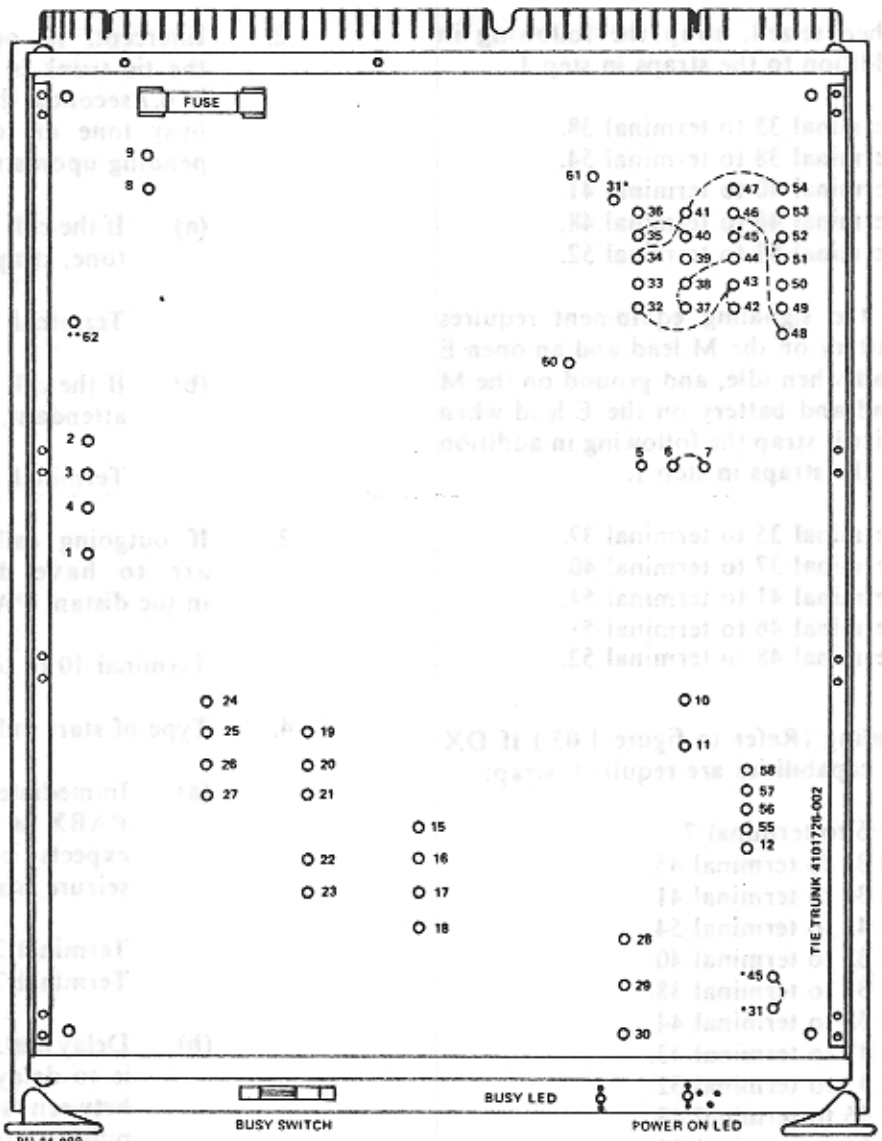
(b) Delay dial. If the distant PABX is to delay or expects a delay between seizure and start of pulsing, strap:

Terminal 25 to terminal 26.
Terminal 29 to terminal 30.

(c) Wink start. If the distant PABX momentarily reverses or expects a momentary reversal of the tip and ring as an indication to start pulsing, strap:

Terminal 24 to terminal 25.
Terminal 28 to terminal 30.

5. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor to seize them.



* Terminals 31 and 45 relocated to lower right hand corner of board, assembly issue P and later.

** Terminal added to board, assembly issue U and later.

FIGURE 1.03 E & M Tie Trunk (TD-4101726-002) DX Signaling Strapping

(a) To assign the trunk to group 1, strap:

Terminal 2 to terminal 4.

(b) To assign the trunk to group 2, strap:

Terminal 2 to terminal 3.
Terminal 3 to terminal 4.

(c) To assign the trunk to group 3, strap:

Terminal 1 to terminal 4.
Terminal 4 to terminal 3.

(d) To assign the trunk to group 4, strap:

Terminal 4 to terminal 8.

(e) To assign the trunk to group 5, strap:

Terminal 4 to terminal 9.

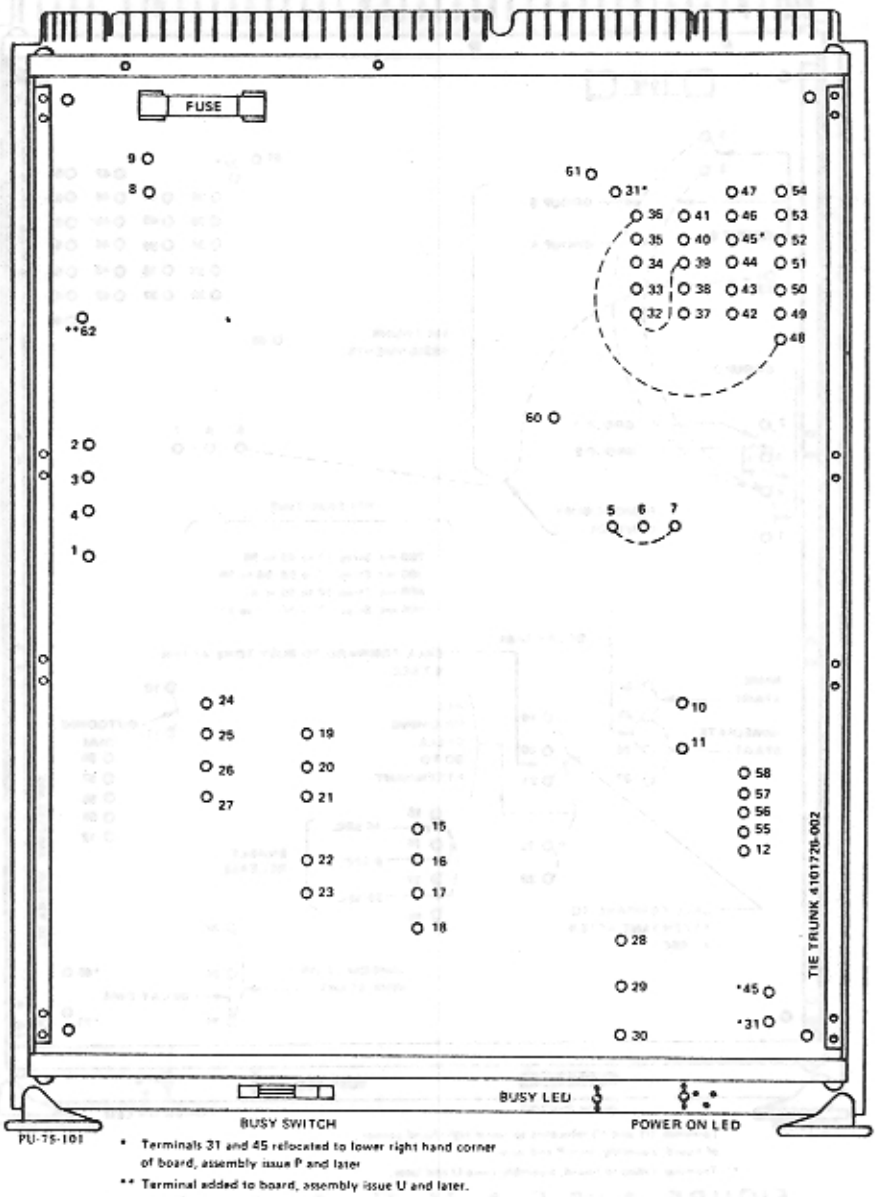


FIGURE 1.04 E & M Tie Trunk (TD-4101726-002) CDQ-2W Strapping

(f) To assign the trunk to group 6, strap:

Terminal 4 to terminal 8.
Terminal 8 to terminal 9.

6. Enable release. The enable release feature permits the tie trunk to disregard a release signal from the distant office during dialing. Enable release timing is strapped as follows:

(a) For release after 8 seconds, strap:

Terminal 15 to terminal 17.

(b) For release after 16 seconds, strap:

Terminal 15 to terminal 16.

(c) For release after 32 seconds, strap:

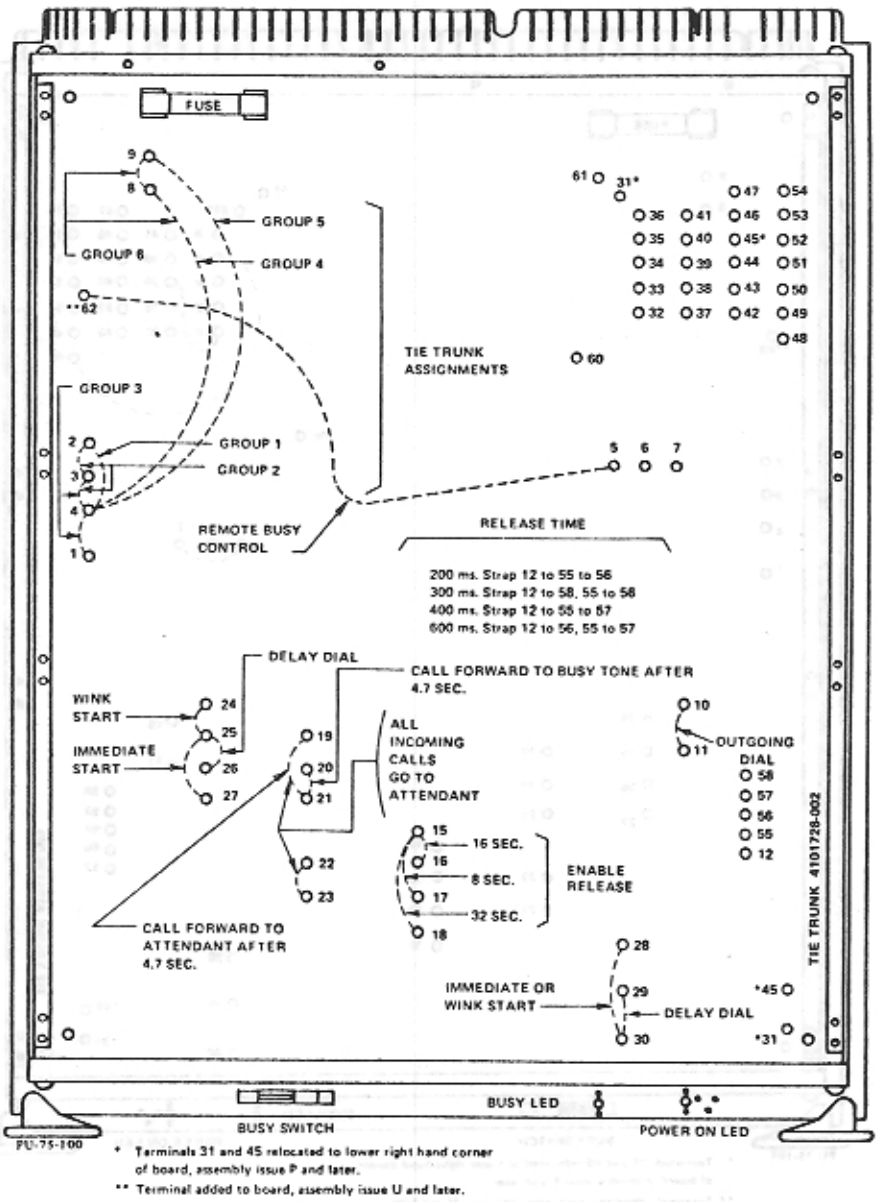


FIGURE 1.05 E & M Tie Trunk (TD-4101726-002) Miscellaneous Strapping

Terminal 15 to terminal 18.

7. Momentary release. To prevent the tie trunk from recognizing any momentary release signal from the distant PABX, determine the timing interval, then strap as follows:

(a) For 200 ms, strap:

Terminal 12 to terminal 55.
Terminal 55 to terminal 56.

(b) For 300 ms, strap:

Terminal 12 to terminal 58.
Terminal 55 to terminal 56.

(c) For 400 ms, strap:

Terminal 12 to terminal 55.
Terminal 55 to terminal 57.

(d) For 600 ms, strap:

Terminal 12 to terminal 56.
Terminal 55 to terminal 57.

NOTE: One of the aforementioned release times be strapped for proper operation.

8. Remote busy control. Remote busy control provides automatic busy to other tie trunks sharing a common signaling and transmission line when one of the trunks seizes the line. For remote busy control, strap:

Terminal 5 to terminal 62.

NOTE: Remote busy control cannot be provided when tie trunks operate in conjunction with an interconnect device.

2.05 E & M Tie Trunk 4101726-010. Perform the following steps as required, to arrange the TD-4101726-010 tie trunk to meet local operating requirements.

a. E & M signaling. (Refer to figure 1.06.)

1. If the trunk is to operate with E & M signaling equipment, or with a CDQ-2X interconnect device, strap:

Terminal 6 to terminal 7.
Terminal 32 to terminal 39.
Terminal 39 to terminal 43.
Terminal 42 to terminal 53.
Terminal 60 to terminal 47.

2. If the signaling equipment requires ground on the M lead and battery on the E lead when idle, and battery on the M lead and ground on the E lead when seized, strap the following in addition to the straps in step 1.

Terminal 35 to terminal 38.
Terminal 38 to terminal 54.
Terminal 40 to terminal 41.
Terminal 46 to terminal 48.
Terminal 51 to terminal 52.

3. If the signaling equipment requires battery on the M lead and an open E lead when idle, and ground on the M lead and battery on the E lead when seized, strap the following in addition to the straps in steps 1.

Terminal 35 to terminal 37.
Terminal 37 to terminal 40.
Terminal 41 to terminal 54.
Terminal 46 to terminal 51.
Terminal 48 to terminal 52.

b. DX signaling. (Refer to figure 1.07.) If DX signaling capabilities are required, strap:

Terminal 6 to terminal 7.
Terminal 31 to terminal 45.
Terminal 34 to terminal 41.
Terminal 41 to terminal 54.
Terminal 35 to terminal 40.
Terminal 37 to terminal 38.
Terminal 38 to terminal 44.
Terminal 42 to terminal 43.
Terminal 43 to terminal 32.
Terminal 46 to terminal 48.
Terminal 51 to terminal 52.

c. CDQ-2W operation. (Refer to figure 1.08.) If the trunk is to operate with a CDQ-2W type interconnect device, strap:

Terminal 5 to terminal 7.
Terminal 32 to terminal 39.
Terminal 36 to terminal 48.

d. Miscellaneous strapping. (Refer to figure 1.09.)

1. If all incoming calls are to go directly to the attendant, strap:

Terminal 19 to terminal 21.
Terminal 22 to terminal 23.

2. Intercept. If, on an incoming call, the tie trunk is not set to a register in 4.7 seconds, the call will advance to busy tone or to the attendant, depending upon strapping.

(a) If the call is to advance to busy tone, strap:

Terminal 20 to terminal 21.

(b) If the call is to be routed to the attendant, strap:

Terminal 19 to terminal 21.

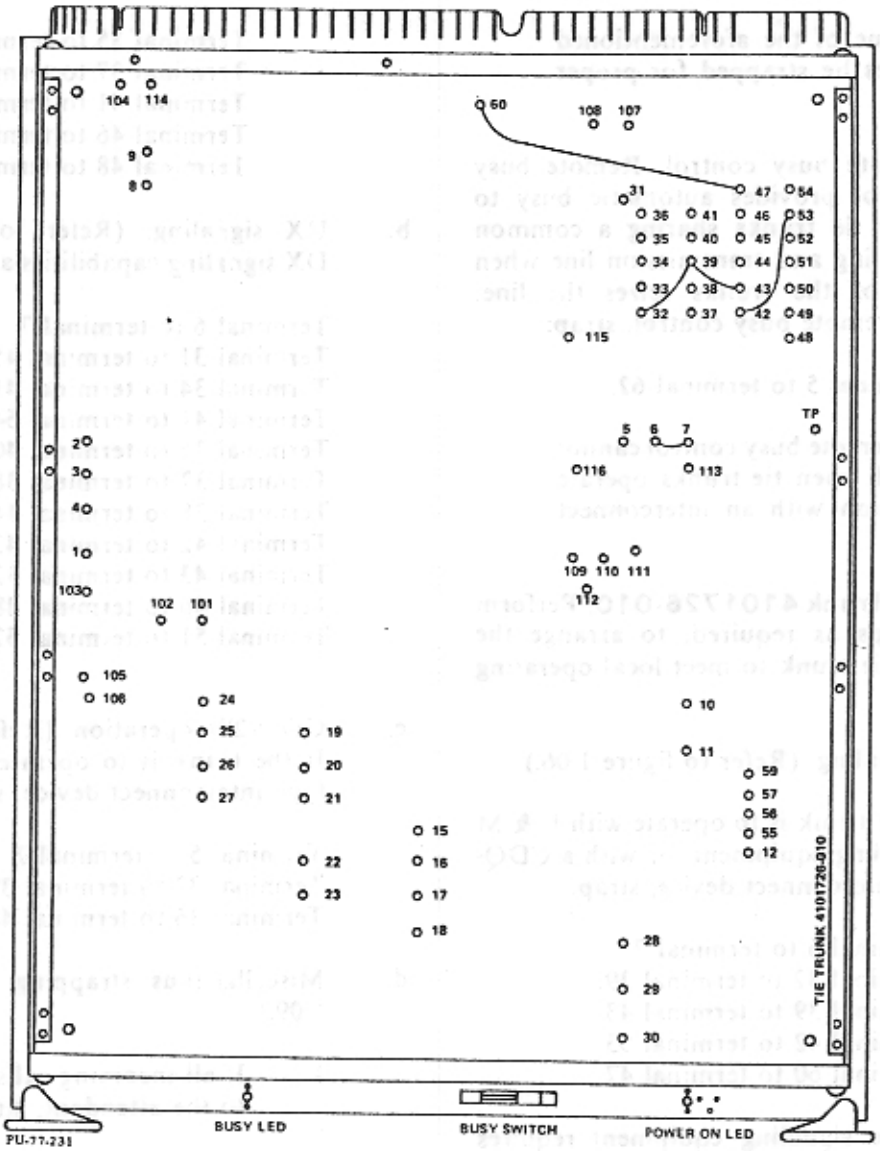


FIGURE 1.06 E & M Tie Trunk (TD-4101726-010) E & M/CDQ-2X Strapping

3. If outgoing calls via the tie trunk are to have dialing capabilities in the distant PABX, strap:

   Terminal 10 to terminal 11.

4. Type of start pulsing signal.

   (a) Immediate start. If the distant PABX is to start pulsing or expects pulsing to start on seizure, strap:

   Terminal 25 to terminal 27.
   Terminal 28 to terminal 30.

   (b) Delay dial. If the distant PABX is to delay or expects a delay between seizure and start of pulsing, strap:

   Terminal 25 to terminal 26.
   Terminal 29 to terminal 30.

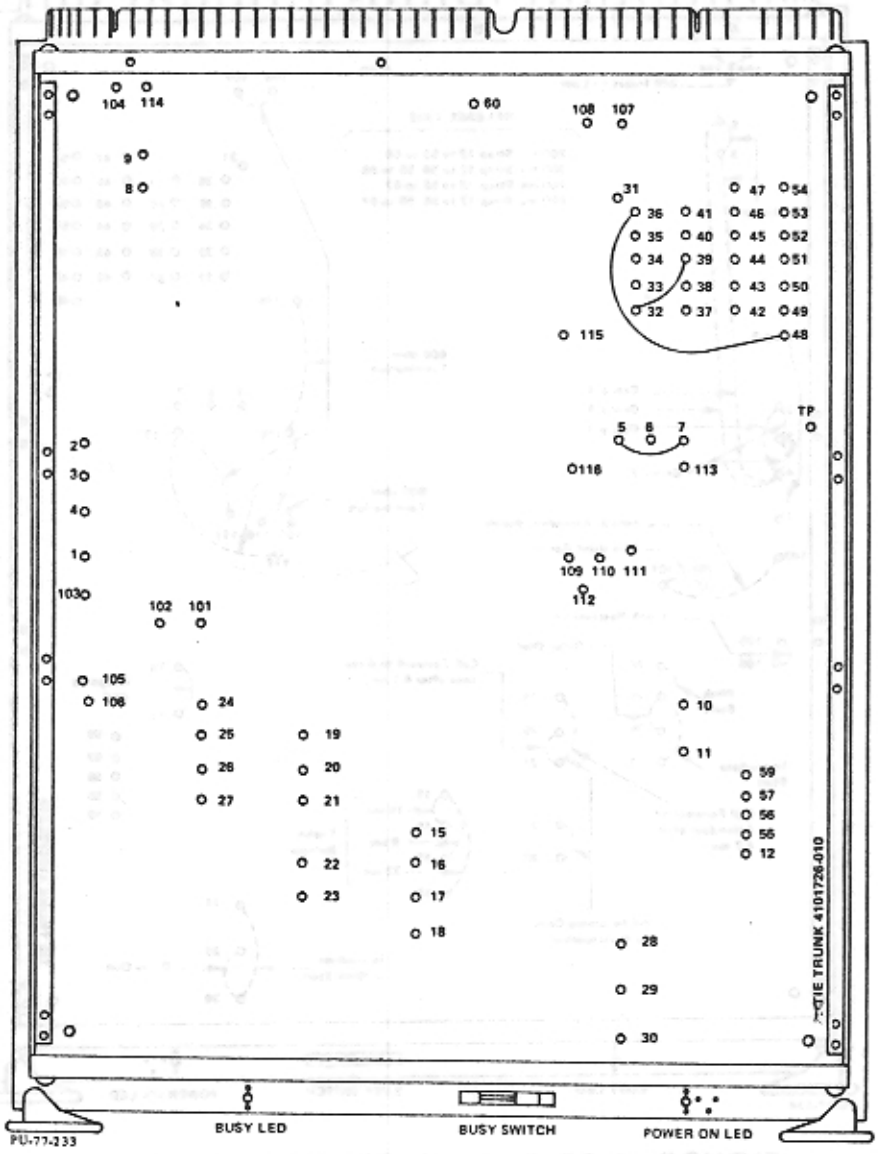


FIGURE 1.08 E & M Tie Trunk (TD-4101726-010) CDQ-2W Strapping

Terminal 1 terminal 4.
Terminal 4 to terminal 3.

(d) To assign the trunk to group 4, strap:

Terminal 4 to terminal 8.

(e) To assign the trunk to group 5, strap:

Terminal 4 to terminal 9.

(f) To assign the trunk to group 6, strap:

Terminal 4 to terminal 8.
Terminal 8 to terminal 9.

6. Enable release. The enable release feature permits the tie trunk to disregard a release signal from the distant office during dialing. Enable release timing is strapped as follows:

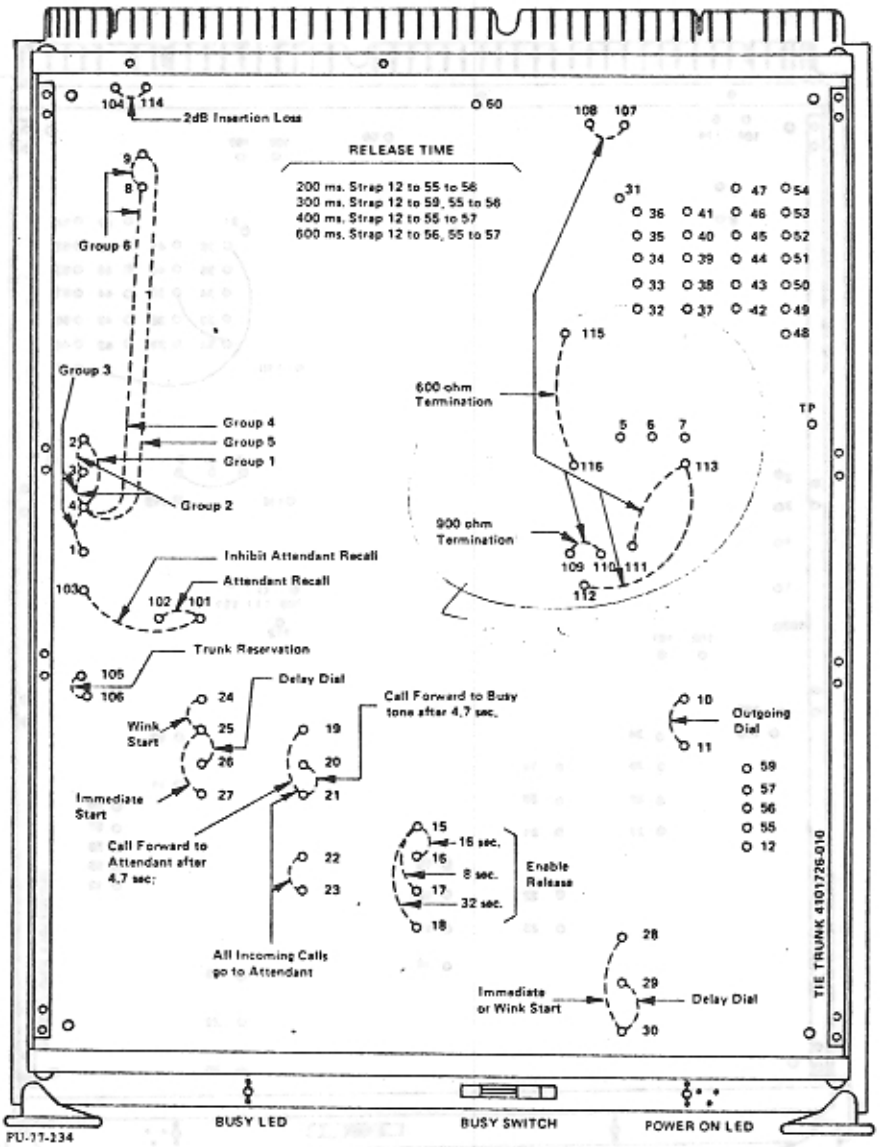


FIGURE 1.09 E & M Tie Trunk (TD-4101726-010) Miscellaneous Strapping

(a) For release after 8 seconds, strap:

Terminal 15 to terminal 17.

(b) For release after 16 seconds, strap:

Terminal 15 to terminal 16.

(c) For release after 32 seconds, strap:

Terminal 15 to terminal 18.

7. Momentary release. To prevent the tie trunk from recognizing any momentary release signal from the distant PABX, determine the timing interval, then strap as follows:

(a) For 200 ms, strap:

Terminal 12 to terminal 55.
Terminal 55 to terminal 56.

(b) For 300 ms, strap:

Terminal 12 to terminal 59.
Terminal 55 to terminal 56.

(c) For 400 ms, strap:

Terminal 12 to terminal 55.
Terminal 55 to terminal 57.

(d) For 600 ms, strap:

Terminal 12 to terminal 56.
Terminal 55 to terminal 57.

NOTE: One of the aforementioned release periods must be strapped for proper operation.

8. Attendant recall allows the station user to recall the attendant.

(a) To allow attendant recall, strap:

Terminal 101 to terminal 102.

(b) To inhibit attendant recall, strap:

Terminal 101 to terminal 103.

9. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap:

Terminal 105 to terminal 106.

10. 2dB insertion loss. To provide 2dB insertion loss on a tandem call connecting to an outgoing central office trunk or tie trunk, strap:

Terminal 104 to terminal 114.

11. To provide 600-ohm termination, strap:

Terminal 107 to terminal 108.
Terminal 109 to terminal 110.
Terminal 111 to terminal 113.
Terminal 112 to terminal 113.
Terminal 115. to terminal 116.

12. To provide 900-ohm termination, strap:

Terminal 109 to terminal 110.

FEATURE STRAPPING
TD-100
DID TRUNK PCB 4101776

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 DID trunk PCB, 4101776. This information is applicable to DID trunk PCB's 4101776-001 and -002. It should be referred to when strapping a DID trunk for a new installation, or when adding or replacing a DID trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to DID Trunk strapping can be found in the following documents.

a. OB-410-160 Class of Service PCB Strapping
b. OB-410-163 Processor II PCB Strapping

1.03 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 Strapping

2.01 General. The DID trunks mount in card positions 1 through14 of the trunk shelf. Each DID trunk provides strapping terminals for a variety of features. These strapping options are explained in the following paragraphs. Pin locations and straps are shown in the accompanying illustrations.

2.02 Information Required. The following information is required to strap the DID trunk.

a. The number of digits to be received from the central office on calls direct to stations.

b The number of digits to be received from the central office on calls direct to the attendant.

c. Type of trunk operation (immediate start, wink start, delay dial, etc.)

d. The miscellaneous feature required.

It should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such

TRUNK RECORD CHART

Incoming Access Digits	985-2481	→	→	→	→	→	→	→	→	→	→	→	643-2XXX	→	942-2691	→	→	→	→	8-	8-	8-	8-	8-	8-
Outgoing Access Digits	91	91	91	91	91	91	91	91	91	91	91	91			92	92	92	92	92	8-	8-	8-	8-	8-	8-
Trunk Board Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
TRUNKS																									
Standard Two-Way	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						
Incoming Only																									
Outgoing Only																									
DID (1-14)													✓	✓	X	X	X	X	X	X	X	X	X	X	
Tie Trunk (15-24 or 1-10 and 15-24)										X	X	X	X	X						✓	✓	✓	✓	✓	
FEATURES																									
Trunk Group (1-6) Tie Trunk Group (1-6)	1	1	1	1	1	1	1	1	1	1	1	1			2	2	2	2	2	1	1	1	1	1	
ANA (1-10) Station Number	230	210	220	255	214	249	216	240	218	260	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
UNA																									
Power Failure Transfer (P.F.T. Circuit 1-10)	10	1	2	3	4	5	6	7	8	9															
Console and Station Number Used for P.F.T.	CONSOLE	230	210	220	213	201	208	268	250	242															
Digit Received (DID Trunks) 1-4													3	3	X	X	X	X	X	X	X	X	X	X	
CDO 2X-2W Interconnect Device (Tie Trunk Only)										X	X	X	X	X											
CDH (Interconnect Device)																									
Trunk Reservation											✓	✓							✓						
Make Busy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						
Automatic Recall (Grd. Start or CDH)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						
Consultation Hold on Incoming Only																									
C.O. Release Time																									
SIGNALING																									
Loop Start													✓	✓											
Ground Start	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						
Wink Start																									
E & M																									
Duplex (Tie Trunks Only)																			✓	✓	✓	✓	✓		
Batt./Grd. (Tie Trunks Only)										X	X	X	X	X											
Delay Dial										X	X	X	X	X											
Immediate Start																									
MISCELLANEOUS																									

PU 77-026

FIGURE 1.00 Typical Trunk Record Chart

a chart and leave it with the system as a permanent record. The chart should show all applicable trunk features. It should be updated any time trunks are replaced, changed or added to the system.

2.03 Access Codes, DID Trunk 4101776-001. Perform steps a, b, or c to strap the generation -001 DID trunk to receive two, three, or four digits from the central office.

a. Two digit access. (Refer to figure 1.01.) If, after seizure, the DID trunk will receive two digits from the central office, strap the trunk as follows:

1. Station access. For two digit station access, strap

   Terminal 26 to terminal 36.
   Terminal 28 to terminal 35.
   Terminal 30 to terminal 31.

2. Attendant access. To permit direct attendant access, also strap

   Terminal 44 to terminal 45.

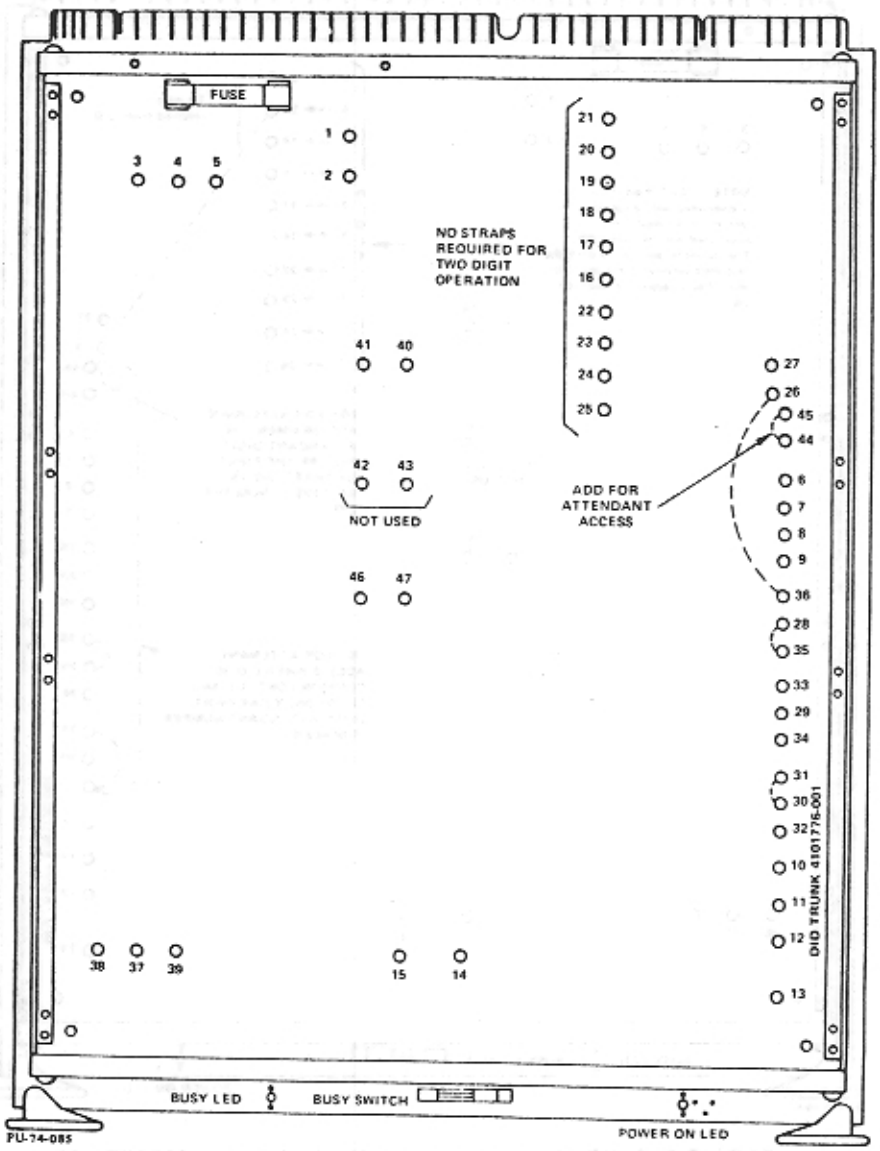

FIGURE 1.01 Strapping for 2-Digit Access (4101776-001)

b. Three digit access. (Refer to figure 1.02.) If, after seizure, the DID trunk will receive three digits from the central office, strap the trunk as follows:

1. Station access. For station access, strap terminal 26 to the terminal (16 - 25) corresponding to the first digit received. Then strap

   Terminal 29 to terminal 33.
   Terminal 31 to terminal 32.

2. Attendant access. To permit direct attendant access, perform the following strapping in addition to that in step 1.

   (a) If the attendant digit will be the first of three digits received, strap

   Terminal 44 to terminal 45.

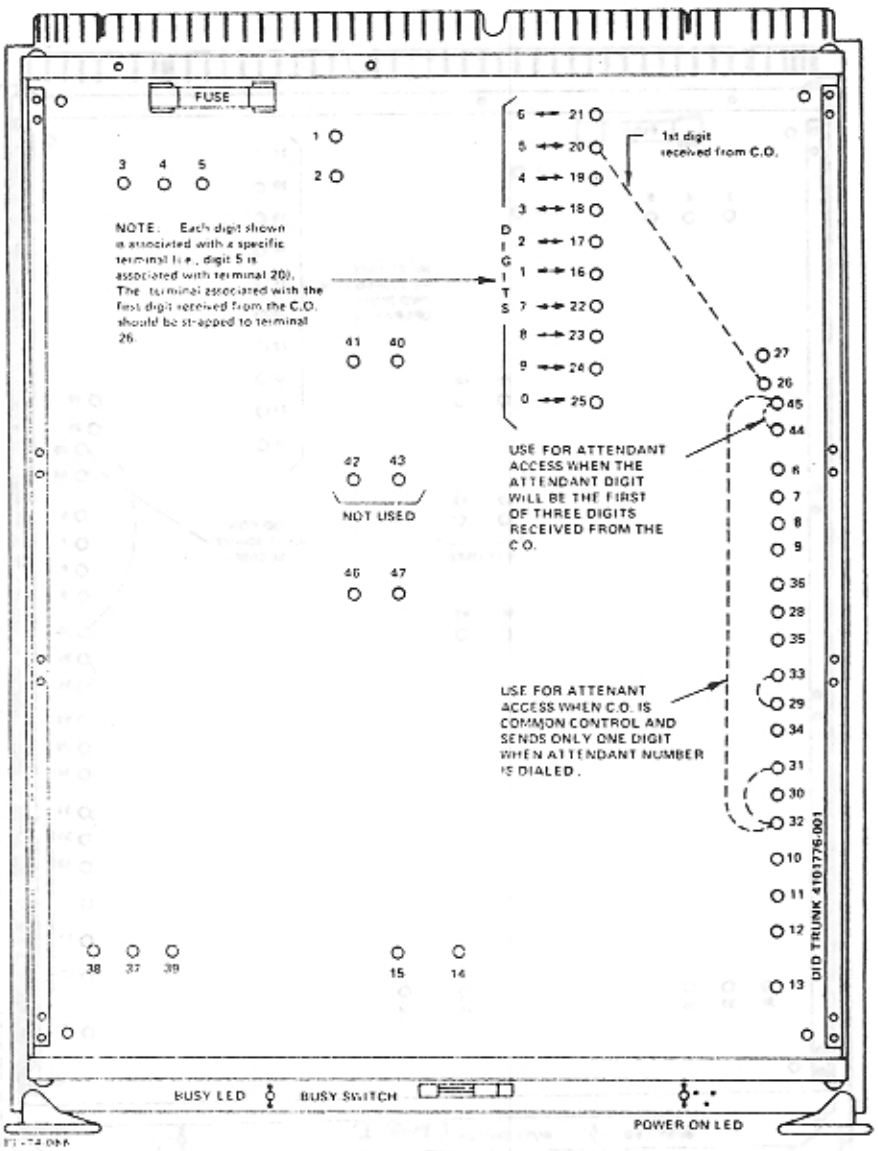

FIGURE 1.02 Strapping for 3 Digit Access (4101776-001)

(b) If, on an attendant call, only one digit will be received, strap

Terminal 32 to terminal 45.

c. Four digit access. (Refer to figure 1.03.) If, after seizure, the DID trunk will receive four digits from the central office, strap the trunk as follows:

1. Station access. For station access, strap terminal 26 to the terminal (16 - 25) corresponding to the second digit received. Then strap

Terminal 28 to terminal 35.
Terminal 31 to terminal 32.
Terminal 33 to terminal 34.

2. Attendant access. To permit direct attendant access, perform the following strapping in addition to that in step 1.

(a) If the attendant digit will be the first of four digits received, strap

Terminal 44 to terminal 45.

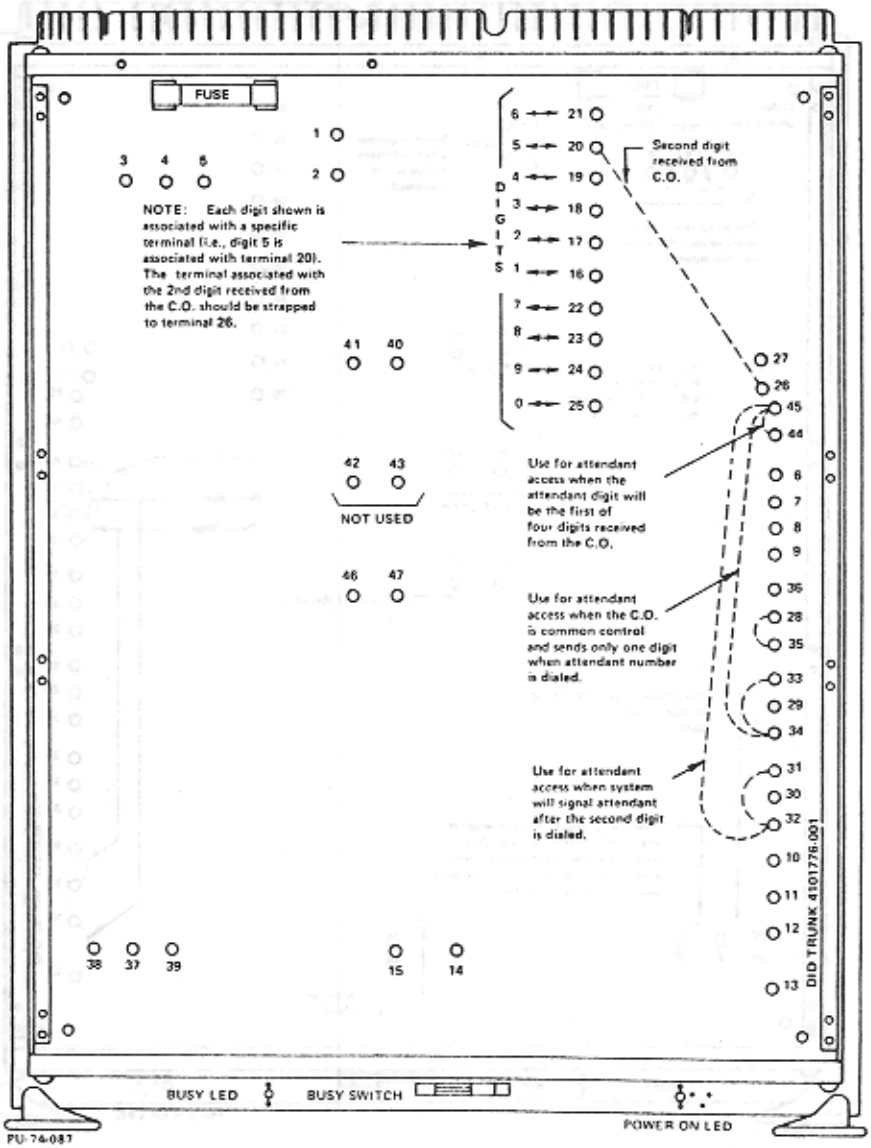

FIGURE 1.03 Strapping for 4-Digit Access (4101776-001)

(b) If, on an attendant call, only one digit will be received, strap

Terminal 34 to terminal 45.

(c) If the attendant will be signaled after the second digit is received, strap

Terminal 32 to terminal 45.

2.04 Miscellaneous Features, DID Trunk 4101776-001. Perform the following steps, as required, to provide the required trunk features. Refer to figure 1.04.

a. Type of start pulsing signal.

1. Immediate start. If pulsing is to begin on seizure, strap

Terminal 6 to terminal 8.

2. Delay dial. If pulsing is delayed until some time after seizure, strap

Terminal 8 to terminal 9.
Terminal 10 to terminal 11.
Terminal 14 to terminal 15.

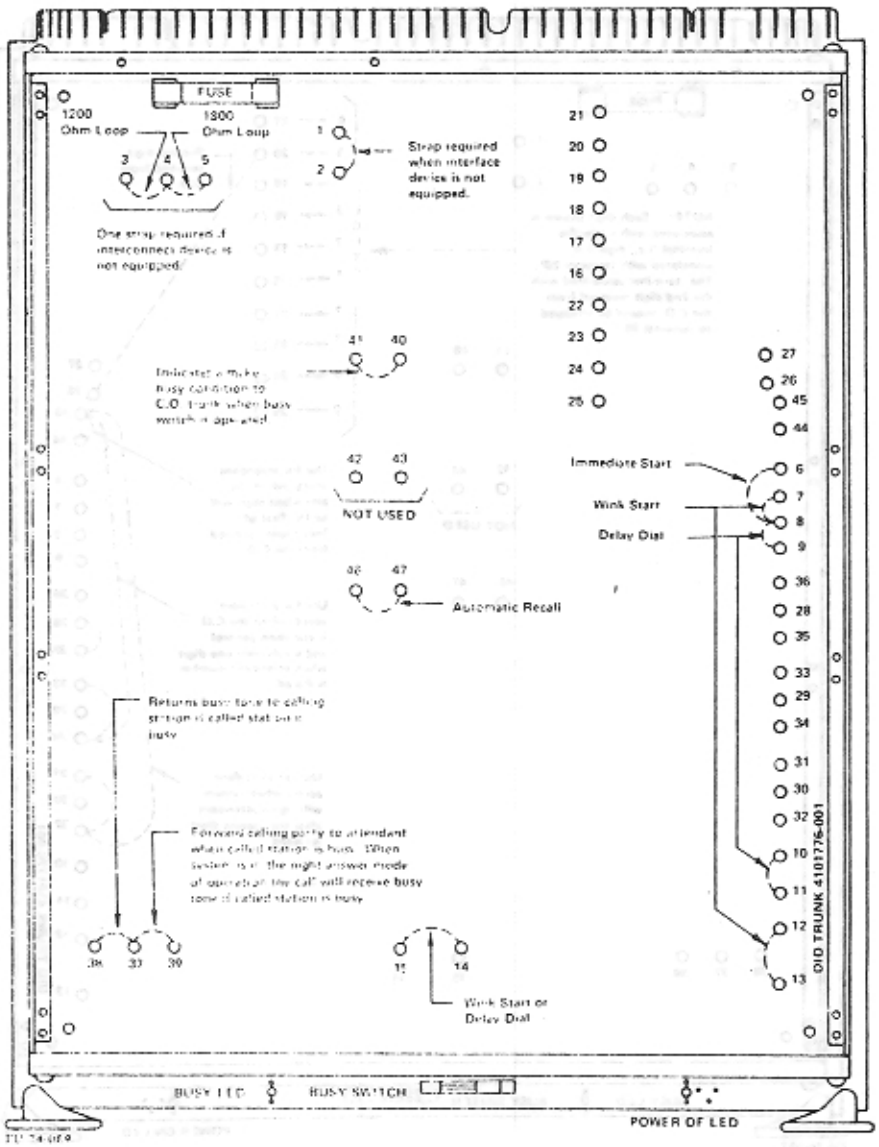

FIGURE 1.04 Miscellaneous Strapping (4101776-001)

3. Wink start. If the central office requires a momentary loop reversal as an indication to start pulsing, strap

   Terminal 7 to terminal 8.
   Terminal 12 to terminal 13.
   Terminal 14 to terminal 15.

b. Intercept.

1. To forward calls to the attendant when the called stations are busy, strap

   Terminal 37 to terminal 39.

2. To return busy tone to the calling party when the called station is busy, strap

   Terminal 37 to terminal 38.

c. Automatic recall. For automatic recall, strap

Terminal 46 to terminal 47.

d. If the trunk is to indicate a busy condition to the C. O. when the busy switch is operated, strap

Terminal 40 to terminal 41.

e. Loop resistance.

1. If loop resistance is 1200 ohms or less, and no interconnect device is used, strap

   Terminal 1 to terminal 2.
   Terminal 3 to terminal 4.

2. If loop resistance is between 1200 and 1800 ohms, and no interconnect device is used, strap

   Terminal 1 to terminal 2.
   Terminal 4 to terminal 5.

2.05 Access Codes, DID Trunk 4101776-002. Perform steps a, b, or c to strap the generation -002 DID trunk to receive two, three, or four digits from the central office.

a. Two digit access. (Refer to figure 1.05.) If, after seizure, the DID trunk will receive two digits from the central office, strap the trunk as follows:

1. Station access. For two digit station access, strap

   Terminal 26 to terminal 36.
   Terminal 28 to terminal 35.
   Terminal 30 to terminal 31.

2. Attendant access. To permit attendant access, also strap,

   Terminal 44 to terminal 45.

b. Three digit access. (Refer to figure 1.06.) If, after seizure, the DID trunk will receive three digits from the central office, strap the trunk as follows:

1. Station access. For station access, strap terminal 26 to the terminal (16 - 25) corresponding to the first digit received. Then strap

   Terminal 29 to terminal 33.
   Terminal 31 to terminal 32.

2. Attendant access. To permit direct attendant access, perform the following strapping in addition to that in step 1.

   (a) If the attendant digit will be the first of three digits received, strap

   Terminal 44 to terminal 45.

   (b) If, on an attendant call, only one digit will be received, strap

   Terminal 32 to terminal 45.

c. Four digit access. (refer to figure 1.07.) If, after seizure, the DID trunk will receive four digits from the central office, strap the trunk as follows:

1. Station access. For station access, strap terminal 26 to the terminal

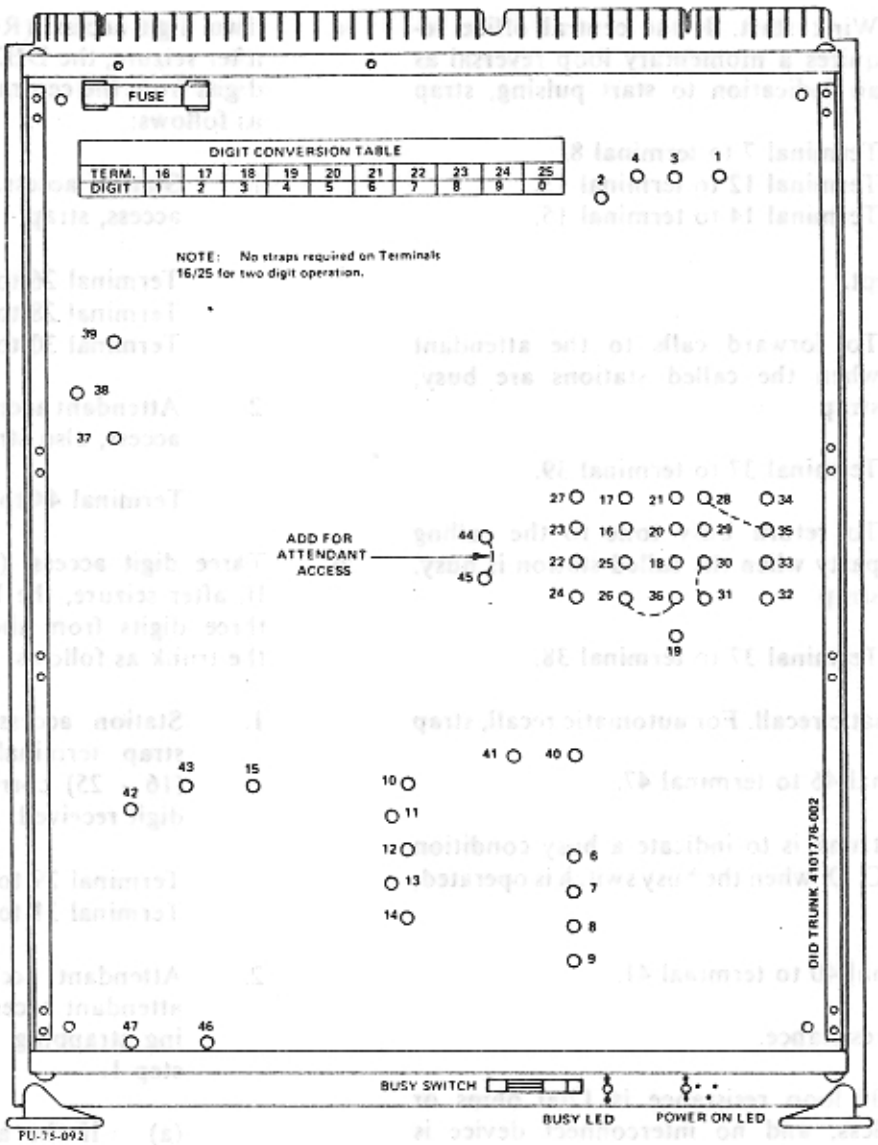

FIGURE 1.05 Strapping for 2-Digit Access (4101776-002)

(16 - 25) corresponding to the second digit received. Then strap

Terminal 28 to terminal 35.
Terminal 31 to terminal 32.
Terminal 33 to terminal 34.

2. Attendant access. To permit direct attendant access, perform the following strapping in addition to that in step 1.

(a) If the attendant digit will be the first of four digits received, strap

Terminal 44 to terminal 45.

(b) If, on an attendant call, only one digit will be received, strap

Terminal 34 to terminal 45.

(c) If the attendant will be signalled after the second digit is received, strap

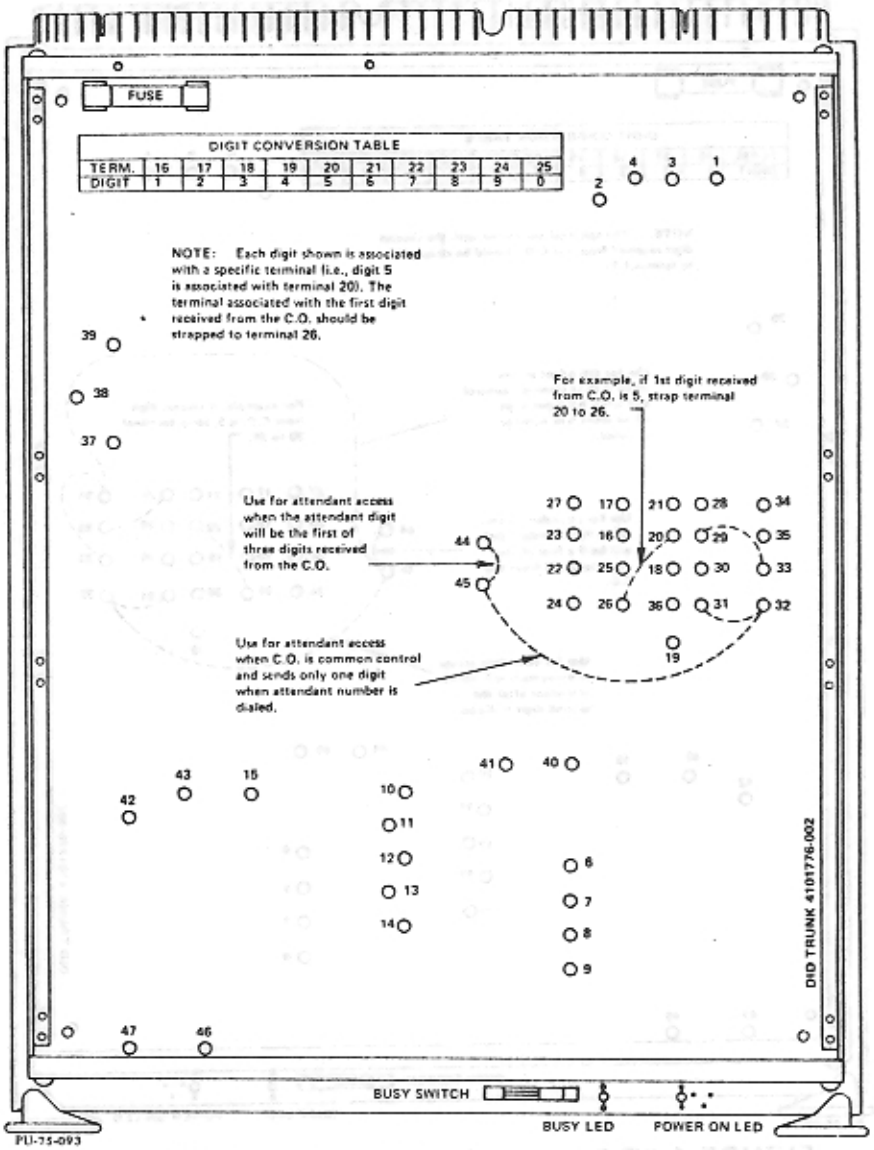

FIGURE 1.06 Strapping for 3-Digit Access (4101776-002)

Terminal 32 to terminal 45.

2.06 Miscellaneous Features, DID Trunk 4101776-002. Perform the following steps, as required, to provide the required trunk features Refer to figure 1.08.

a. Type of start pulsing signal.

1. Immediate start. If pulsing is to begin on seizure, strap

   Terminal 6 to terminal 7.

2. Delay dial. If pulsing is delayed until some time after seizure, strap

   Terminal 6 to terminal 8.

3. Wink start. If the central office requires a momentary loop reversal as an indication to start pulsing, strap

   Terminal 6 to terminal 9.

b. Intercept.

1. To forward calls to the attendant when

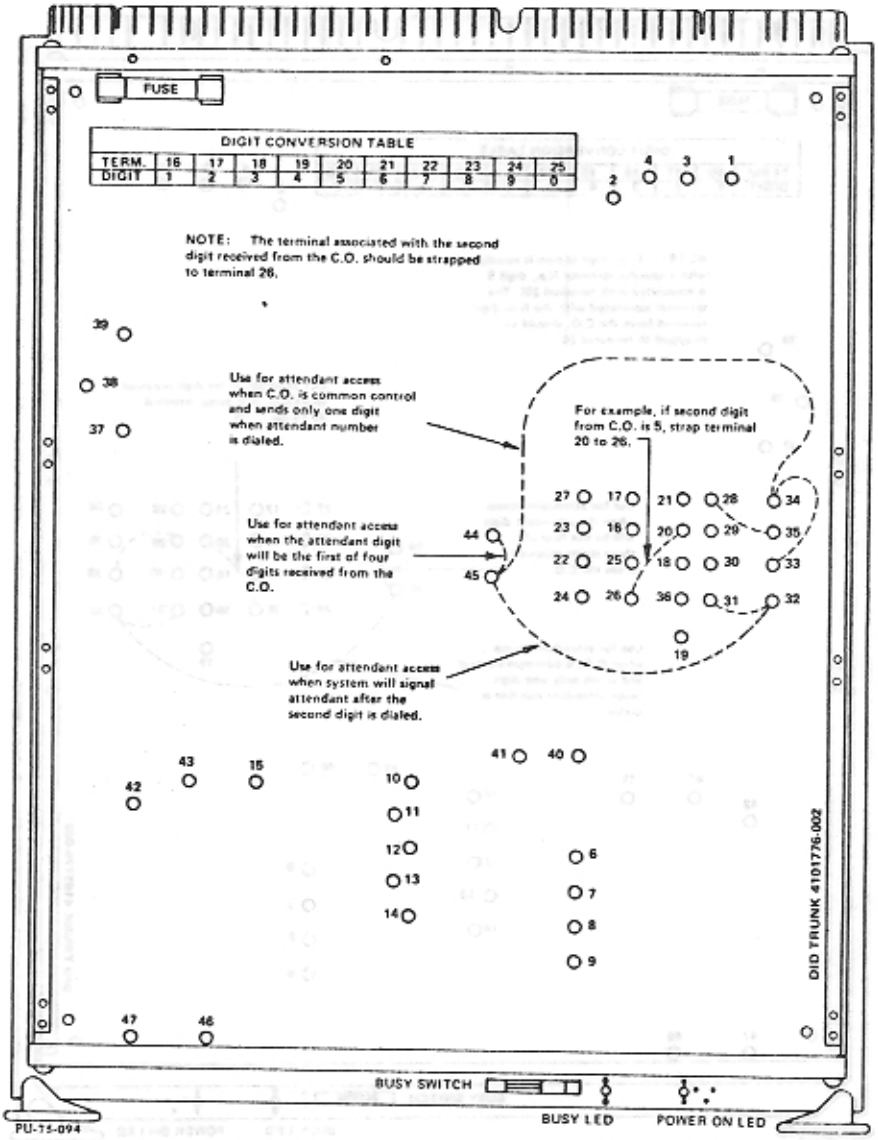

FIGURE 1.07 Strapping for 4-Digit Access (4101776-002)

the called stations are busy, strap

Terminal 37 to terminal 39.

2. To return busy tone to the calling party when the called station is busy, strap

Terminal 37 to terminal 38.

c. Automatic recall. For automatic recall, strap

Terminal 46 to terminal 47.

d. If the trunk is to indicate a busy condition to the C. O. when the busy switch is operated, strap

Terminal 40 to terminal 41.

e. Loop operation. The generation -002 DID trunk is arranged for 1800 ohm loop operation with an interconnect device. If no interconnect device is required, strap

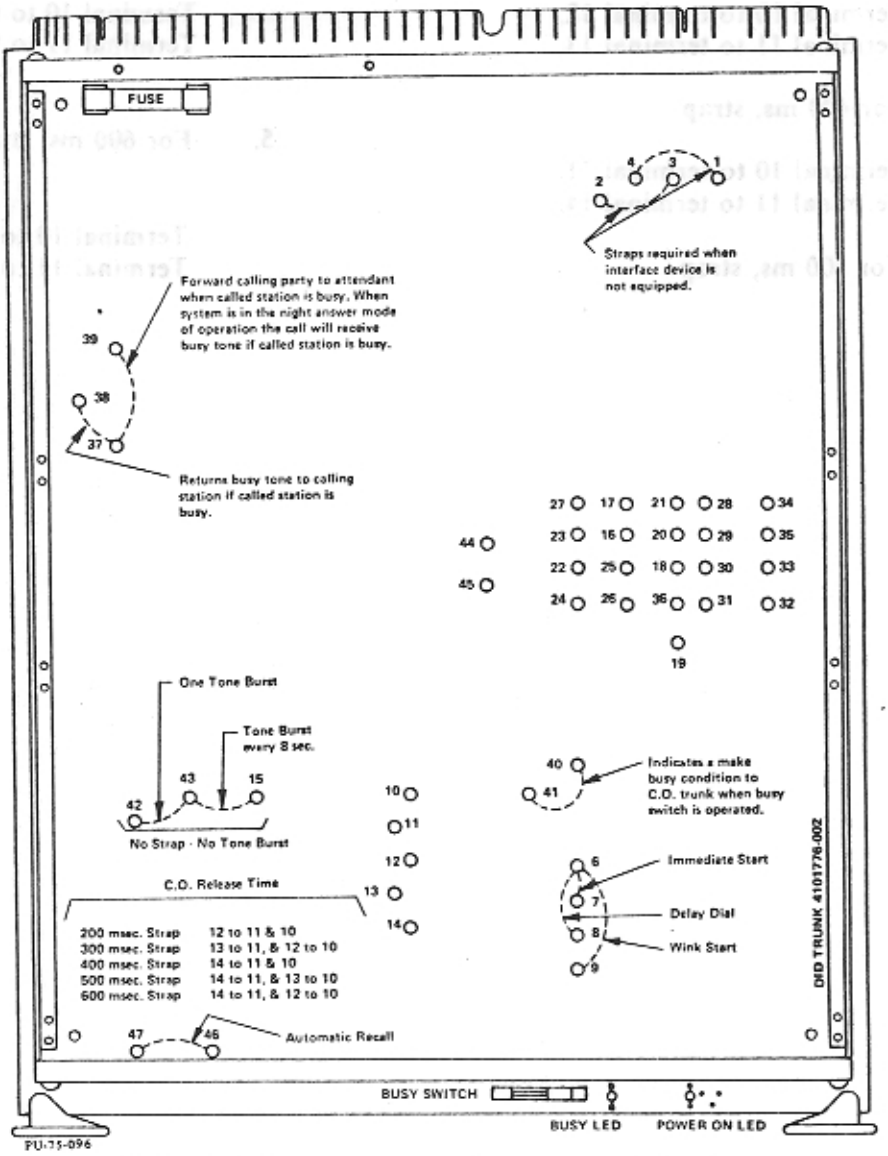

FIGURE 1.08 Miscellaneous Strapping (4101776-002)

Terminal 1 to terminal 4.
Terminal 2 to terminal 3.

f. Camp-on-busy tone.

1. For one burst of tone, strap

   Teminal 42 to terminal 43.

2. For one burst of tone every 8 seconds, strap

   Terminal 43 to terminal 15.

3. For no tone, no straps are required.

g. Central office release time. If the central office is to disregard a momentary release signal from the trunk, determine the time period, then strap as follows:

1. For 200 ms, strap

   Terminal 10 to terminal 11.
   Terminal 11 to terminal 12.

2. For 300 ms, strap

Terminal 10 to terminal 12.
Terminal 11 to terminal 13.

3. For 400 ms, strap

Terminal 10 to terminal 11.
Terminal 11 to terminal 14.

4. For 500 ms, strap

Terminal 10 to terminal 13.
Terminal 11 to terminal 14.

5. For 600 ms, strap

Terminal 10 to terminal 12.
Terminal 11 to terminal 14.

FEATURE STRAPPING
TD-100
ALARM PANEL PCB 4101786

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1.01 Alarm PCB Strapping, 4101786-003 2
1.02 Alarm PCB Strapping, 4101786-005 2

1.00 INTRODUCTION

1.01 Purpose of Section This section describes strapping for the TD-100 alarm panel PCB, 4101786. This information is applicable to alarm panel PCB's 4101786-002, -003, and -005. It should be referred to when strapping the alarm PCB for a new installation, or when replacing the alarm PCB in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The alarm PCB mounts in card position 1 of the line shelf. It monitors system operation and provides visual indications of major and minor alarms. Circuitry on the alarm panel board controls indicators on the board, on the attendant console, and if required, at a remote location.

2.02 Procedure. Figures 1.00, 1.01, and 1.02 show strapping for the generation -002, -003, and -005 alarm panel boards. Refer to the applicable illustration and strap the alarm PCB as follows:

a. Alarm PCB 4101786-002. (Refer to figure 1.00.) If a moderately high cabinet temperture is to light the MIN ALM (minor alarm) and HT (high temperature) LED's on the alarm panel, strap terminal 25 to terminal 26.

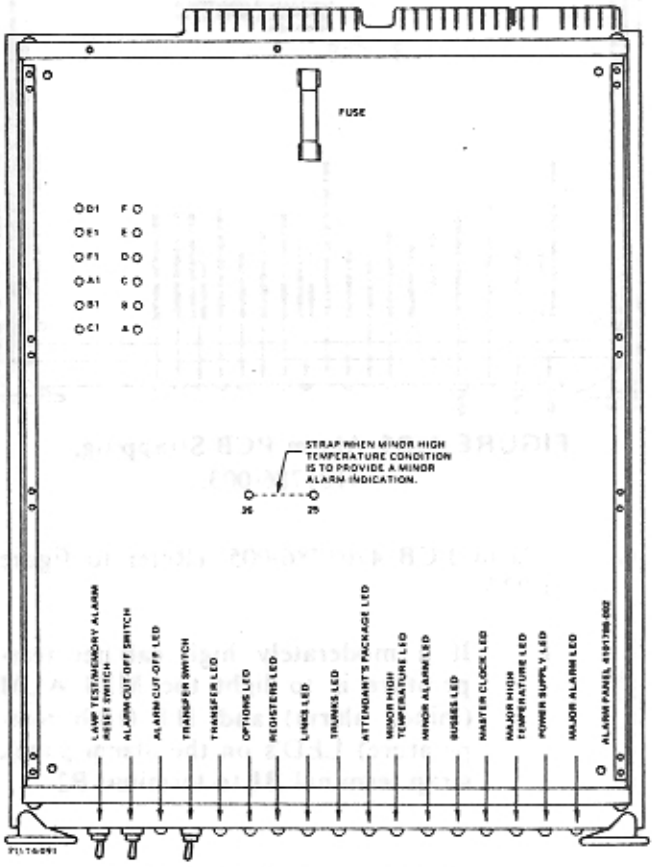

FIGURE 1.00 Alarm PCB Strapping, 4101786-002.

b. Alarm PCB 4101786-003. (Refer to figure 1.01.) If a modertely high cabinet temperature is to light the MIN ALM (minor alarm)

and HT (high temperature) LED's on the alarm panel, strap terminal 1 to terminal 2.

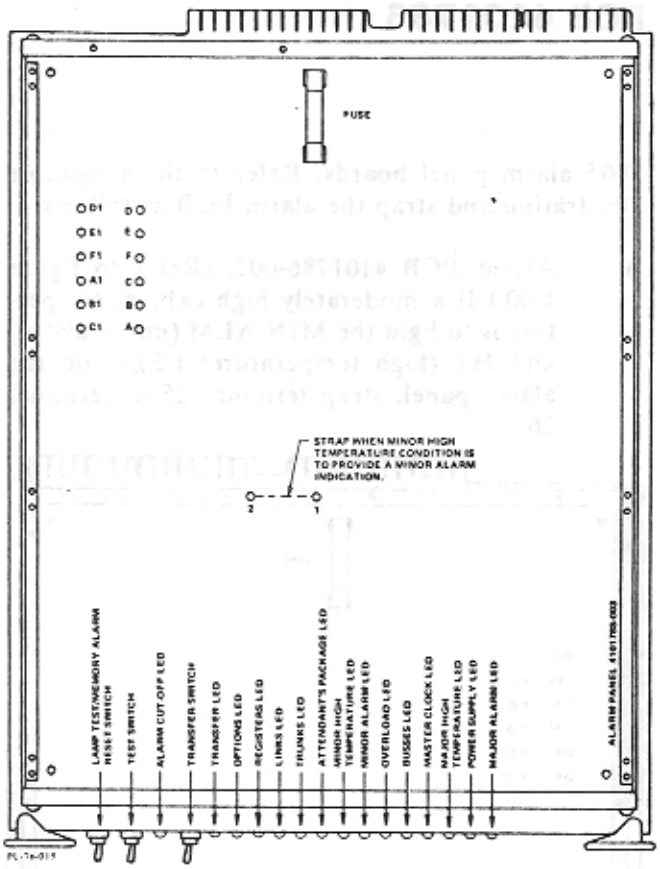

FIGURE 1.01 Alarm PCB Strapping, 4101786-003.

c. Alarm PCB 4101786-005. (Refer to figure 1.02.)

1. If a moderately high cabinet temperature is to light the MIN ALM (minor alarm) and HT (high temperature) LED's on the alarm panel, strap terminal B1 to terminal B2.

2. To provide a ground return for the 10 VAC source to operate an external buzzer for manual intercom service, strap terminal A1 to terminal A2.

3. To provide control for a remote console buzzer, strap terminal E1 to terminal E2.

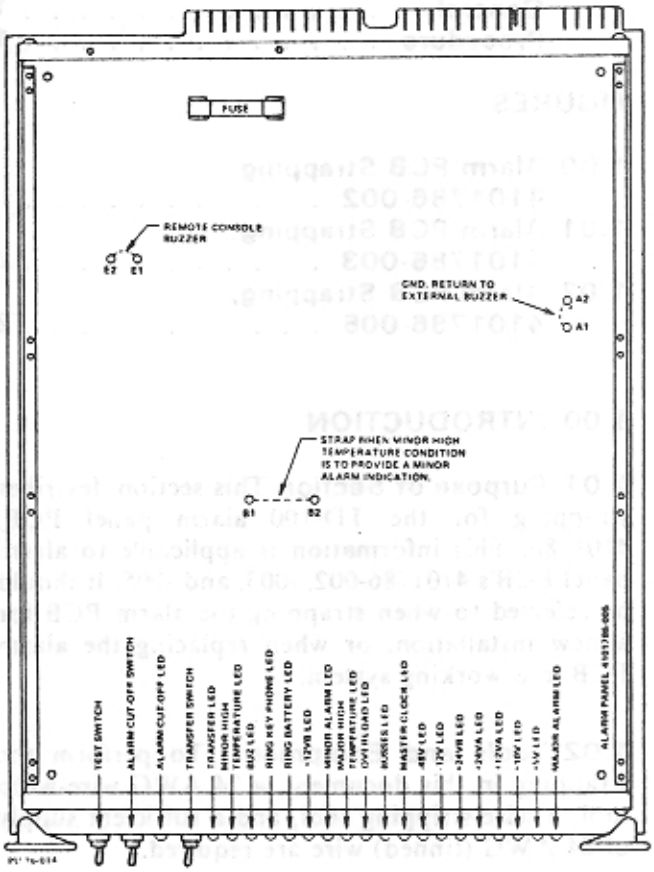

FIGURE 1.02 Alarm PCB Strapping, 4101786-005

FEATURE STRAPPING
TD-100
PRIVATE LINE AND MANUAL INTERCOM PCB
(TD-4101916- 001, -002, -010)

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1.01 Strapping for 2-Party Service (TD-4101916-001, -002, -010) . . 2
1.02 Strapping for STC Interconnect Device (TD-4101916-001, -002, -010) 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section explains how to strap the TD-100 private line and manual intercom PCB for private line service. This information is applicable to PCB assemblies numbered TD-4101916-001, -002, and -010. It should be consulted when strapping a private line and manual intercom PCB for a new installation, or one being added or replaced in a working system.

1.02 Tools and Equipment. No tools are required to strap the private line and manual intercom PCB. Feature strapping is accomplished by the insertion of option plugs (shipped with the PCB) into option blocks mounted on the PCB.

2.00 STRAPPING

2.01 General. The system can be equipped with up to three private line and manual intercom PCB's. The boards mount in positions 22, 25 or 26 of the line subrack. Each PCB includes two private line circuits and three manual intercom circuits. Only the private line circuits require strapping.

2.02 Information Required. To strap each private line circuit, the installer must know if the associated trunk is connected via an STC interconnect device, or if the associated station line is arranged for single-party or two-party service.

2.03 Procedure. If the trunk associated with the private line circuit to be strapped is to utilize loop ringing, insert an option plug in block A (4 for circuit 1 or 5 for circuit 2) to short pins 2 and 5, and in block B (4 for circuit 1 or 5 for circuit 2) to short pins 3 and 6. See figure 1.00 and the note below.

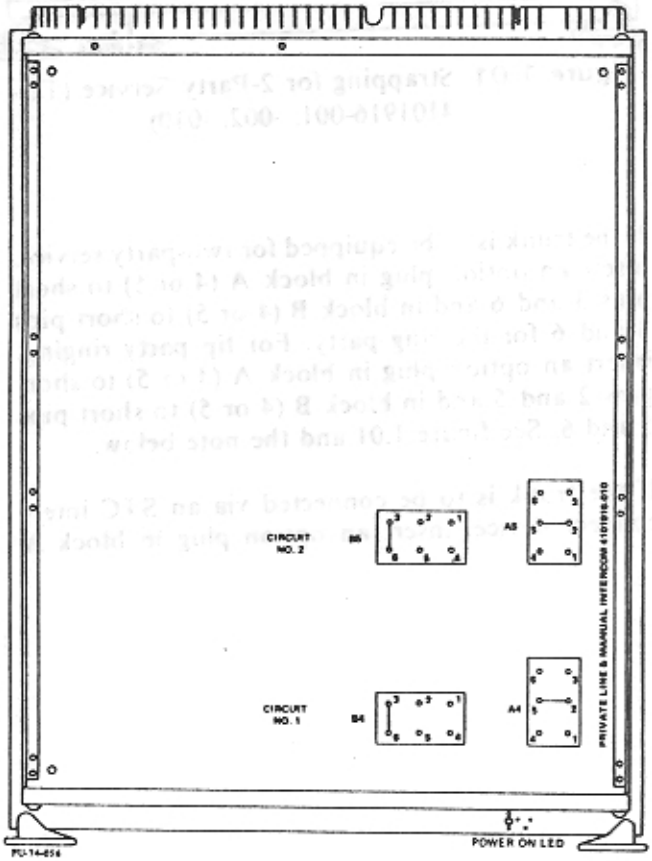

Figure 1.00 Strapping for Loop Ringing (TD-4101916-001, -002, -010)

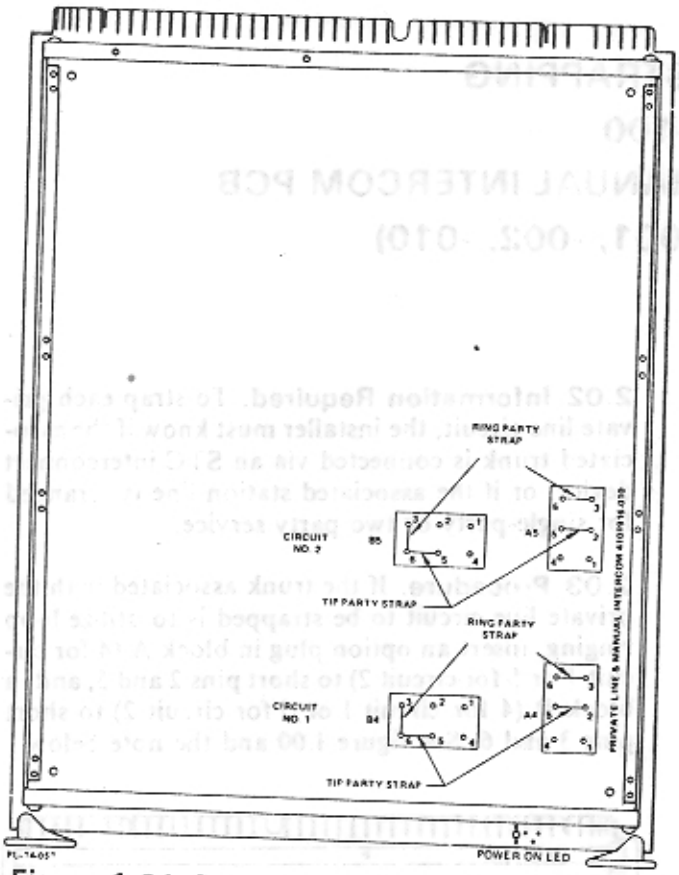

Figure 1.01 Strapping for 2-Party Service (TD-4101916-001, -002, -010)

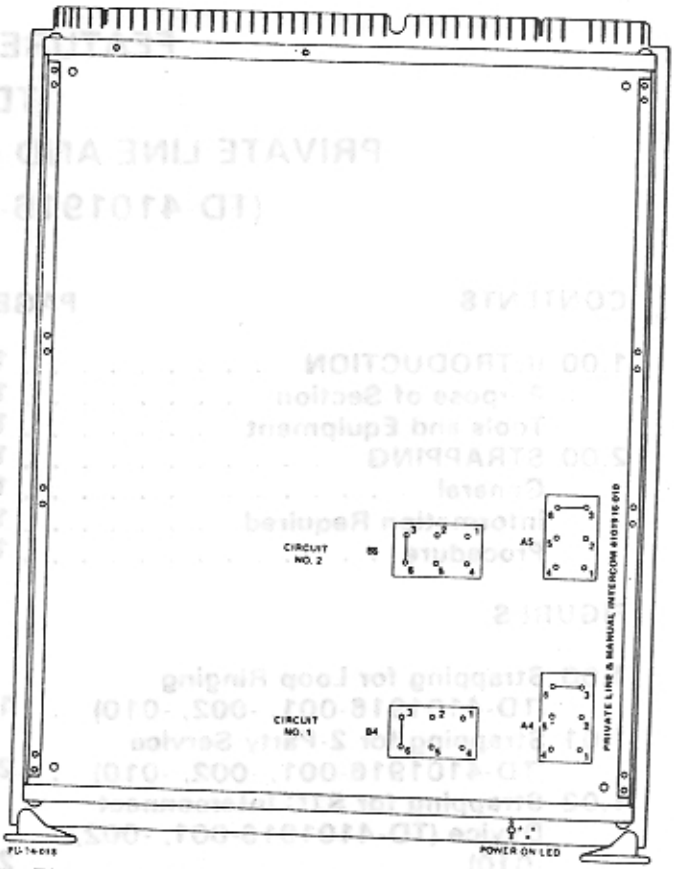

Figure 1.02 Strapping for STC Interconnect Device (TD-4101916-001, -002, -010)

If the trunk is to be equipped for two-party service, insert an option plug in block A (4 or 5) to short pins 3 and 6 and in block B (4 or 5) to short pins 3 and 6 for the ring party. For tip party ringing, insert an option plug in block A (4 or 5) to short pins 2 and 5 and in block B (4 or 5) to short pins 5 and 6. See figure 1.01 and the note below.

If the trunk is to be connected via an STC interconnect device, insert an option plug in block A (4 or 5) to short pins 3 and 6 and in block B (4 or 5) to short pins 3 and 6. See figure 1.02 and the note below.

NOTE: Figures 1.00, 1.01 and 1.02 show a TD-4101916-010 PCB; however, the information contained therein also applies to PCB's numbered TD-4101916-001 and -002.

FEATURE STRAPPING
TD-100
PAGING ACCESS SERVICE

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1.03 Paging Access PCB Strapping (TD-4101926-010) 4

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 paging access feature. Included are explanations and illustrations for strapping the paging access PCB, TD-4101926, and the processor 2 PCB, TD-4101636. This information is applicable to paging access PCB's numbered TD-4101926-001, -002 and -010, and processor 2 PCB's numbered TD-4101636-003, -004, -005 and -010. It should be referred to when strapping a new system for paging access, when replacing a paging access PCB, or when adding paging service to a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The paging access feature permits the attendant and local station users to access a customer-provided loud speaker system. With a paging access PCB numbered TD-4101926-010 and a processor 2 PCB numbered TD-4101636-005 (with issue R or later PROM's) or TD-4101636-010, answer back is provided in addition to paging access. This additional feature allows the paged party to dial an access code and be connected directly to the paging party's line. The TD-100 system will accommodate up to three paging access circuits and implementation requires distributing frame cross-connections, and the strapping of the paging access and processor 2 PCB's. In systems equipped with channel motherboard TD-4101717-002, the paging access PCB mounts in positions 10-14 of the channel subrack. In systems equipped with motherboard TD-4101716-003, the boards mount in positions 10-13 of the channel subrack. Channel motherboard assemblies issue W and earlier must be modified per drawing 15970( )79 to accommodate the TD-4101926-010 paging access PCB.

2.02 Information Required. In order to strap this feature, the following must be determined.

a. Applicable access code(s).

b. Is music to be provided over the loud speaker system when idle?

c. Is music to be provided via an external muting device?

d. Is a tone burst to be extended to the paging originator upon access?

e. Is this service to be class of service restricted? If yes, refer to OB-410-160 for class of service strapping.

2.03 Processor 2 Strapping. On the processor 2 PCB, the paging access code is assigned by strapping the PA1, PA2, and PA3 H (hundreds) and T (tens) terminals to the respective access code HUNDREDS and TENS terminals. If a single digit is used for paging access, strap only the hundreds digit. If two-digit access is required, both the hundreds and tens digits must be strapped.

Figures 1.00 and 1.01 are examples of two-digit access strapping for the TD-4101636-005 and -010 PCB's The illustrations show strapping for a system with three paging circuits, where the access codes are 31, 32, and 33. The hundreds digit for all three paging circuits is 3, hence the PA1, PA2, and PA3 H terminals are multipled and strapped to HUNDREDS terminal 3. The tens digit for the first paging circuit is 1, hence the PA1 T terminal is strapped to TENS terminal 1. Similarly, the PA2 and PA3 T terminals are strapped to TENS terminals 2 and 3, respectively.

To provide the paging access answer back feature requires additional strapping of the processor 2 PCB numbered TD-4101636-005 (with issue R or later PROM's) or TD-4101636-010.

a. To assign the answer back access code for the TD-4101636-005 PCB, the 07 H (hundreds) terminal is strapped to the corresponding hundreds terminal and the 07 T (tens) terminal is strapped to the corresponding tens terminal for two digit access. Single digit access requires strapping the 07 H (hundreds) and T (tens) terminals to the selected hundreds terminal.

b. To assign the answer back code for the TD-4101636-010 PCB, the PAAB (paging access answer back) H (hundreds) terminal is strapped to the corresponding hundreds terminal of the access code and the T (tens) terminal is strapped to the corresponding tens terminal of the access code.

Figures 1.00 and 1.01 illustrate strapping where the answer back code is 42.

2.04 Paging Access PCB Strapping. Arrangement of the strapping terminals on the paging access PCB's is shown in figure 1.02 for the TD-4101926-002 PCB, and figure 1.03 for the TD-4101926-010 PCB. An explanation of the strapping follows:

a. If music is to be provided over the PA system when the paging access circuit is idle and if, on seizure, a one-half second burst of tone is to be heard at the originating station and over the PA system, strap

   Terminal A to terminal D
   Terminal B to terminal E.

b. If no music is provided, or music is provided via an external muting device, strap the paging access PCB as follows:

   1. If, on seizure, a one-half second tone burst is to be heard at the originating station and over the PA system, strap

      Terminal A to terminal D
      Terminal E to terminal F.

   2. If, on seizure, a one-half second tone burst is to be heard only at the originating station, strap

      Terminal A to terminal B
      Terminal E to terminal F.

c. Paging Systems. One paging access PCB must be provided for each paging system equipped.

   1. If only 1 paging system is provided, strap

      Terminal1 to adjacent terminal C on the first PCB.

   2. If 2 paging systems are provided, strap

      Terminal 1 to adjacent terminal C on the first PCB
      Terminal 2 to adjacent terminal C on the second PCB.

   3. If 3 paging systems are provided, strap

      Terminal 1 to adjacent terminal C on

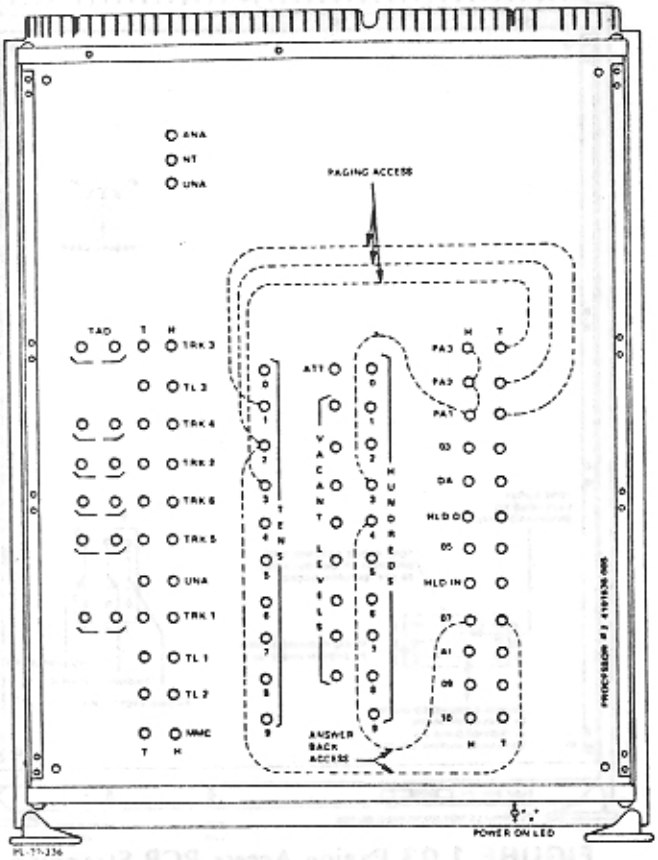

FIGURE 1.00 Paging Access and Answer Back Strapping, Processor 2 PCB (TD-4101636-005)

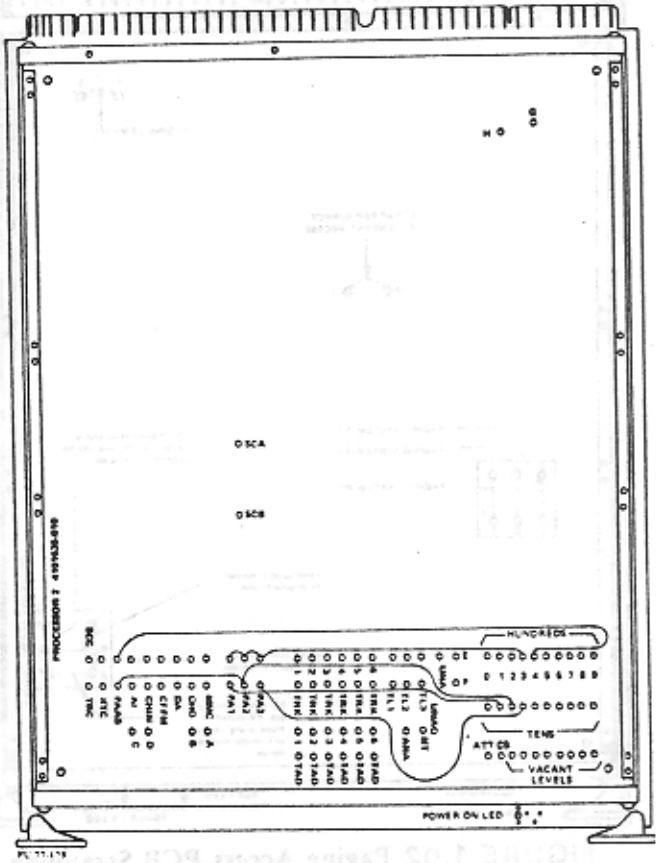

FIGURE 1.01 Paging Access and Answer Back Strapping, Processor 2 PCB (TD-4101636-010)

the first PCB.
Terminal 2 to adjacent terminal C on the second PCB.
Terminal 3 to adjacent terminal C on the third PCB.

d. For brighter lighting of the PAGE lamp on the attendant console, strap

Terminal 4 to terminal 5.

e. To provide for direct attendant access on the TD-4101926-002 PCB only, strap

Terminal 6 to terminal 7.

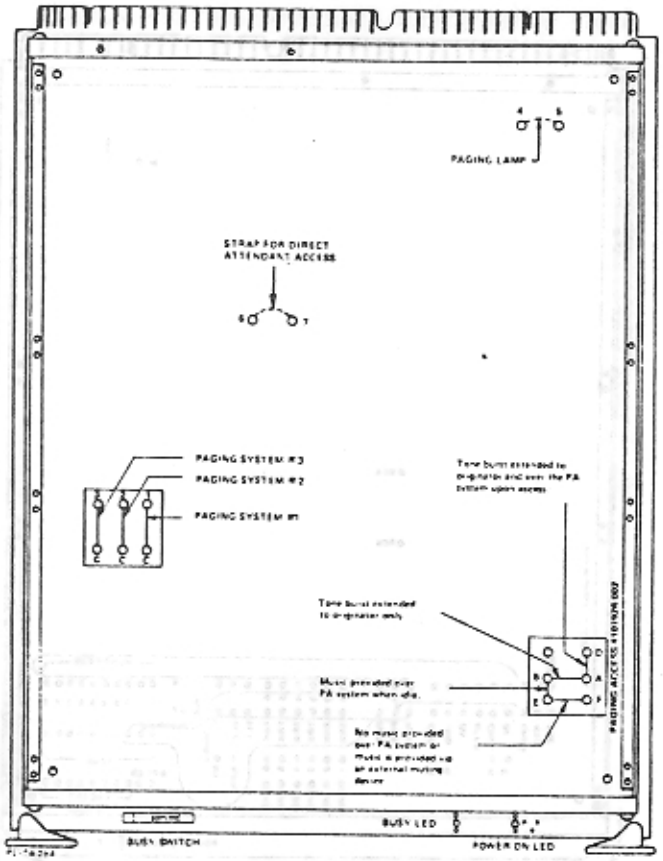

FIGURE 1.02 Paging Access PCB Strapping (TD-4101926-002)

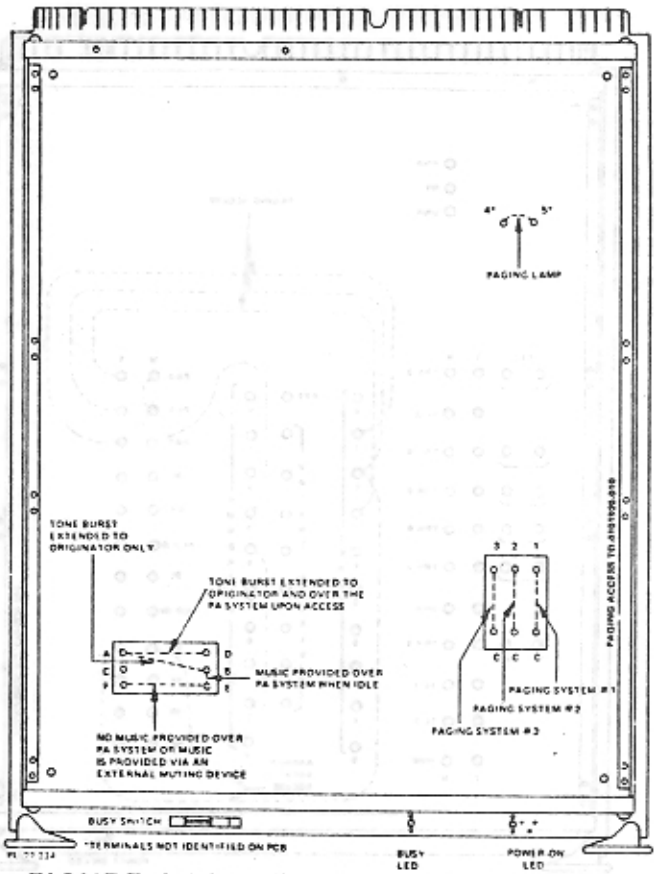

FIGURE 1.03 Paging Access PCB Strapping (TD-4101926-010)

FEATURE STRAPPING
TD-100
MESSAGE REGISTRATION SERVICE

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1.01 Message Registration Strapping, MMRIB PCB, TD-4102276-001 . . 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 message registration feature. This information is applicable to MMRIA PCB's numbered TD-4102266-001, MMRIB PCB's numbered TD-4102276-001, and message registration assemblies numbered TD-4102266-101. This document should be referred to when strapping the MMRIA and/or MMRIB for a new installation, or when adding or replacing either PCB in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. For message registration service, the system must be equipped with the MMRIA PCB, or the message registration assembly which is made up of the MMRIA PCB and the piggyback MMRIB PCB. The MMRIA PCB or the assembly mounts in position 27 of the trunk subrack.

The MMRIA parent board provides circuitry for metering completed calls made by up to 75 stations, via one or more selected trunk groups. With the additional MMRIB PCB, circuitry is provided for metering completed calls from 25 additional stations and for third wire metering of up to 24 trunks.

2.02 MMRIA PCB Strapping. Arrangement of the strapping terminals of the MMRIA PCB is shown in figure 1.00. Strap these terminals as follows:

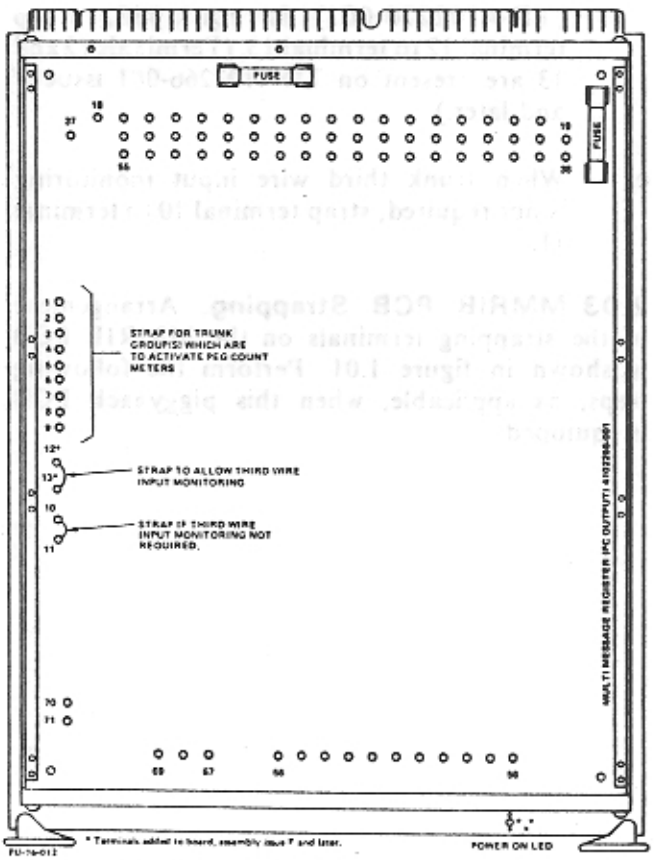

FIGURE 1.00 Message Registration Strapping, MMRIA PCB, TD-4102266-001.

a. Trunk group allocation. To identify the trunks over which calls will be metered, the trunk group identity must be strapped.

   1. To meter calls via trunk group 1, strap terminal 2 to terminal 9.

   2. To meter calls via trunk group 2, strap terminal 1 to terminal 5.

   3. To meter calls via trunk group 3, strap terminal 3 to terminal 6.

   4. To meter calls via trunk group 4, strap terminal 3 to terminal 7.

   5. To meter calls via trunk group 5, strap terminal 2 to terminal 8.

   6. To meter calls via trunk group 6, strap terminal 1 to terminal 4.

b. To permit monitoring of trunk third wire input when the piggyback MMRIB PCB (TD-4102276-001) is equipped, strap terminal 12 to terminal 13. (Terminals 12 and 13 are present on TD-4102266-001 issue F and later.)

c. When trunk third wire input monitoring is not required, strap terminal 10 to terminal 11.

2.03 MMRIB PCB Strapping. Arrangement of the strapping terminals on the MMRIB PCB is shown in figure 1.01. Perform the following steps, as applicable, when this piggyback PCB is equipped.

a. For each trunk that returns ground on the sleeve lead, strap the applicable terminal A to terminal B on the MMRIB PCB.

NOTE: Strapping of the A and B terminals is not necessary for trunks that return battery on the S lead.

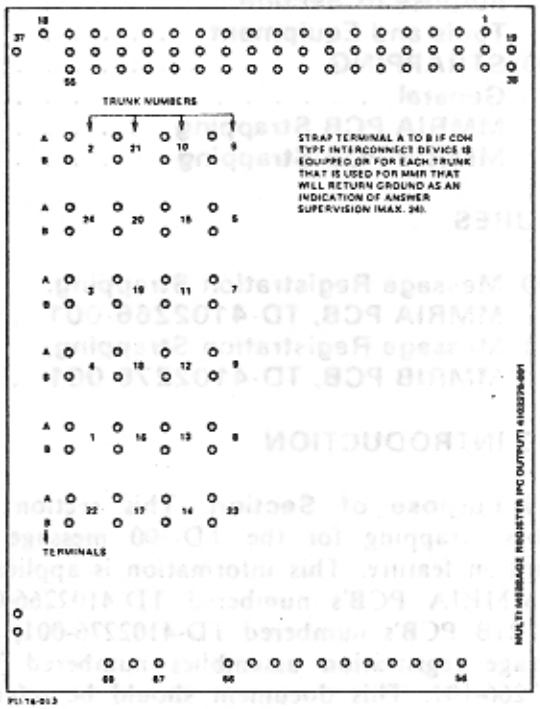

FIGURE 1.01 Message Registration Strapping, MMRIB PCB, TD-4102276-001.

FEATURE STRAPPING AND PROM PROGRAMMING TD-100 TOLL RESTRICTOR PCB (TD-4102286-001, -010)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping and PROM (programmable read only memory) programming for the TD-100 toll restrictor. This information is applicable to toll restrictor PCB's numbered TD-4102286-001 and -010. It should be referred to when strapping or programming the toll restrictor PCB for a new installation, or when adding or replacing the toll restrictor PCB in a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. Toll restriction is an optional feature of the TD-100 EPABX. This service is provided by adding one, two, or three custom programmed toll restrictor PCB's to the system. In systems equipped with channel motherboard TD-4101716-002, the boards may be mounted in card positions 10 through 14 of the channel subrack. In systems equipped with channel motherboard TD-4101716-003, the boards may be mounted in card positions 10 through 13 of the channel subrack.

Each toll restrictor PCB is arranged to accommodate from one to four programmable read only memory (PROM) units. The PROM's contain the area codes, office codes, and specific numbers to be allowed or denied. They are normally programmed in the factory according to information received from the customer. Strapping terminals on each PCB are provided for assigning the PROM's to the applicable trunk groups and for other functions. Strapping and PROM programming are therefore interdependent.

2.02 Information Required. A customer request form is used to determine the number of toll restrictor PCB's for a particular application, and to record which trunk groups will be toll restricted, what specific codes and numbers will be allowed and denied, and any special instructions. The form and instructions for its completion are included in ITT practice MA-000-002. For each trunk group requiring toll restriction, one such form should be filled out and submitted to ITT Telecommunications when ordering the toll restrictor PCB. A copy of the form and all applicable strapping and programming information will be returned to the customer with each toll restrictor PCB. Factory strapping will be noted on the ordering form.

2.03 Purpose of Strapping Terminals. Arrangement of the strapping terminals on the toll restrictor PCB is illustrated in figure 1.00. The purpose of each strapping terminal is discussed in the following paragraphs.

a. TK1-TK6, trunk group identity terminals. These terminals are used to strap the trunk group to be restricted to the PROM's containing the respective program. On PCB's with factory programmed PROM's, these terminals will be strapped prior to shipment.

b. TL1-TL3, tie trunk group identity terminals. These terminals are used to strap the tie trunk group to be restricted to the PROM's containing the respective programs. On PCB's with factory programmed PROM's, these terminals will be strapped prior to shipment.

c. P1A/P1B-P4A/P4B, PROM identity terminals. Each of these terminals corresponds to a half PROM. P1A and P1B are associated with PROM 1, P2A and P2B with PROM 2, etc. Where a restriction program for a particular trunk group or tie trunk group uses more than a half PROM, the terminals of all half PROM's containing the program must be strapped together. One of the terminals must also be strapped to the respective trunk group or tie trunk group identity terminals. On PCB's with factory programmed PROM's, these terminals will be strapped prior to shipment.

d. A1 & AD1, allow or deny terminals for PROM 1.
A2 & AD2, allow or deny terminals for PROM 2.
A3 & AD3, allow or deny terminals for PROM 3.
A4 & AD4, allow or deny terminals for PROM 4.

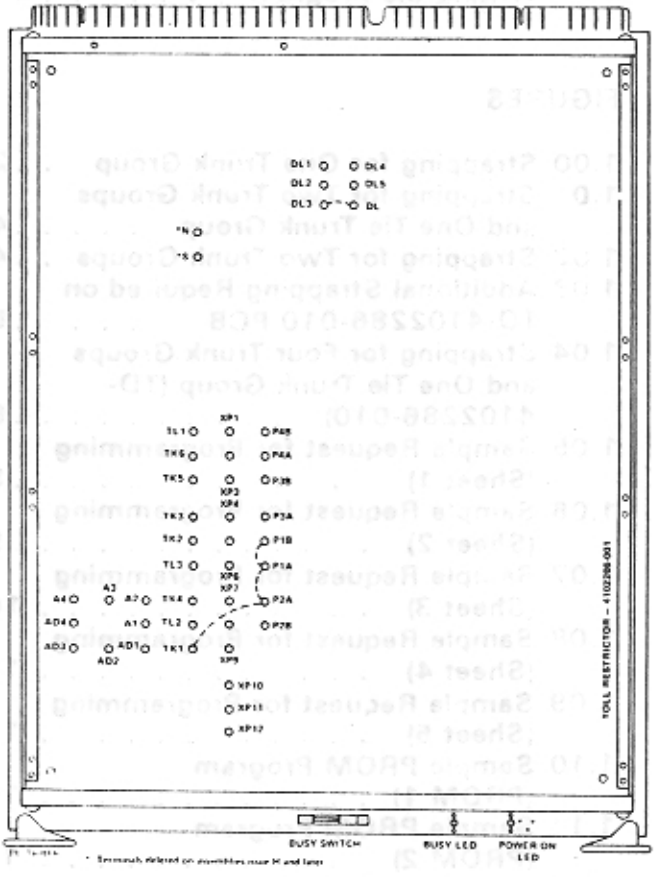

FIGURE 1.00 Strapping for One Trunk Group

Strap the respective A( ) to AD( ) terminals if all codes not programmed are to be allowed. Do not strap if all codes not programmed are to be denied. When more than one PROM is used for a particular trunk or tie trunk group, a strap must be provided for each PROM if all non-programmed codes are to be allowed. On PCB's with factory programmed PROM's, these terminals will be strapped prior to shipment.

e. Dl & DL (1-5), dial tone delay timing terminals. These terminals are used to equip the trunks to accommodate central office dial tone delay. They must be strapped by installation personnel on site. Strap as follows:

1. Strap DL to DL1 for 0.4 seconds delay.
2. Strap DL to DL2 for 0.8 seconds delay.
3. Strap DL to DL3 for 1.6 seconds delay.
4. Strap DL to DL4 for 3.2 seconds delay.
5. Strap DL to DL5 for 6.4 seconds delay.

NOTE: If the toll restrictor PCB serves more than one trunk or tie trunk group, strap these terminals to meet the requirements of the group with the longest delay time.

f. XP1-XP12. These terminals are provided for flexibility in assigning trunk or tie trunk groups to PROM's. They are arranged in four sets of three. Terminals XP1-XP3 are one set, XP4-XP6 are the second set, XP7-XP9 are the third set, and XP10-XP12 the fourth set. The first two terminals in each set are AND gate inputs; the third terminal is the AND gate output. These terminals permit a trunk or tie trunk group to share the program in a PROM or half PROM with another trunk or tie trunk group while maintaining the separation between other PROM's that may be used by the same two trunk groups. On PCB's with factory programmed PROM's, these terminals will be strapped prior to shipment.

g. E1, E4, E5 & E7. These terminals are equipped on TD-4102286-010 toll restrictor PCB's. Terminal E1 must be strapped to E4 to provide -12V for the components on the PCB. Terminals E5 and E7 are not strapped.

h. Class of service strapping. Where tool restriction is being added to a working system, strapping on the class of service PCB may have to be changed. Refer to section OB-410-160 for information concerning toll restriction.

2.04 Strapping Examples. Five examples of toll restrictor PCB strapping are shown in figures 1.00, 1.01, 1.02, 1.03 and 1.04. The first three examples show the TD-4102286-001 PCB and the last two examples show the TD-4102286-010 PCB. With the exception of the E1, E4, E5 and E7 terminals, the strapping shown is applicable to either PCB. The examples are explained in paragraphs a, b, c, d and e.

a. Strapping for a single trunk group using one full PROM and a half PROM is shown in figure 1.00. An analysis of the strapping follows.

1. P1A to P1B. P1A to P2A. These straps connect the three half PROM's containing the restriction program.
2. TK1 to P2A. This strap assigns trunk group 1 to the program in half PROM's 1A, 1B and 2A.
3. DL to DL3. This strap sets dial tone delay timing for 1.6 seconds.

b. Strapping for two trunk groups and one tie trunk group is shown in figure 1.01. In this example, both trunk groups use the same programming. A separate program applies to the tie trunk group. An analysis of the strapping follows.

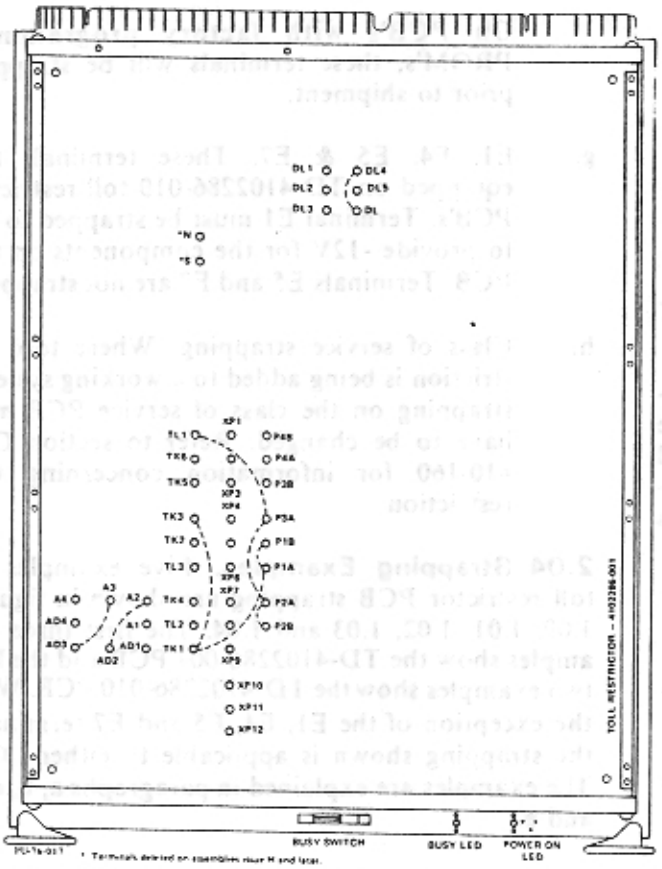

FIGURE 1.01 Strapping for Two Trunk Groups and One Tie Trunk Group

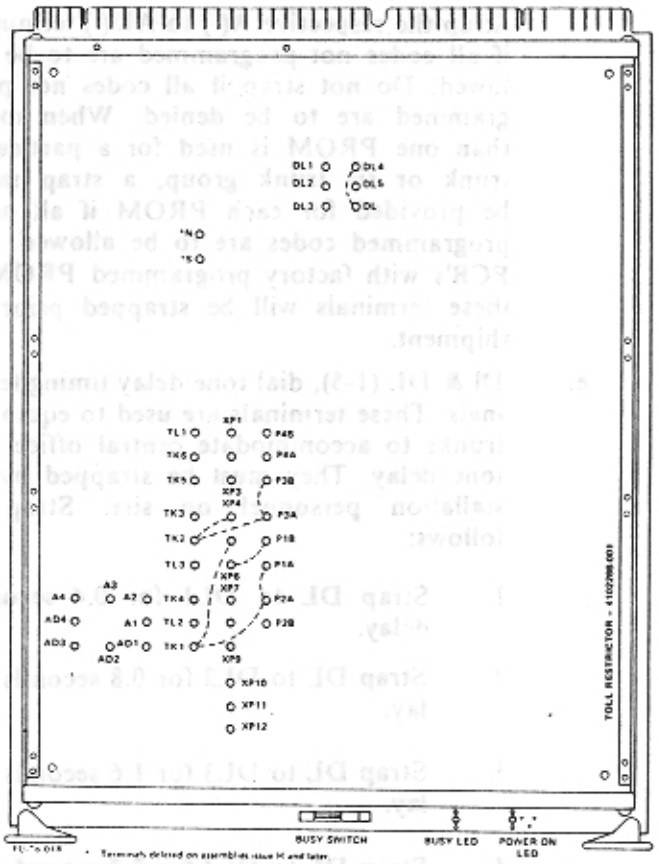

FIGURE 1.02 Strapping for Two Trunk Groups

1. P1A to P1B. This strap connects the two half PROM's containing the restriction program for the two trunk groups.

2. TK1 to P1A. TK3 to TK1. These straps assign trunk groups 1 and 3 to the program in half PROM's 1A and 1B.

3. P2A to P2B. P2A to P3A. These straps connect the three half PROM's containing the restriction program for the tie trunk group.

4. TL1 to P3A. This strap assigns tie trunk group 1 to the program in half PROM's 2A, 2B, and 3A.

5. A2 to AD2. A3 to AD3. These straps are provided to allow all codes not programmed in half PROM's 2A, 2B, and 3A.

NOTE: Since no strap is provided for A1 to AD1, all codes not programmed in PROM 3 for trunk groups 1 and 3 will be denied.

6. DL to DL4. This strap sets dial tone delay timing for trunk groups 1 and 3 and tie trunk group 1 for 3.2 seconds.

c. Strapping for two trunk groups, where part of the program is the same for both groups is shown in figure 1.02. An analysis of the strapping follows.

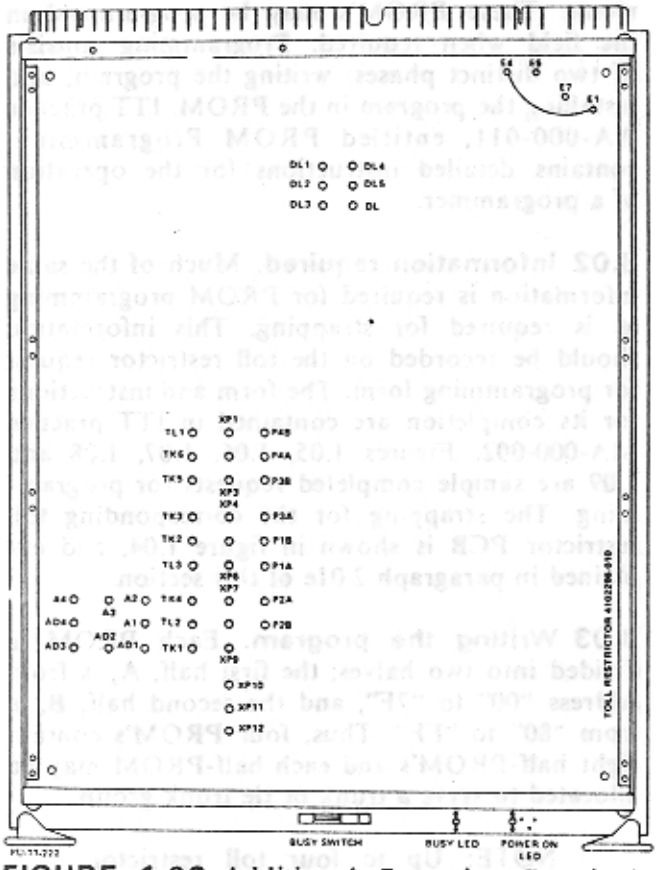

FIGURE 1.03 Additional Strapping Required on TD-4102286-010 PCB

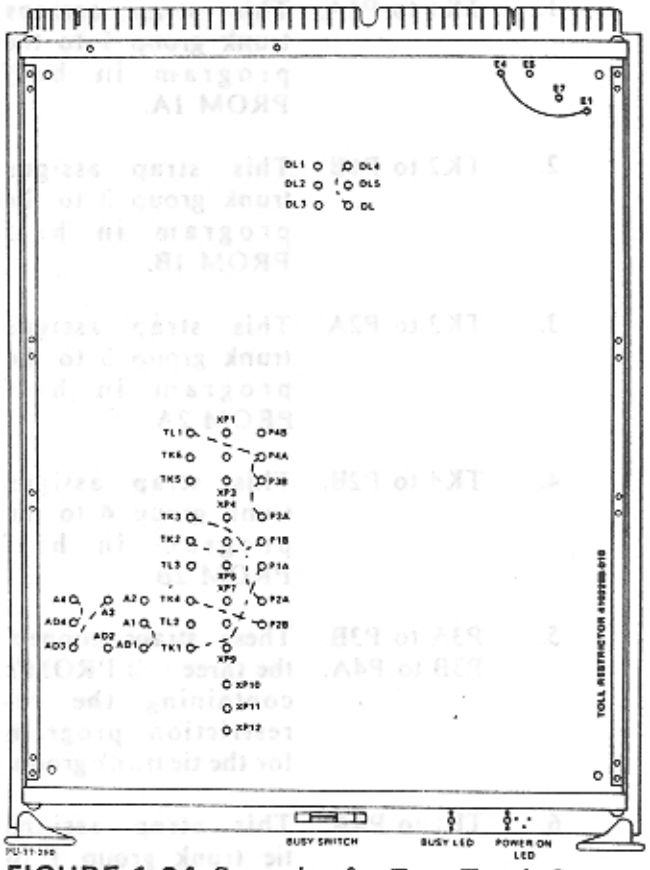

FIGURE 1.04 Strapping for Four Trunk Groups and One Tie Trunk Group (TD-4102286-010)

1. P1A to P2A. This strap connects the two half PROM's containing the unique portion of the program for the first trunk group.

2. TK1 to P2A. This strap assigns the trunk group 1 to the program in half PROM's 1A and 2A.

3. P3A to P3B. This strap connects the two half PROM's containing the unique portion of the program for the second trunk group.

4. TK2 to P3A. This strap assigns trunk group 2 to the program in half PROM's 3A and 3B.

5. TK1 to XP5. TK2 to XP4. XP6 to P1B. These straps assign both trunk groups to the program in half PROM 1B by way of the AND gate formed by XP4, XP5 and XP6.

6. DL to DL4. This strap sets dial tone delay timing for both trunk groups for 3.2 seconds.

d. On the TD-4102286-010 toll restrictor PCB, terminal E1 must be strapped to E4, as illustrated in figure 1.03, to provide -12V to the components on the PCB. Terminals E5 and E7 are not strapped.

e. Strapping for four trunk groups and one tie trunk group is shown in figure 1.04. An analysis of the strapping follows.

1. TK1 to P1A. This strap assigns trunk group 1 to the program in half PROM 1A.

2. TK2 to P1B. This strap assigns trunk group 2 to the program in half PROM 1B.

3. TK3 to P2A. This strap assigns trunk group 3 to the program in half PROM 2A.

4. TK4 to P2B. This strap assigns trunk group 4 to the program in half PROM 2B.

5. P3A to P3B. P3B to P4A. These straps connect the three half PROM's containing the re-restriction program for the tie trunk group.

6. TL1 to P4A. This strap assigns tie trunk group 1 to the program in half PROM's 3A, 3B and 4A.

7. A1 to AD1. A3 to AD3. A4 to AD4. These straps are to allow all codes not programmed in PROM's 1, 3, and 4.

NOTE: Since no strap is provided for A2 to AD2, all codes not programmed in PROM 2 for trunk groups 3 and 4 will be denied.

8. DL to DL4. This strap sets dial tone delay for trunk groups 1, 2, 3 and 4 and tie trunk group 1 for 3.2 seconds.

3.00 PROM PROGRAMMING

3.01 General. The toll restrictor PCB contains four PROM's which are normally programmed at the factory to accommodate customer requirements. These PROM's may be programmed in the field when required. Programming consists of two distinct phases: writing the program, and installing the program in the PROM. ITT practice AA-000-011, entitled PROM Programming, contains detailed instructions for the operation of a programmer.

3.02 Information required. Much of the same information is required for PROM programming as is required for strapping. This information should be recorded on the toll restrictor request for programming form. The form and instructions for its completion are contained in ITT practice MA-000-002. Figures 1.05, 1.06, 1.07, 1.08 and 1.09 are sample completed requests for programming. The strapping for the corresponding toll restrictor PCB is shown in figure 1.04, and explained in paragraph 2.01e of this section.

3.03 Writing the program. Each PROM is divided into two halves; the first half, A, is from address "00" to "7F", and the second half, B, is from "80" to "FF". Thus, four PROM's contain eight half-PROM's and each half-PROM may be allocated to serve a trunk or tie trunk group.

NOTE: Up to four toll restrictor PCB's may be used in each TD-100 system, but the restriction program for one trunk must be confined to a single toll restrictor PCB.

Each half-PROM will accommodate a maximum of 64 three-digit numbers that are to be allowed, denied or absorbed. This is based on the fact that a single one-, two- or three-digit number plus an action character requires two addresses. Table 1.00 lists the action characters that may be used, and the meaning of each.

PROM programs are written one step at a time, but still within an overview of the entire program. Once the required programming information is assembled, it must be translated to a series of hexadecimal codes. Table 1.01 shows the code series required to perform each possible toll restriction operation; the addresses shown are only for reference and could be any from "00" to "FF."

Figures 1.10, 1.11, 1.12 and 1.13 are sample toll restriction programs. The programs will execute toll restriction as requested in the sample requests

for programming previously presented. A comparison of the sample requests for programming, table 1.01, and the sample programs reveals the program writing methods.

For example, in figure 1.05 there is a request to allow the area code 800 and deny all other area codes. The request also states that 1+ dialing to the CO is used. In table 1.01, the code series to absorb one digit is

Address	Data
01	TF
01	FC

where T is the digit to be absorbed, F is a filler character, and C is the absorb action character. In figure 1.10 at address "01" and "02," is the code series to absorb 1 as the first digit. The 1 (for 1+ dialing to the CO) is absorbed rather than allowed to eliminate the need to program allow codes for all other first digits. The codes at addresses "05" through "34" deny all possible area codes except 800. Thus, even though 1+ dialing is not denied, the program ensures that 1+ any area code other than 800 is denied. Note that 0+ dialing is denied at addresses "03" and "04." The remainder of the program from address "35" through "78" is used to deny the specific office codes as requested in the sample shown in figure 1.05. Note also, that the begin program code is at address "00." The begin program code does not have to be placed at address "00," but it must be placed somewhere within the program and address "00" is a likely choice.

It is important to realize that programs may be written many different ways and still accomplish the same objectives. The skilled program writer will avoid duplication and omission, and construct programs that are concise and complete. A study of the sample programs presented here will enable personnel to construct custom programs for the toll restrictor PCB.

TOLL RESTRICTOR

REQUEST FOR PROGRAMMING

Request for (Company Name) MODERN TELEPHONE COMPANY		Customer P.O. Number 407-1-76	Special Instructions
Address 1000 MAIN STREET		ITT S.T. Number	
City MIDDLEBURG	State TENNESSEE / Zip Code 38340	Date OCTOBER 7, 1976	
Telephone (615) 555-4411	Originator JOE H. REELS	SHEET 1 OF 5	

THIS SHEET IS FOR TRUNK GROUP NUMBER TK1 ONLY.

	AREA CODES	OFFICE CODES	SPECIAL SERVICE CODES	OTHER
ALLOW	800	ALL OTHER		
DENY	ALL OTHER	235, 282, 296, 329, 335, 364, 444, 698, 769, 237, 287, 298, 331, 337, 383, 449, 749, 925, 784, 843, 929, 265, 828, 288, 326, 333, 361, 436, 696, 762, 825, 848, 961, 963	0	
ABSORB	NONE	NONE		

Is 1+ Dailing to the CO used? YES
Is 0+ Dialing to the CO used? YES

NOTES:

PU-77-251

FIGURE 1.05 Sample Request for Programming (Sheet 1)

TOLL RESTRICTOR

REQUEST FOR PROGRAMMING

Request for (Company Name): MODERN TELEPHONE COMPANY			Customer P.O. Number: 407-1-76	Special Instructions
Address: 1000 MAIN STREET			ITT S.T. Number:	
City: MIDDLEBURG	State: TENNESSEE	Zip Code: 38340	Date: OCTOBER 7, 1976	
Telephone: (615) 555-4411	Originator: JOE H. REELS		SHEET 2 OF 5	

THIS SHEET IS FOR TRUNK GROUP NUMBER TK2 ONLY.

	AREA CODES	OFFICE CODES	SPECIAL SERVICE CODES	OTHER
ALLOW	NONE	ALL LOCAL		
DENY	ALL	ALL TOLL	0, 1	
ABSORB				

Is 1+ Dailing to the CO used? YES
Is 0+ Dialing to the CO used? YES

NOTES:

PU-77-252

FIGURE 1.06 Sample Request for Programming (Sheet 2)

TOLL RESTRICTOR

REQUEST FOR PROGRAMMING

Request for (Company Name): MODERN TELEPHONE COMPANY		Customer P.O. Number: 407-1-76	Special Instructions
Address: 1000 MAIN STREET		ITT S.T. Number:	
City: MIDDLEBURG	State: TENNESSEE / Zip Code: 38340	Date: OCTOBER 7, 1976	
Telephone: (615) 555-4411	Originator: JOE H. REELS	SHEET 3 OF 5	

THIS SHEET IS FOR TRUNK GROUP NUMBER TK3 ONLY.

	AREA CODES	OFFICE CODES	SPECIAL SERVICE CODES	OTHER
ALLOW	NONE	359		
DENY	ALL	ALL OTHER	0,1	
ABSORB				

Is 1+ Dailing to the CO used? YES
Is 0+ Dialing to the CO used? YES

NOTES:

PU-77-253

FIGURE 1.07 Sample Request for Programmig (Sheet 3)

TOLL RESTRICTOR

REQUEST FOR PROGRAMMING

Request for (Company Name) MODERN TELEPHONE COMPANY			Customer P.O. Number 407-1-76	Special Instructions
Address 1000 MAIN STREET			ITT S.T. Number	
City MIDDLEBURG	State TENNESSEE	Zip Code 38340	Date OCTOBER 7, 1976	
Telephone (615) 555-4411	Originator JOE H. REELS		SHEET 4 OF 5	

THIS SHEET IS FOR TRUNK GROUP NUMBER TK4 ONLY.

	AREA CODES	OFFICE CODES	SPECIAL SERVICE CODES	OTHER
ALLOW	NONE	268, 346, 351, 352, 353, 354, 356, 358, 359, 425, 429, 623, 624, 627, 634, 638, 735, 753, 786, 942, 947, 355		
DENY	ALL	ALL OTHER	0, 1	
ABSORB				

Is 1+ Dialing to the CO used? YES
Is 0+ Dialing to the CO used? YES

NOTES:

PU-77-254

FIGURE 1.08 Sample Request for Programming (Sheet 4)

TOLL RESTRICTOR

REQUEST FOR PROGRAMMING

Request for (Company Name): MODERN TELEPHONE COMPANY		Customer P.O. Number: 407-1-76	Special Instructions
Address: 1000 MAIN STREET		ITT S.T. Number:	
City: MIDDLEBURG	State: TENNESSEE	Zip Code: 38340	Date: OCTOBER 7, 1976
Telephone: (615)555-4411	Originator: JOE H. REELS		SHEET 5 OF 5

THIS SHEET IS FOR TRUNK GROUP NUMBER TL1 ONLY.

	AREA CODES	OFFICE CODES	SPECIAL SERVICE CODES	OTHER
ALLOW	9+1+800	9+ANY OFFICE CODE NOT LISTED BELOW		
DENY	ALL OTHER	9+235, 282, 296, 329, 335, 364, 444, 698, 769, 237, 287, 298, 331, 337, 383, 449, 749, 925, 784, 843, 929, 265, 828, 288, 326, 333, 361, 436, 696, 762, 825, 848, 961, 963		
ABSORB				

Is 1+ Dailing to the CO used? _____
Is 0+ Dialing to the CO used? _____

NOTES: FOR TIE TRUNK ACCESS, STATION USERS DIAL 9. ON RECEIPT OF DISTANT PABX DIAL TONE, STATION USERS DIAL 9+THE OFFICE CODE AND NUMBER.

PU-77-255

FIGURE 1.09 Sample Request for Programming (Sheet 5)

TOLL RESTRICTOR PROM PROGRAMMING (PCB 1)

TRUNK GROUP TK1 PROM 1 A						TRUNK GROUP TK2 PROM 1 B					
AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS
00	FB	START OF PROGRAM	40	4D	DENY 364	80	FB	START OF PROGRAM	C0		
01	1F	ABSORB 1	41	44	DENY 444	81	0F	DENY 0	C1		
02	FC		42	4D		82	FD		C2		
03	0F	DENY 0+	43	69	DENY 698	83	1F	DENY 1	C3		
04	FD		44	8D		84	FD		C4		
05	20	DENY 20	45	76	DENY 769	85	20	DENY 20	C5		
06	FD		46	9D		86	FD		C6		
07	21	DENY 21	47	23	DENY 237	87	21	DENY 21	C7		
08	FD		48	7D		88	FD		C8		
09	30	DENY 30	49	28	DENY 287	89	30	DENY 30	C9		
0A	FD		4A	7D		8A	FD		CA		
0B	31	DENY 31	4B	29	DENY 298	8B	31	DENY 31	CB		
0C	FD		4C	8D		8C	FD		CC		
0D	40	DENY 40	4D	33	DENY 331	8D	40	DENY 40	CD		
0E	FD		4E	1D		8E	FD		CE		
0F	41	DENY 41	4F	33	DENY 337	8F	41	DENY 41	CF		
10	FD		50	7D		90	FD		D0		
11	50	DENY 50	51	38	DENY 383	91	50	DENY 50	D1		
12	FD		52	3D		92	FD		D2		
13	51	DENY 51	53	44	DENY 449	93	51	DENY 51	D3		
14	FD		54	9D		94	FD		D4		
15	60	DENY 60	55	74	DENY 749	95	60	DENY 60	D5		
16	FD		56	9D		96	FD		D6		
17	61	DENY 61	57	92	DENY 925	97	61	DENY 61	D7		
18	FD		58	5D		98	FD		D8		
19	70	DENY 70	59	78	DENY 784	99	70	DENY 70	D9		
1A	FD		5A	4D		9A	FD		DA		
1B	71	DENY 71	5B	84	DENY 843	9B	71	DENY 71	DB		
1C	FD		5C	3D		9C	FD		DC		
1D	81	DENY 81	5D	92	DENY 929	9D	80	DENY 80	DD		
1E	FD		5E	9D		9E	FD		DE		
1F	90	DENY 90	5F	26	DENY 265	9F	81	DENY 81	DF		
20	FD		60	5D		A0	FD		E0		
21	91	DENY 91	61	82	DENY 828	A1	90	DENY 90	E1		
22	FD		62	8D		A2	FD		E2		
23	80	DENY 801	63	28	DENY 288	A3	91	DENY 91	E3		
24	1D		64	8D		A4	FD		E4		
25	80	DENY 802	65	32	DENY 326	A5			E5		
26	2D		66	6D		A6			E6		
27	80	DENY 803	67	33	DENY 333	A7			E7		
28	3D		68	3D		A8			E8		
29	80	DENY 804	69	36	DENY 361	A9			E9		
2A	4D		6A	1D		AA			EA		
2B	80	DENY 805	6B	43	DENY 436	AB			EB		
2C	5D		6C	6D		AC			EC		
2D	80	DENY 806	6D	69	DENY 696	AD			ED		
2E	6D		6E	6D		AE			EE		
2F	80	DENY 807	6F	72	DENY 726	AF			EF		
30	7D		70	6D		B0			F0		
31	80	DENY 808	71	82	DENY 825	B1			F1		
32	8D		72	5D		B2			F2		
33	80	DENY 809	73	84	DENY 848	B3			F3		
34	9D		74	8D		B4			F4		
35	23	DENY 235	75	96	DENY 961	B5			F5		
36	5D		76	1D		B6			F6		
37	28	DENY 282	77	96	DENY 963	B7			F7		
38	2D		78	3D		B8			F8		
39	29	DENY 296	79			B9			F9		
3A	6D		7A			BA			FA		
3B	32	DENY 329	7B			BB			FB		
3C	9D		7C			BC			FC		
3D	33	DENY 335	7D			BD			FD		
3E	5D		7E			BE			FE		
3F	36		7F			BF			FF		

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FIGURE 1.10 Sample PROM Program (PROM 1)

TOLL RESTRICTOR PROM PROGRAMMING (PCB 1)

TRUNK GROUP TK3 PROM 2 A						TRUNK GROUP TK4 PROM 2 B					
AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS
00	FB	START OF PROGRAM	40			80	FB	START OF PROGRAM	C0		
01	0F	DENY 0+	41			81	0F	DENY 0+	C1		
02	FD		42			82	FD		C2		
03	1F	DENY 1+	43			83	1F	DENY 1+	C3		
04	FD		44			84	FD		C4		
05	35	ALLOW 359	45			85	26	ALLOW 268	C5		
06	9A		46			86	8A		C6		
07			47			87	34	ALLOW 346	C7		
08			48			88	6A		C8		
09			49			89	35	ALLOW 351	C9		
0A			4A			8A	1A		CA		
0B			4B			8B	35	ALLOW 352	CB		
0C			4C			8C	2A		CC		
0D			4D			8D	35	ALLOW 353	CD		
0E			4E			8E	3A		CE		
0F			4F			8F	35	ALLOW 354	CF		
10			50			90	4A		D0		
11			51			91	35	ALLOW 356	D1		
12			52			92	6A		D2		
13			53			93	35	ALLOW 358	D3		
14			54			94	8A		D4		
15			55			95	35	ALLOW 359	D5		
16			56			96	9A		D6		
17			57			97	42	ALLOW 425	D7		
18			58			98	5A		D8		
19			59			99	42	ALLOW 429	D9		
1A			5A			9A	9A		DA		
1B			5B			9B	62	ALLOW 623	DB		
1C			5C			9C	3A		DC		
1D			5D			9D	62	ALLOW 624	DD		
1E			5E			9E	4A		DE		
1F			5F			9F	62	ALLOW 627	DF		
20			60			A0	7A		E0		
21			61			A1	63	ALLOW 634	E1		
22			62			A2	4A		E2		
23			63			A3	63	ALLOW 638	E3		
24			64			A4	8A		E4		
25			65			A5	73	ALLOW 735	E5		
26			66			A6	5A		E6		
27			67			A7	75	ALLOW 753	E7		
28			68			A8	3A		E8		
29			69			A9	78	ALLOW 786	E9		
2A			6A			AA	6A		EA		
2B			6B			AB	94	ALLOW 942	EB		
2C			6C			AC	2A		EC		
2D			6D			AD	94	ALLOW 947	ED		
2E			6E			AE	7A		EE		
2F			6F			AF	35	ALLOW 355	EF		
30			70			B0	5A		F0		
31			71			B1			F1		
32			72			B2			F2		
33			73			B3			F3		
34			74			B4			F4		
35			75			B5			F5		
36			76			B6			F6		
37			77			B7			F7		
38			78			B8			F8		
39			79			B9			F9		
3A			7A			BA			FA		
3B			7B			BB			FB		
3C			7C			BC			FC		
3D			7D			BD			FD		
3E			7E			BE			FE		
3F			7F			BF			FF		

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FIGURE 1.11 Sample PROM Program (PROM 2)

TOLL RESTRICTOR PROM PROGRAMMING (PCB 1)

TRUNK GROUP TL1 PROM 3 A						TRUNK GROUP TL1 PROM 3 B					
ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS
00	FB	START OF PROGRAM	40	BE	DENY 9+1+81	80	92		C0	FD	
01	91	ALLOW 9+1+800	41	1F		81	BE	DENY 9+282	C1	93	
02	BE		42	FF		82	2F		C2	BE	DENY 9+383
03	00		43	FD		83	FF		C3	3F	
04	FF		44	91		84	FD		C4	FF	
05	FA		45	9E	DENY 9+1+90	85	92		C5	FD	
06	90	DENY 9+0	46	0F		86	2E	DENY 9+226	C6	94	
07	FD		47	FF		87	6F		C7	4E	DENY 9+449
08	91		48	FD		88	FF		C8	9F	
09	2E	DENY 9+1+20	49	91		89	FD		C9	FF	
0A	0F		4A	9E	DENY 9+1+91	8A	93		CA	FD	
0B	FF		4B	1F		8B	2E	DENY 9+329	CB	97	
0C	FD		4C	FF		8C	9F		CC	4E	DENY 9+749
0D	91		4D	FD		8D	FF		CD	9F	
0E	2E	DENY 9+1+21	4E	91		8E	FD		CE	FF	
0F	1F		4F	BE	DENY 9+1+801	8F	93		CF	FD	
10	FF		50	01		90	3E	DENY 9+335	D0	99	
11	FD		51	FF		91	5F		D1	2E	DENY 9+925
12	91		52	FD		92	FF		D2	5F	
13	3E	DENY 9+1+30	53	91		93	FD		D3	FF	
14	0F		54	BE	DENY 9+1+802	94	93		D4	FD	
15	FF		55	02		95	6E	DENY 9+364	D5	97	
16	FD		56	FF		96	4F		D6	BE	DENY 9+784
17	91		57	FD		97	FF		D7	4F	
18	3E	DENY 9+1+31	58	91		98	FD		D8	FF	
19	1F		59	8E	DENY 9+1+803	99	94		D9	FD	
1A	FF		5A	03		9A	4E	DENY 9+444	DA	98	
1B	FD		5B	FF		9B	4F		DB	4E	DENY 9+843
1C	91		5C	FD		9C	FF		DC	3F	
1D	4E	DENY 9+1+40	5D	91		9D	FD		DD	FF	
1E	0F		5E	BE	DENY 9+1+804	9E	96		DE	FD	
1F	FF		5F	04		9F	9E	DENY 9+698	DF	99	
20	FD		60	FF		A0	BF		E0	2E	DENY 9+929
21	91		61	FD		A1	FF		E1	9F	
22	4E	DENY 9+1+41	62	91		A2	FD		E2	FF	
23	1F		63	8E	DENY 9+1+805	A3	97		E3	FD	
24	FF		64	05		A4	6E	DENY 9+769	E4	92	
25	FD		65	FF		A5	9F		E5	6E	DENY 9+265
26	91		66	FD		A6	FF		E6	5F	
27	5E	DENY 9+1+50	67	91		A7	FD		E7	FF	
28	0F		68	8E	DENY 9+1+806	A8	92		E8	FD	
29	FF		69	06		A9	3E	DENY 9+237	E9	98	
2A	FD		6A	FF		AA	7F		EA	2E	DENY 9+828
2B	91		6B	FD		AB	FF		EB	BF	
2C	5E	DENY 9+1+51	6C	91		AC	FD		EC	FF	
2D	1F		6D	8E	DENY 9+1+807	AD	92		ED	FD	
2E	FF		6E	07		AE	BE	DENY 9+287	EE	92	
2F	FD		6F	FF		AF	7F		EF	BE	DENY 9+288
30	91		70	FD		B0	FF		F0	BF	
31	6E	DENY 9+1+60	71	91		B1	FD		F1	FF	
32	0F		72	8E	DENY 9+1+808	B2	92		F2	FD	
33	FF		73	08		B3	9E	DENY 9+298	F3	93	
34	FD		74	FF		B4	BF		F4	2E	DENY 9+326
35	91		75	FD		B5	FF		F5	6F	
36	6E	DENY 9+1+61	76	91		B6	FD		F6	FF	
37	1F		77	8E	DENY 9+1+809	B7	93		F7	FD	
38	FF		78	09		B8	3E	DENY 9+331	F8	93	
39	FD		79	FF		B9	1F		F9	3E	DENY 9+333
3A	91		7A	FD		BA	FF		FA	3F	
3B	7E	DENY 9+1+70	7B	92		BB	FD		FB	FF	
3C	0F		7C	3E	DENY 9+235	BC	93		FC	FD	
3D	FF		7D	5F		BD	3E	DENY 9+337	FD	93	
3E	FD		7E	FF		BE	7F		FE	6E	DENY 9+361
3F	91		7F	FD		BF	FF		FF	1F	

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FIGURE 1.12 Sample PROM Program (PROM 3)

TOLL RESTRICTOR PROM PROGRAMMING (PCB 1)

TRUNK GROUP TL1 PROM 4 A						TRUNK GROUP ____ PROM __ B					
AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS
00	FF		40			80			C0		
01	FD		41			81			C1		
02	94		42			82			C2		
03	3E	DENY	43			83			C3		
04	6F	9+436	44			84			C4		
05	FF		45			85			C5		
06	FD		46			86			C6		
07	96		47			87			C7		
08	9E	DENY	48			88			C8		
09	6F	9+696	49			89			C9		
0A	FF		4A			8A			CA		
0B	FD		4B			8B			CB		
0C	97		4C			8C			CC		
0D	6E	DENY	4D			8D			CD		
0E	2F	9+762	4E			8E			CE		
0F	FF		4F			8F			CF		
10	FD		50			90			D0		
11	98		51			91			D1		
12	2E	DENY	52			92			D2		
13	5F	9+825	53			93			D3		
14	FF		54			94			D4		
15	FD		55			95			D5		
16	98		56			96			D6		
17	4E	DENY	57			97			D7		
18	8F	9+848	58			98			D8		
19	FF		59			99			D9		
1A	FD		5A			9A			DA		
1B	99		5B			9B			DB		
1C	6E	DENY	5C			9C			DC		
1D	1F	9+961	5D			9D			DD		
1E	FF		5E			9E			DE		
1F	FD		5F			9F			DF		
20	99		60			A0			E0		
21	6E	DENY	61			A1			E1		
22	3F	9+963	62			A2			E2		
23	FF		63			A3			E3		
24	FD		64			A4			E4		
25			65			A5			E5		
26			66			A6			E6		
27			67			A7			E7		
28			68			A8			E8		
29			69			A9			E9		
2A			6A			AA			EA		
2B			6B			AB			EB		
2C			6C			AC			EC		
2D			6D			AD			ED		
2E			6E			AE			EE		
2F			6F			AF			EF		
30			70			B0			F0		
31			71			B1			F1		
32			72			B2			F2		
33			73			B3			F3		
34			74			B4			F4		
35			75			B5			F5		
36			76			B6			F6		
37			77			B7			F7		
38			78			B8			F8		
39			79			B9			F9		
3A			7A			BA			FA		
3B			7B			BB			FB		
3C			7C			BC			FC		
3D			7D			BD			FD		
3E			7E			BE			FE		
3F			7F			BF			FF		

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FIGURE 1.13 Sample PROM Program (PROM 4)

TABLE 1.00 Action Characters

CHARACTER	MEANING
A	Allow
B	Begin Program
C	Absorb
D	Deny
E	More to Follow
F	Filler Character

TABLE 1.01 PROM Programming Code Series

ADDRESS	DATA	FUNCTION
01	TF	Allow One Digit (T)
02	FA	
01	TU	Allow Two Digits (T, U)
02	FA	
01	TU	Allow Three Digits (T, U, V)
02	VA	
01	TU	Allow Four Digits (T, U, V, W)
02	VE	
03	WF	
04	FF	
05	FA	
01	TU	Allow Five Digits (T, U, V, W, X)
02	VE	
03	WX	
04	FF	
05	FA	
01	TU	Allow Six Digits (T, U, V, W, X, Y)
02	VE	
03	WX	
04	YF	
05	FA	
01	TU	Allow Seven Digits (T, U, V, W, X, Y, Z)
02	VE	
03	WX	
04	YZ	
05	FA	
01	TF	Deny One Digit (T)
02	FD	
01	TU	Deny Two Digits (T, U)
02	FD	
01	TU	Deny Three Digits (T, U, V)
02	VD	
01	TU	Deny Four Digits (T, U, V, W)
02	VE	
03	WF	
04	FF	
05	FD	

TABLE 1.01 PROM Programming Code Series (Cont.)

ADDRESS	DATA	FUNCTION
01	TU	
02	VE	
03	WX	Deny Five Digits (T, U, V, W, X)
04	FF	
05	FD	
01	TU	
02	VE	
03	WX	Deny Six Digits (T, U, V, W, X, Y)
04	YF	
05	FD	
01	TU	
02	VE	
03	WX	Deny Seven Digits (T, U, V, W, X, Y, Z)
04	YZ	
05	FD	
01	TF	Absorb One Digit (T)
02	FC	
01	TU	Absorb Two Digits (T, U)
02	FC	
01	TU	Absorb Three Digits (T, U, V)
02	VC	

FEATURE STRAPPING AND PROM PROGRAMMING TD-100 NUMBER TRANSLATOR PCB (TD-4102946-001)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping and PROM (programmable read only memory) programming for the TD-100 number translator. This information is applicable to number translator PCB's numbered TD-4102946-001. It should be referred to when strapping or programming the number translator PCB for a new installation, or when adding or replacing the number translator PCB in a working system.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. Number translation is an optional feature of the TD-100 EPABX. This service is provided by adding a custom programmed number translator PCB to the system. In systems equipped with channel motherboard numbered TD-4101716-003, the PCB mounts in position 12 of the channel subrack. (TD-100 systems equipped with standard Z wiring require modification kit 16192 ( )79 to place the number translator PCB in service.)

The number translator PCB is used to translate dialed numbers into TD-100 equipment numbers. Its primary application is as a room number translator in hotel/motel systems. In such applications, it can be used to translate two- and three-digit special service numbers or room numbers into three-digit station numbers.

Each number translator PCB is equipped with two programmable read only memory (PROM) units. The PROM's contain the dialed number codes and TD-100 station numbers to which they are to be translated. The PROM's are normally programmed in the factory according to information received from the customer. Strapping terminals on each PCB are provided for arranging the PROM's to accommodate customer translation requirements and for other purposes. Strapping and PROM programming are therefore interdependent.

Strapping on the number translator PCB and on the register PCB's is interrelated. Section OB-410-166 contains full information on strapping the system registers.

2.02 Information Required. A customer request form is used to determine the number translation required for a particular application as well as any special instructions. The form and instructions for its completion are included in ITT practice MA-000-002. The form should be completed and submitted to ITT Telecommunications when ordering the number translator PCB. A copy of the form and all applicable strapping and programming information will be returned to the customer with each PCB. Factory strapping will be noted on the ordering form.

2.03 Purpose of Strapping Terminals. Arrangement of the strapping terminals on the number translator PCB is illustrated in figure 1.00. The purpose of each strapping terminal is discussed in the following paragraphs. All required strapping is done prior to shipment on PCB's with factory programmed PROM's.

a. H0 - H9, hundreds 0 through 9 terminals. These terminals are used to assign the hundreds digit of dialed numbers to the half-PROM containing the appropriate program.

b. T0 - T9, tens 0 through 9 terminals. These terminals are used to assign the tens digit of dialed numbers to the PROM address required for approriate translation.

c. FL1 - FL4, floor 1 through 4 terminals. These terminals are used with the H0 - H9 terminals. Each enables a separate half-PROM containing the appropriate program.

d. F1 - F5. These terminals are used with the T0 - T9 terminals. Each is permanently connected directly to an E1 - E5 terminal.

e. E1 - E5. These terminals are used with A, B, C, D and E terminals to cause predetermined partial addressess to be marked to the PROM's.

f. Group 1 - H, T1, T2, T3, T4; Group 2 - H, T1, T2, T3, T4; Group 3 - H, T1, T2, T3, T4, hundreds, tens 1 through tens 4 for groups 1 through 3. These terminals are used with the H0 - H9 terminals to identity unassigned hundreds and tens digits.

g. M. This terminal is used to provide a pull-up voltage to all unused group terminals and A-E terminals.

h. TDA, two digit access. This terminal is used to arrange the PCB for two digit translation.

i. PE2, PROM enable two. This terminal is used to enable PROM 2 during two digit translation. It is used with terminal TDA.

j. UAN, unassigned number. This terminal is used to arrange the PCB to deal with unassigned numbers.

k. IDA. This terminal is used to identify hundreds digits of two digit access codes.

l. Permanent straps and unused terminals. Terminal TD-100 is permanently connected to terminal -12V. Terminal ITA is permanently connected to terminal B5. Terminals IT, B1-B4, and B6-B8 are not used at this time.

2.04 Strapping Example. Figure 1.01 is a sample of the strapping required for the number translator. The strap from terminal TD-100 to terminal -12V and the strap from terminal B5 to terminal ITA are permanent straps and must be strapped on all number translator PCB's. Due to the absolute interdependence of the strapping and PROM programming, the remaining straps will be explained in paragraph 3.03 of this publication.

3.00 PROM PROGRAMMING

3.01 General. The number translator PCB contains two PROM's which are normally programmed at the factory to accommodate customer translation requirements. These PROM's may be programmed in the field when required. Programming consists of two distinct phases: writing the program, and installing the program in the PROM. ITT practice AA-000-011, entitled PROM Programming, contains detailed instructions for the operation of a programmer.

3.02 Information required. Much of the same information is required for PROM programming as is required for strapping. This information

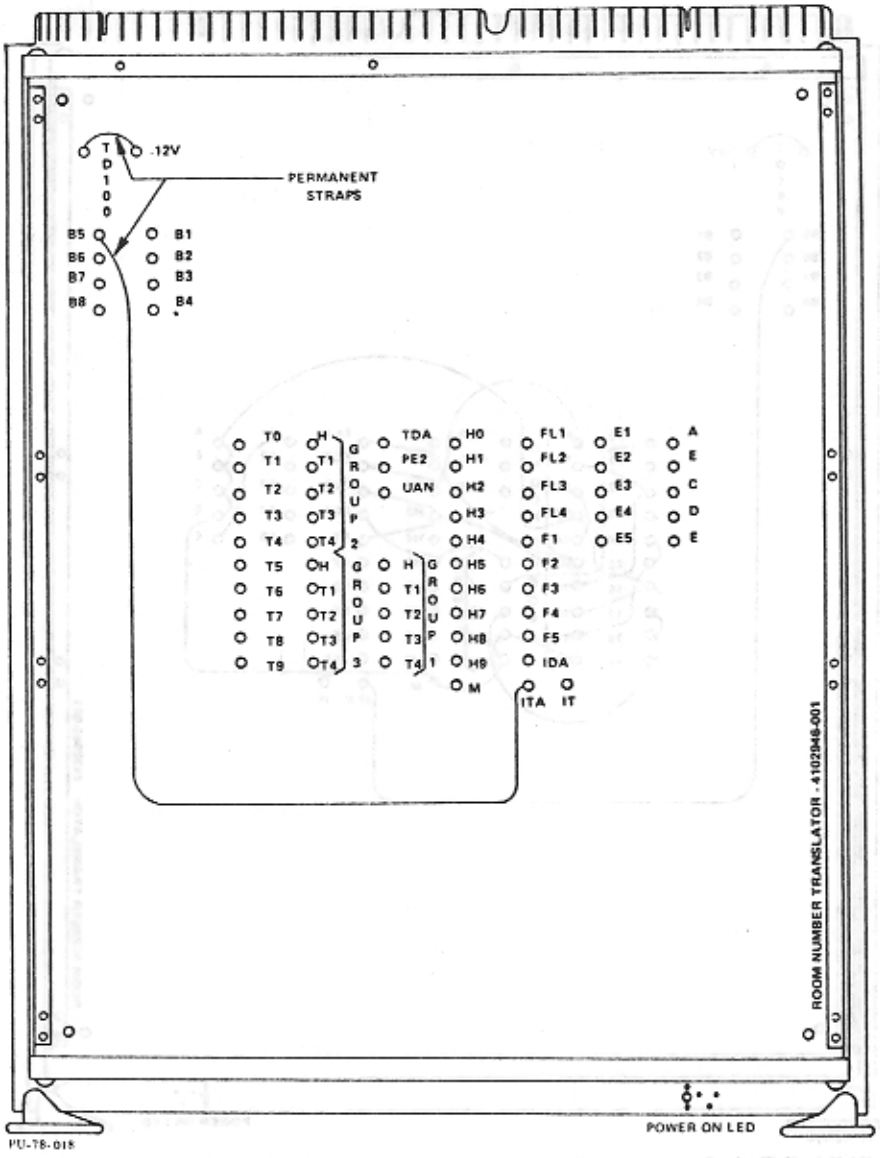

FIGURE 1.00 Strapping Terminals, Number Translator PCB (TD-4102946-001)

should be recorded on the number translator request for programming form. The form and instructions for its completion are contained in ITT practice MA-000-002. Figure 1.02 shows a sample completed request for programming. The strapping for the corresponding PCB is shown in figure 1.01; the PROM program is shown in figures 1.02 and 1.03. The strapping and the associated PROM programming are explained in the following paragraphs. A working knowledge of the number translator circuitry is required for successful programming and a copy of the schematic drawing (TD-4102947-001) should be available for reference.

3.03 Writing the Program. PROM programs are written one step at a time, but still within an overview of the entire program. Once the required programming information is assembled, it must be translated to a series of hexadecimal codes. Each PROM is divided into two halves; the first half is from address "00" to "7F", and the second half is from "80" to "FF". Thus, two PROM's contain four half-PROM's and each half-PROM may be allocated to serve a group of numbers that comprise, for example, one floor of a hotel. Separating the numbers into groups and handling each group with a separate half-PROM is necessary to allow two numbers with the same tens

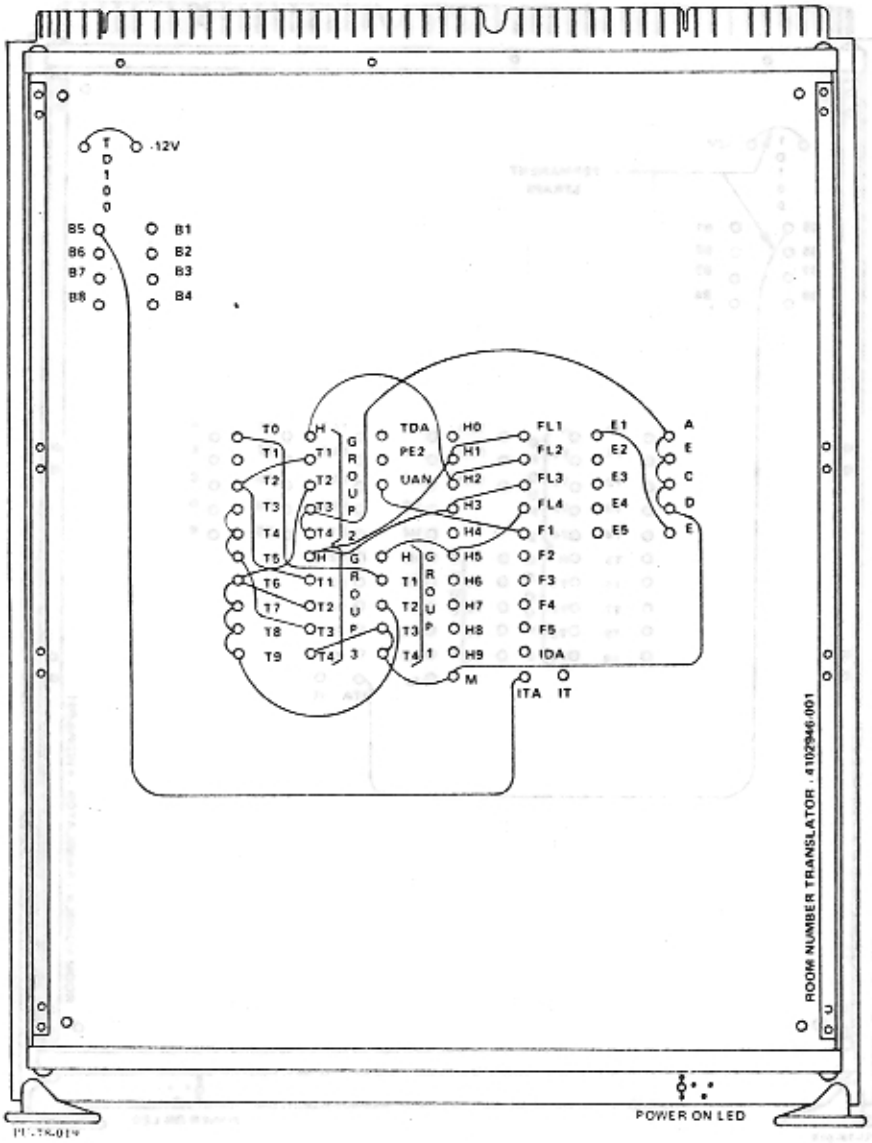

FIGURE 1.01 Sample Strapping, Number Translator PCB (TD-4102946-001)

and units digits to be translated into entirely different station numbers which are marked on the T01-T08 leads to the register. An "EE" marked out resets the register and causes the originating station to receive busy tone.

The basic programming procedure consists of correlating the room number (X00-X79) to its corresponding address in the appropriate half-PROM and causing the half-PROM to output the correct tens and units digits. In the first half of each PROM, the tens and units digits of the room number is the address. For example, the address of room number X10 is "10", when floor X is allocated to the first half of either PROM. The room number/ address correlation is more complicated when a floor is dedicated to the second half of either PROM. That correlation is shown in table 1.00.

Thus, to cause room number 101 to be translated to station 208, for example (when floor 1 is allocated to the second half of PROM 1), first find room number X01 in table 1.00. The corresponding address is "81". Program PROM 1 at address "81" to output data "08".

The strapping shown in figure 1.01 and the PROM programs shown in figure 1.03 comply with the sample request for programming shown in figure 1.02. An analysis of the strapping follows.

NUMBER TRANSLATOR PROM PROGRAMMING (PROM 1)											
FIRST HALF						SECOND HALF					
AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS	AD-DRESS	DATA	REMARKS
00	EE	200 TO B.T.	40	40	240 TO 240	80	EE	100 TO B.T.	C0		
01	20	201 TO 220	41	41	241 TO 241	81	08	101 TO 208	C1		
02	21	202 TO 221	42	42	242 TO 242	82	09	102 TO 209	C2		
03	22	203 TO 222	43	43	243 TO 243	83	10	103 TO 210	C3		
04	23	204 TO 223	44	44	244 TO 244	84	11	104 TO 211	C4		
05	24	205 TO 224	45	45	245 TO 245	85	12	105 TO 212	C5		
06	25	206 TO 225	46	46	246 TO 246	86	13	106 TO 213	C6		
07	26	207 TO 226	47	47	247 TO 247	87	14	107 TO 214	C7		
08	27	208 TO 227	48	48	248 TO 248	88	15	108 TO 215	C8		
09	28	209 TO 228	49	49	249 TO 249	89	16	109 TO 216	C9		
0A			4A			8A			CA		
0B			4B			8B			CB		
0C			4C			8C			CC		
0D			4D			8D			CD		
0E	EE	28X TO B.T.	4E			8E	EE	18X TO B.T.	CE	EE	14X TO B.T.
0F			4F			8F			CF		
10	29	210 TO 229	50	50	250 TO 250	90	17	110 TO 217	D0		
11	30	211 TO 230	51	EE	251 TO B.T.	91	18	111 TO 218	D1		
12	31	212 TO 231	52	EE	252 TO B.T.	92	19	112 TO 219	D2		
13	EE	213 TO B.T.	53	EE	253 TO B.T.	93	EE	113 TO B.T.	D3		
14	EE	214 TO B.T.	54	EE	254 TO B.T.	94	EE	114 TO B.T.	D4		
15	EE	215 TO B.T.	55	EE	255 TO B.T.	95	EE	115 TO B.T.	D5		
16	EE	216 TO B.T.	56	EE	256 TO B.T.	96	EE	116 TO B.T.	D6		
17	EE	217 TO B.T.	57	EE	257 TO B.T.	97	EE	117 TO B.T.	D7		
18	EE	218 TO B.T.	58	EE	258 TO B.T.	98	EE	118 TO B.T.	D8		
19	EE	219 TO B.T.	59	EE	259 TO B.T.	99	EE	119 TO B.T.	D9		
1A			5A			9A			DA		
1B			5B			9B			DB		
1C			5C			9C			DC		
1D			5D			9D			DD		
1E	EE	29X TO B.T.	5E			9E	EE	19X TO B.T.	DE	EE	15X TO B.T.
1F			5F			9F			DF		
20			60			A0			E0		
21			61			A1			E1		
22			62			A2			E2		
23			63			A3			E3		
24			64			A4			E4		
25			65			A5			E5		
26			66			A6			E6		
27			67			A7			E7		
28			68			A8			E8		
29			69			A9			E9		
2A			6A			AA			EA		
2B			6B			AB			EB		
2C			6C			AC			EC		
2D			6D			AD			ED		
2E	EE	22X TO B.T.	6E	EE	26X TO B.T.	AE	EE	12X TO B.T.	EE	EE	16X TO B.T.
2F			6F			AF			EF		
30	EE	230 TO B.T.	70			B0			F0		
31	EE	231 TO B.T.	71			B1			F1		
32	32	232 TO 232	72			B2			F2		
33	33	233 TO 233	73			B3			F3		
34	34	234 TO 234	74			B4			F4		
35	35	235 TO 235	75			B5			F5		
36	36	236 TO 236	76			B6			F6		
37	37	237 TO 237	77			B7			F7		
38	38	238 TO 238	78			B8			F8		
39	39	239 TO 239	79			B9			F9		
3A			7A			BA			FA		
3B			7B			BB			FB		
3C			7C			BC			FC		
3D			7D			BD			FD		
3E			7E	EE	27X TO B.T.	BE	EE	13X TO B.T.	FE	EE	17X TO B.T.
3F			7F			BF			FF		

X = ANY DIGIT 0-9
B.T. = BUSY TONE

PU-78-020

FIGURE 1.02 Sample PROM Program (PROM 1)

NUMBER TRANSLATOR PROM PROGRAMMING (PROM 2)

FIRST HALF						SECOND HALF					
ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS
00			40			80	EE	300 TO B.T.	C0		
01			41			81	51	301 TO 251	C1		
02			42			82	52	302 TO 252	C2		
03			43			83	53	303 TO 253	C3		
04			44			84	54	304 TO 254	C4		
05			45			85	55	305 TO 255	C5		
06			46			86	56	306 TO 256	C6		
07			47			87	57	307 TO 257	C7		
08			48			88	58	308 TO 258	C8		
09			49			89	59	309 TO 259	C9		
0A			4A			8A			CA		
0B			4B			8B			CB		
0C			4C			8C			CC		
0D			4D			8D			CD		
0E	EE	58 TO B.T.	4E			8E	EE	38X TO B.T.	CE	EE	34X TO B.T.
0F		50 TO B.T.	4F	03	54 TO 203	8F			CF		
10			50			90	60	310 TO 260	D0		
11			51			91	61	311 TO 261	D1		
12			52			92	62	312 TO 262	D2		
13			53			93	EE	313 TO B.T.	D3		
14			54			94	EE	314 TO B.T.	D4		
15			55			95	EE	315 TO B.T.	D5		
16			56			96	EE	316 TO B.T.	D6		
17			57			97	EE	317 TO B.T.	D7		
18			58			98	EE	318 TO B.T.	D8		
19			59			99	EE	319 TO B.T.	D9		
1A			5A			9A			DA		
1B			5B			9B			DB		
1C			5C			9C			DC		
1D			5D			9D			DD		
1E	EE	59 TO B.T.	5E			9E	EE	39X TO B.T.	DE	EE	35X TO B.T.
1F	00	51 TO 200	5F	04	55 TO 204	9F			DF		
20			60			A0			E0		
21			61			A1			E1		
22			62			A2			E2		
23			63			A3			E3		
24			64			A4			E4		
25			65			A5			E5		
26			66			A6			E6		
27			67			A7			E7		
28			68			A8			E8		
29			69			A9			E9		
2A			6A			AA			EA		
2B			6B			AB			EB		
2C			6C			AC			EC		
2D			6D			AD			ED		
2E			6E	EE	56 TO B.T.	AE	EE	32X TO B.T.	EE	EE	36X TO B.T.
2F	01	52 TO 201	6F			AF			EF		
30			70			B0			F0		
31			71			B1			F1		
32			72			B2			F2		
33			73			B3			F3		
34			74			B4			F4		
35			75			B5			F5		
36			76			B6			F6		
37			77			B7			F7		
38			78			B8			F8		
39			79			B9			F9		
3A			7A			BA			FA		
3B			7B			BB			FB		
3C			7C			BC			FC		
3D			7D			BD			FD		
3E			7E	EE	57 TO B.T.	BE	EE	33X TO B.T.	FE	EE	37X TO B.T.
3F	02	53 TO 202	7F			BF			FF		

X = ANY DIGIT 0-9
B.T. = BUSY TONE

PU-78-021

FIGURE 1.03 Sample PROM Program (PROM 2)

TABLE 1.00 Room Number/Address Correlation (Second Half of PROM)

ROOM NUMBER	ADDRESS	ROOM NUMBER	ADDRESS	ROOM NUMBER	ADDRESS	ROOM NUMBER	ADDRESS
X00	80	X25	A5	X50	D0	X75	F5
X01	81	X26	A6	X51	D1	X76	F6
X02	82	X27	A7	X52	D2	X77	F7
X03	83	X28	A8	X53	D3	X78	F8
X04	84	X29	A9	X54	D4	X79	F9
X05	85	X30	B0	X55	D5		
X06	86	X31	B1	X56	D6		
X07	87	X32	B2	X57	D7		
X08	88	X33	B3	X58	D8		
X09	89	X34	B4	X59	D9		
X10	90	X35	B5	X60	E0		
X11	91	X36	B6	X61	E1		
X12	92	X37	B7	X62	E2		
X13	93	X38	B8	X63	E3		
X14	94	X39	B9	X64	E4		
X15	95	X40	C0	X65	E5		
X16	96	X41	C1	X66	E6		
X17	97	X42	C2	X67	E7		
X18	98	X43	C3	X68	E8		
X19	99	X44	C4	X69	E9		
X20	A0	X45	C5	X70	F0		
X21	A1	X46	C6	X71	F1		
X22	A2	X47	C7	X72	F2		
X23	A3	X48	C8	X73	F3		
X24	A4	X49	C9	X74	F4		

X may be any digit 1 through 4.

a. Terminal H1 to terminal FL1
Terminal H2 to terminal FL2
Terminal H3 to terminal FL3
Terminal H5 to terminal FL4

These straps allocate numbers with 1 as the hundreds digit to the second half of PROM 1, numbers with 2 as the hundreds digit to the first half of PROM 1, numbers with 3 as the hundreds digit to the second half of PROM 2, and numbers with 5 as the hundreds digit to the first half of PROM 2.

b. Terminal (Group 1) H to terminal H5
Terminal (Group 1) T1 to terminal T0
Terminal (Group 1) T2 to terminals T6, T7, T8, T9

These straps cause calls dialed with 5 as the hundreds digit and 0, 6, 7, 8 or 9 as the tens digit to be routed to UAN (unassigned number).

c. Terminal (Group 2) H to terminal H2
Terminal (Group 2) T1 to terminal T2
Terminal (Group 2) T2 to terminals T6, T7, T8, T9.

These straps cause calls dialed with 2 as the hundreds digit and 2, 6, 7, 8 or 9 as the tens digit to be routed to UAN (unassigned number).

d. Terminal (Group 3) H to terminals H1, H3
Terminal (Group 3) T1 to terminal T2.
Terminal (Group 3) T2 to terminals T6, T7, T8, T9

These straps cause calls dialed with 1 or 3 as the hundreds digit and 2, 6, 7, 8 or 9 as the tens digit to be routed to UAN (unassigned number).

e. Terminal UAN to terminal F1
Terminal E1 to terminal E

These straps cause calls to UAN to always address the PROM's at "XE" where X is any tens digit.

f. Terminal M to terminals A, B, C, D, (Group 1) T3 and T4, (Group 2) T3 and T4, and (Group 3) T4

These straps connect all unused group terminals and A through E terminals to a logic high.

A comparison of figures 1.01, 1.02 and 1.03 with table 1.00 and preceding strapping explanations and the number translator schematic (TD-4102947-001) will reveal additional details. It is important to realize that programs may be written many different ways and still accomplish the same objectives. For example, a request for translation of a single two-digit number, for example 52 to 205, may be fulfilled in a different manner (from that previously described) by the following strapping.

a. Terminal H5 to terminal FL4

This strap causes calls with 5 as the hundreds digit to enable the first half of PROM 2.

b. Terminal T2 to terminal F1
Terminal E1 to terminal A

These straps cause calls with 2 as the tens digit (and 5 as the hundreds digit) to address PROM 2 at "2A."

Note that this strapping is not complete; unused terminals, etc. must still be strapped. Also required is a program entry in PROM 2 at address "2A" to output "05" (for station 205). Additional programming is also required.

A complete written description of all strapping and programming options is impractical since that list would be almost limitless. The skilled programmer will take the guidelines presented in this section and, with a knowledge of the number translation circuit operation, construct programs that are concise, complete, and that avoid duplication and contradiction.

FEATURE STRAPPING
TD-100
RECORDER DISCONNECT PCB 4102956

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1.00 Recorder Disconnect PCB Strapping 1

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 recorder disconnect PCB 4102956. This information is applicable to recorder disconnect PCB 4102956-001. It should be referred to when strapping a recorder disconnect PCB for a new installation, or when adding or replacing the recorder disconnect PCB in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The recorder disconnect PCB is for use in systems where automatic answering devices are connected to certain EPABX station lines. The board includes six disconnect circuits for use with answering devices which require a period of silence to disconnect. The disconnect circuits are assigned to station lines at the EPABX cross-connect frame. Refer to section OB-000-005 for cross-connect details.

The recorder disconnect PCB mounts in the option 2 position (card slot 25) of the line shelf. It can only be used in systems equipped with line motherboard 4101566-003 or later.

2.02 Instructions. Arrangement of the strapping terminals on the recorder disconnect PCB is shown in figure 1.00. Referring to the illustration, strap the terminals as follows:

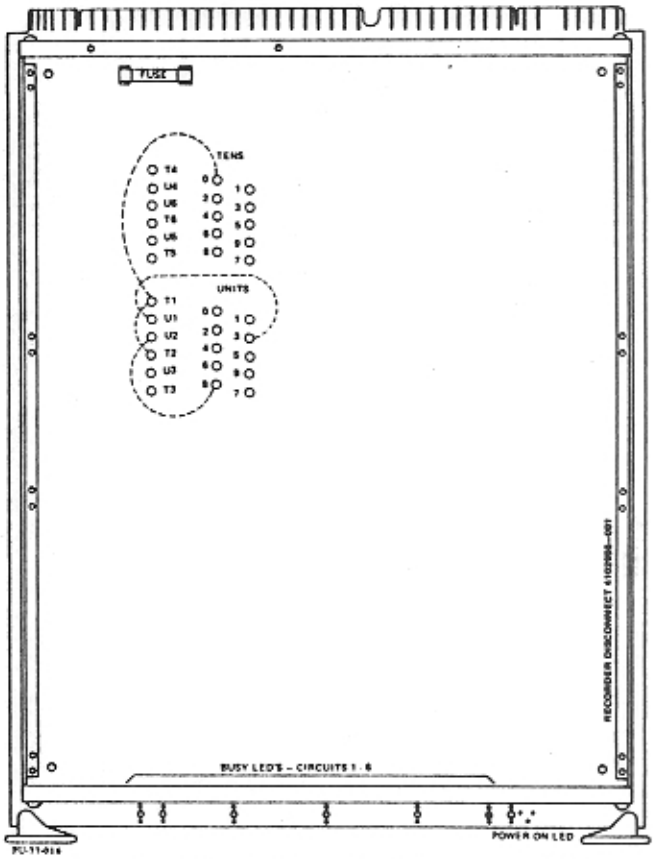

FIGURE 1.00 Recorder Disconnect PCB Strapping

a. Determine from the cross-connect records, line numbers of the stations connected to each of the six disconnect circuits.

b. Strap terminals T1 through T6 to the TENS terminals corresponding to the tens digits of the assigned stations.

c. Strap terminals U1 through U6 to the UNITS terminals corresponding to the units digits of the assigned stations.

EXAMPLE: Assume station 203 is cross-connected to disconnect circuit 1 and station 208 is cross-connected to circuit 2.

Since both stations have the same tens digits, strap terminal T2 to T1 and terminal T1 to TENS terminal 0. Then strap terminal U2 to UNITS terminal 3 and terminal U2 to UNITS terminal 8. This strapping is illustrated in figure 1.00.

FEATURE STRAPPING
TD-100
BUSY TRUNK, BUSY LINE CALL BACK TD-4102966-001

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1.00 Busy Trunk Call Back Assignments . 2

FIGURE

1.00 Busy Trunk, Busy Line Call Back Strapping (TD-4102966-001) . . . 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the feature strapping for the TD-100 busy trunk, busy line call back printed circuit board (PCB) TD-4102966-001. It should be referred to when strapping a busy trunk, busy line call back PCB for a new installation, or when adding or replacing a busy trunk, busy line call back PCB in a working system.

1.02 Tools and Equipment. The tools and equipment required to strap the call back PCB is a 24 AWG wire-wrap tool, a wire-stripping tool, and a sufficient supply of 24 AWG insulated wire (tinned).

2.00 STRAPPING

2.01 General. The busy trunk, busy line call back PCB in equipped in position 27 of the channel subrack. To provide call back service, memory PCB, 4101616-005 or later and processor 2 PCB, TD-4101636-010 must be equipped. To modify the equipment cabinet for this feature, modification kit 16053( )79 is required for TD-4101716-002, and modification kit 16155( )79 is required for TD-4101716-003 issue AA and earlier channel motherboards. The call back PCB provides call back service for up to seven groups with a maximum of seven reservations for each group. Six of these groups are reserved for busy trunk call back (either CO trunk and/or tie trunks) and one group is reserved for busy line call back. The group reserved for lines is built into the call back PCB and no strapping is required on the call back PCB, but all vacant numbers must be strapped to vacant number intercept (VNI) on the class-of-service PCB. The CO and/or tie trunk groups that are provided with busy trunk call back are determined by PROM programming and by optional strapping on the PCB.

2.02 Information Required. At the time the call back PCB is ordered, the customer must provide trunk group assignment information to allow programming of the programmable read only memory (PROM) unit on the call back PCB. Table 1.00 lists the variations of the PROM programming available (-001 through -007). The check (✓) in the trunk group columns indicate the PROM is programmed to provide call back capabilities to that group.

> EXAMPLE: The -004 programming for the PROM is to provide call back capabilities for CO trunk groups 1 through 3 and tie trunk groups 1 through 3.

2.03 Procedure. Perform the following steps, as required, to arrange the generation -001 busy trunk, busy line call back PCB to meet local operating requirements (see figure 1.00).

> NOTE: Only trunk groups that have programming in the PROM can be strapped for busy trunk call back.

a. To assign trunk groups to the busy trunk call back feature strap as follows:

1. To assign call back capabilities to the trunks assigned to:

   Trunk group 1 strap terminal 12 to terminal 5.

TABLE 1.00 Busy Trunk Call Back Assignments

Variations Available	CO TRUNK GROUPS						TIE TRUNK GROUPS					
	1	2	3	4	5	6	1	2	3	4	5	6
-001	√	√	√	√	√	√						
-002	√	√	√	√	√		√					
-003	√	√	√	√			√	√				
-004	√	√	√				√	√	√			
-005	√	√					√	√	√	√		
-006	√						√	√	√	√	√	
-007							√	√	√	√	√	√

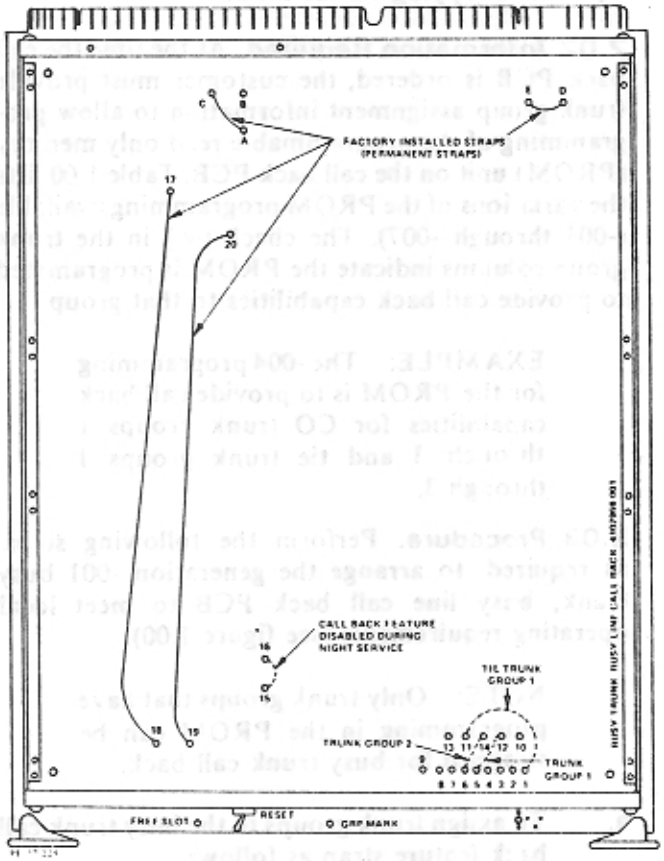

FIGURE 1.00 Busy Trunk, Busy Line Call Back PCB Strapping (TD-4102966-001)

Trunk group 2 strap terminal 14 to terminal 6.

Trunk group 3 strap terminal 10 to terminal 4.

Trunk group 4 strap terminal 10 to terminal 9.

Trunk group 5 strap terminal 12 to terminal 7.

Trunk group 6 strap terminal 14 to terminal 3.

2. To provide call back capabilities in the tie trunk assigned to:

Tie trunk group 1 strap terminal 11 to terminal 1.

Tie trunk group 2 strap terminal 11 to terminal 8.

Tie trunk group 3 strap terminal 13 to terminal 2.

Tie trunk group 4 strap terminal 10 to terminal 9.

Tie trunk group 5 strap terminal 12 to terminal 7.

Tie trunk group 6 strap terminal 14 to terminal 3.

b. To disable the busy trunk, busy line call back feature when the TD-100 is in a night service mode of operation (NIGHT switch on the attendant's console set to the ON position) strap:

Terminal 15 to terminal 16.

c. There are four permanent straps that are factory installed that must be equipped on every busy trunk, busy line call back PCB. These straps are as follows:

Terminal 17 must be strapped to terminal 18.

Terminal 19 must be strapped to terminal 20.

Terminal A must be strapped to terminal C.

Terminal D must be strapped to terminal E.

Terminal B is a spare terminal and should not be strapped.

Figure 1.00 shows how a typical busy trunk, busy line call back PCB might be strapped. In this example, trunk groups 1 and 2 and tie trunk group 1 are strapped for busy trunk call back. The call back feature will be disabled during night service (terminal 15 strapped to terminal 16), the remaining straps are factory installed and must always be equipped.

FEATURE STRAPPING
TD-100 EPABX
CALL FORWARD FOLLOW ME, BUSY LINE/DON'T ANSWER/ANA
(TD-4103086-001)

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1.00 Call Forward Follow Me, Busy Line/Don't Answer, ANA Strapping (TD-4103086-001) 4
1.01 Processor 2 Strapping (TD-4101636-010) 5
1.02 CO Trunk Strapping (TD-4104006-001) 6
1.03 Station Hunt Strapping (TD-4101656-002/004) 7

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 call forward follow me, busy line/don't answer with assigned night answer (CFFM, BL/DA, ANA) PCB. Included are explanations and illustrations for strapping the various features of the CFFM, BL/DA, ANA board, TD-4103086-001; processor 2 PCB, TD-4101636-010; CO trunk PCB, TD-4104006-001; and station hunt PCB, TD-4101656-002/004.

This document should be referred to when strapping the CFFM, BL/DA with ANA board for a new installation or when adding or replacing the PCB in a working system.

1.02 Related Strapping Documents. Additional information which may apply to the CFFM, BL/DA, ANA PCB strapping can be found in the following related documents.

a. OB-410-160 Class of Service PCB Strapping

b. OB-410-163 Processor 2 PCB Strapping

c. OB-410-165 Station Hunt PCB Strapping

d. OB-410-400 CO Trunk PCB Strapping

1.03 Tools and Equipment. To perform the strapping described in this document requires a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire.

2.00 STRAPPING

2.01 General The CFFM, BL/DA with ANA board mounts in position 2 of the channel subrack, TD-4101716-003. If the channel subrack is issue Y or earlier, it must be equipped with modification kit 16055( )79. Programming switches on the PCB provide for the assignment of access codes for the CFFM feature and the busy line/don't answer feature, thereby eliminating strapping on the processor 2 PCB for these access codes. In addition, strapping terminals are provided to allow incoming calls via a maximum of 10 trunks to be routed to preselected stations for assigned night answer (ANA) service.

To provide ANA service requires additional strapping on the processor 2 PCB, TD-4101636-010; CO trunk, TD-4104006-001; and station hunt PCB, TD-4101656-002/004.

The following explanations and illustrations refer to strapping the CFFM, BL/DA with ANA

board, TD-4103086-001 which must be used in conjunction with the following issues of PCB's.

a. Memory PCB, TD-4101616-005

b. Processor 1 PCB, TD-4101626-010

c. Processor 2 PCB, TD-4101636-010

d. Channel Motherboard, TD-4101716-003

e. CO Trunk PCB, TD-4104006-001

2.02 Information Required. The following information is required in order to strap the CFFM, BL/DA, ANA board.

a. Select two separate access codes, one for the CFFM and one for the busy line/don't answer feature.

b. Select the trunks (maximum of 10) to be assigned to night answer stations.

c. Select the stations to be assigned to each night answer trunk.

Consult the processor 2 PCB strapping chart as suggested in section OB-410-163 to prevent access code assignment conflicts in the system.

2.03 CFFM, BL/DA Strapping. Refer to figure 1.00. Programming switches on the CFFM, BL/DA PCB provide for assignment of the CFFM and BL/DA access codes.

Two separate access codes are required, but the hundreds digit for both codes must always be the same. Assignable hundreds and tens digits are:

Hundreds digits - 1,3,4,5
Tens digits - 1,2,3,4

a. CFFM. Call forward follow me provides immediate transfer of a call to the programmed follow me station number, regardless of the status of the called station. To provide CFFM:

1. Set the hundreds digit programming switch to the selected hundreds access digit.

2. Set the CFFM tens digit programming switch to the selected tens access digit.

b. BL/DA. Busy line/don't answer provides for two conditions which may occur when a call is placed to a station programmed for BL/DA.

1. If a call is placed to a station programmed for BL/DA and the station is busy, the call will be transferred to the forward station. If the forward station is busy, the caller will receive busy tone.

2. If a call is placed to a station programmed for BL/DA and the station is idle, it will ring that station, but if there is no answer within 16 seconds, it will be transferred to the previously programmed forward station. If the forward station is idle, it will ring until answered or the call is abandoned. If the forward station is busy, the call will be transferred back to the original called station and ring until answered or the call is abandoned.

NOTE: The master of a hunting group can be provided CFFM, but should be denied BL/DA by assigning the station a class of service.

To provide BL/DA:

1. Set the hundreds digit programming switch to the selected hundreds access digit.

2. Set the BL/DA tens digit programming switch to the selected tens access digit.

EXAMPLE: Figure 1.00 shows the CFFM access code as 41 and the BL/DA access code as 42.

To program the system for CFFM or BL/DA the station user dials the required access code, listens for dial tone, and then dials the forward station number. Busy tone is returned to indicate the pro-

gramming is complete. To reset the equipment, the forwarding station's number is dialed from that station.

Stations programmed for CFFM and BL/DA are cleared by the console attendant when the night switch on the console is turned on or off and must be reprogrammed daily.

2.04 ANA Strapping. Refer to figure 1.00. By strapping the CFFM, BL/DA, ANA PCB, the processor 2 PCB, the CO trunk PCB, and the station hunt PCB, incoming calls via a maximum of 10 trunks will be routed to preselected stations when the NIGHT switch on the console is placed in the ON position. Strapping on the CFFM, BL/DA, ANA board determines which stations will serve as night answer stations. Cabinet wiring for the system provides for trunks in the first ten positions to be used for ANA.

For ANA, strap the tens and units terminals of the selected trunks, TKT and TKU, to the tens and units terminals of the assigned answering stations.

Also provided are 5 groups of bunching pins, BP1 through BP5. Each of these groups of five terminals may be used as required for additional grouping tie points.

EXAMPLE: Figure 1.00 shows trunks 1 through 4 strapped to stations X21, X22, X23, and X24 for ANA. Terminals P1 through PO and terminal TP1 are reserved for future use.

2.05 Processor 2 Strapping. Refer to figure 1.01, processor 2 PCB, TD-4101636-010. Strap terminal ANA to terminal NT for night answer service.

NOTE: If combined UNA/ANA service is required, refer to section OB-410-163 for additional strapping. The CFFM, BL/DA, ANA PCB is applicable to systems equipped with processor 2 PCB, TD4101636-010.

2.06 CO Trunk Strapping. Refer to figure 1.02, CO trunk PCB, TD-4104006-001. Strap terminal 29 to terminal 30 for normal night answer service. A lamp indication is provided on the attendant's console, but the incoming calls will not sound the buzzer.

2.07 Station Hunt Strapping. Refer to figure 1.03, station hunt PCB, TD-4101656-002/004. Terminal N1 must be strapped to terminal N2 to inhibit hunting during night service.

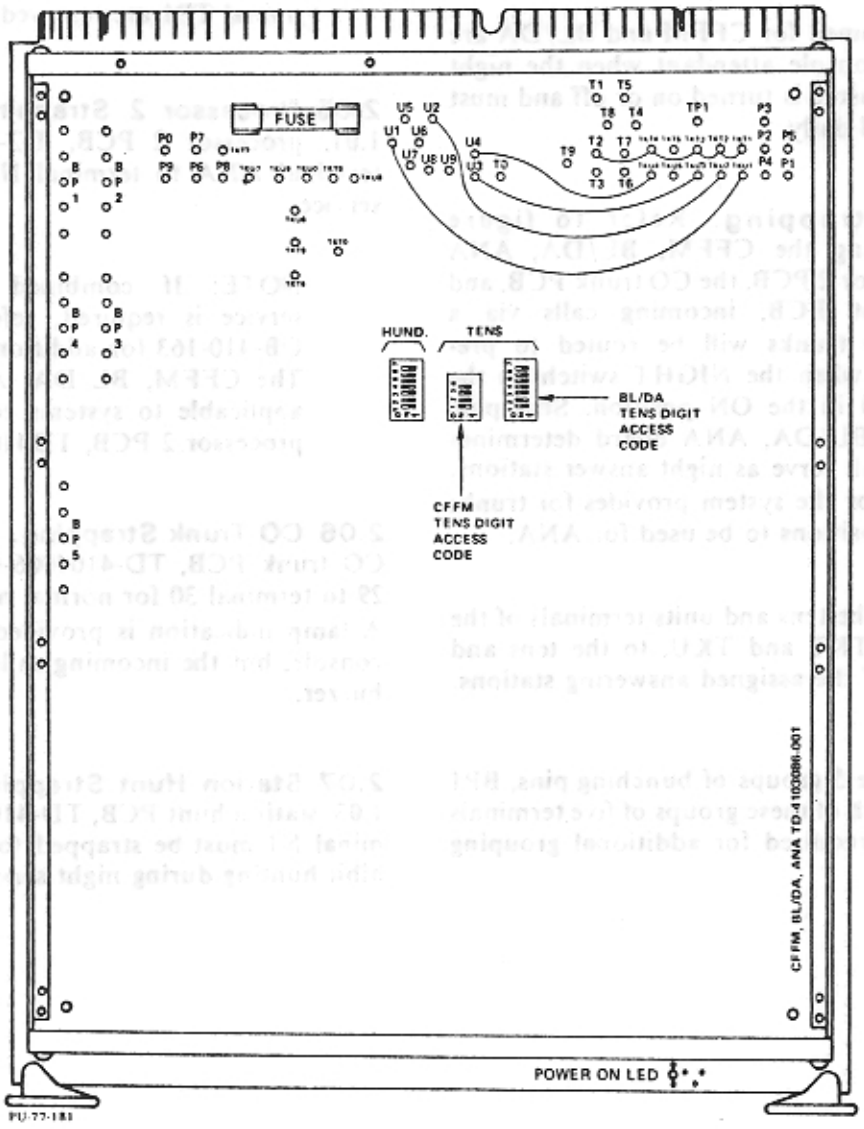

FIGURE 1.00 Call Forward Follow Me, Busy Line/Don't Answer, ANA Strapping (TD-4103086-001)

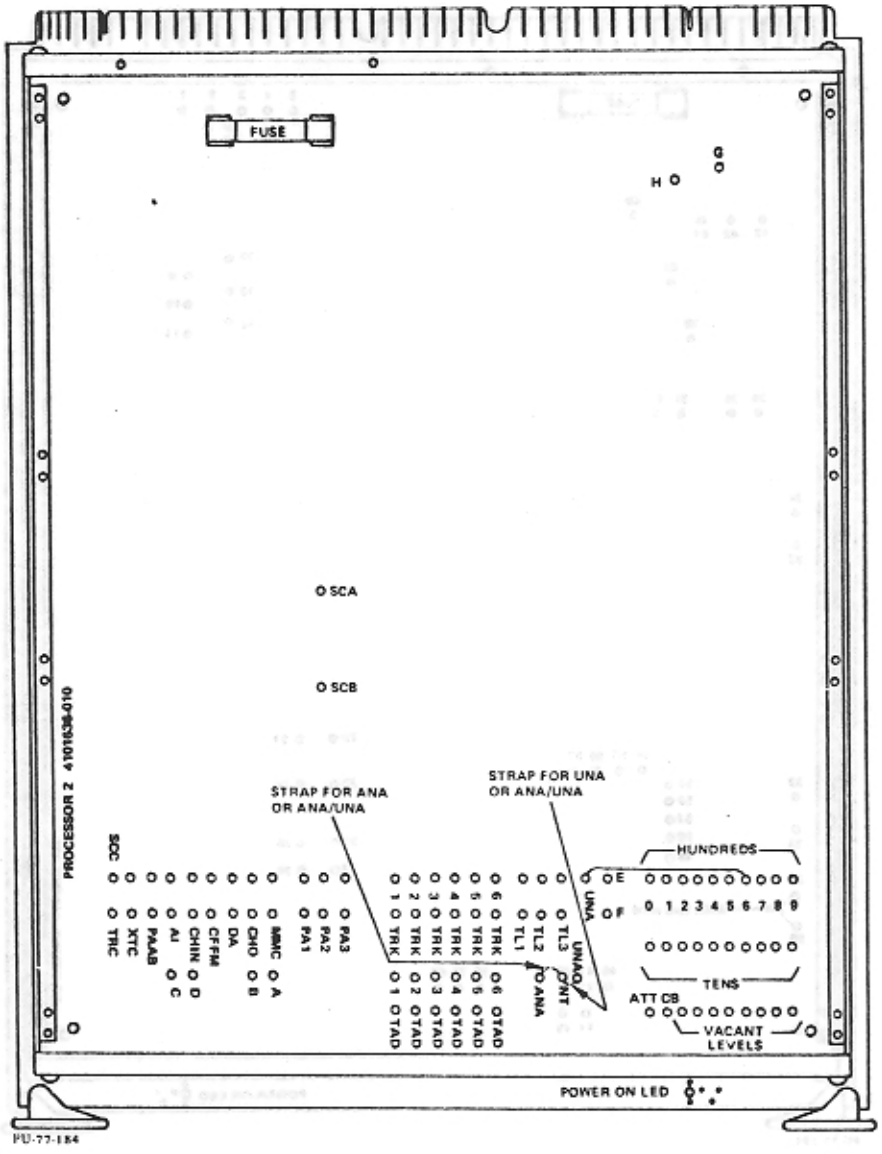

FIGURE 1.01 Processor 2 Strapping (TD-4101636-010)

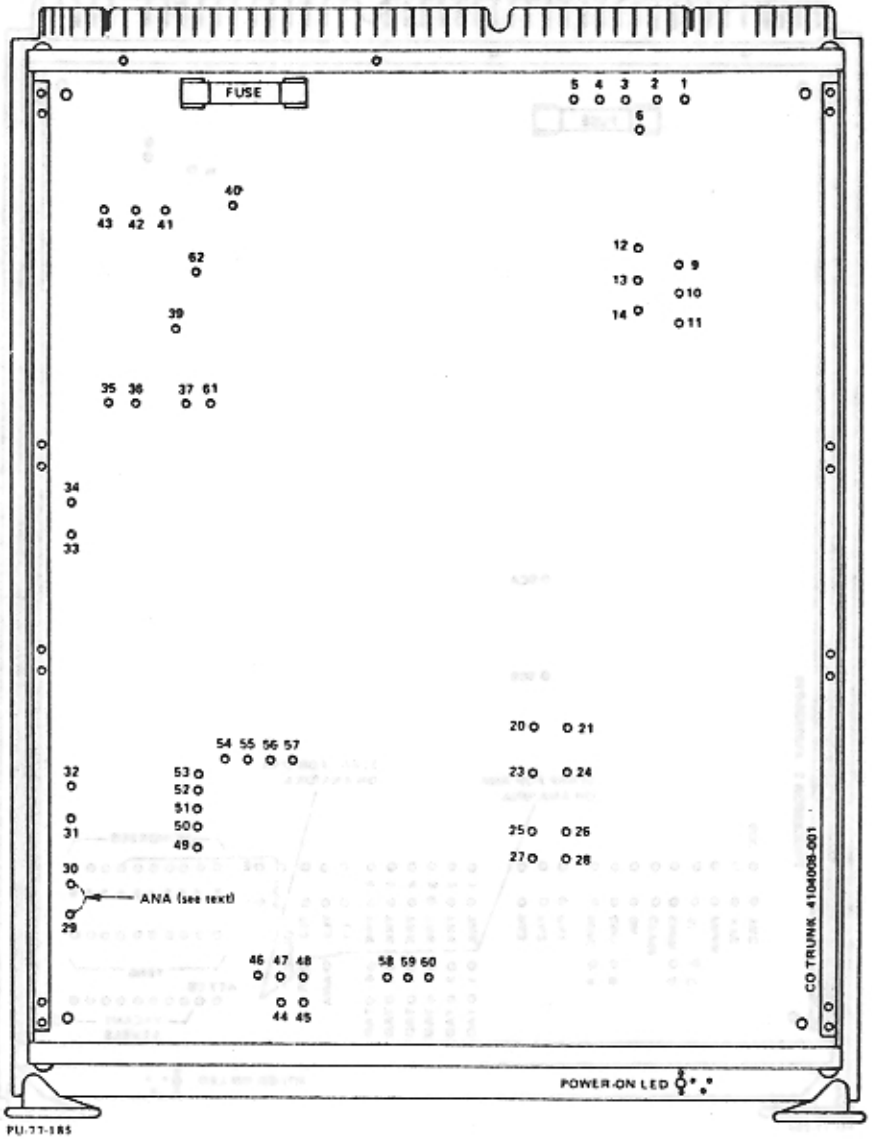

FIGURE 1.02 CO Trunk Strapping (TD-4104006-001)

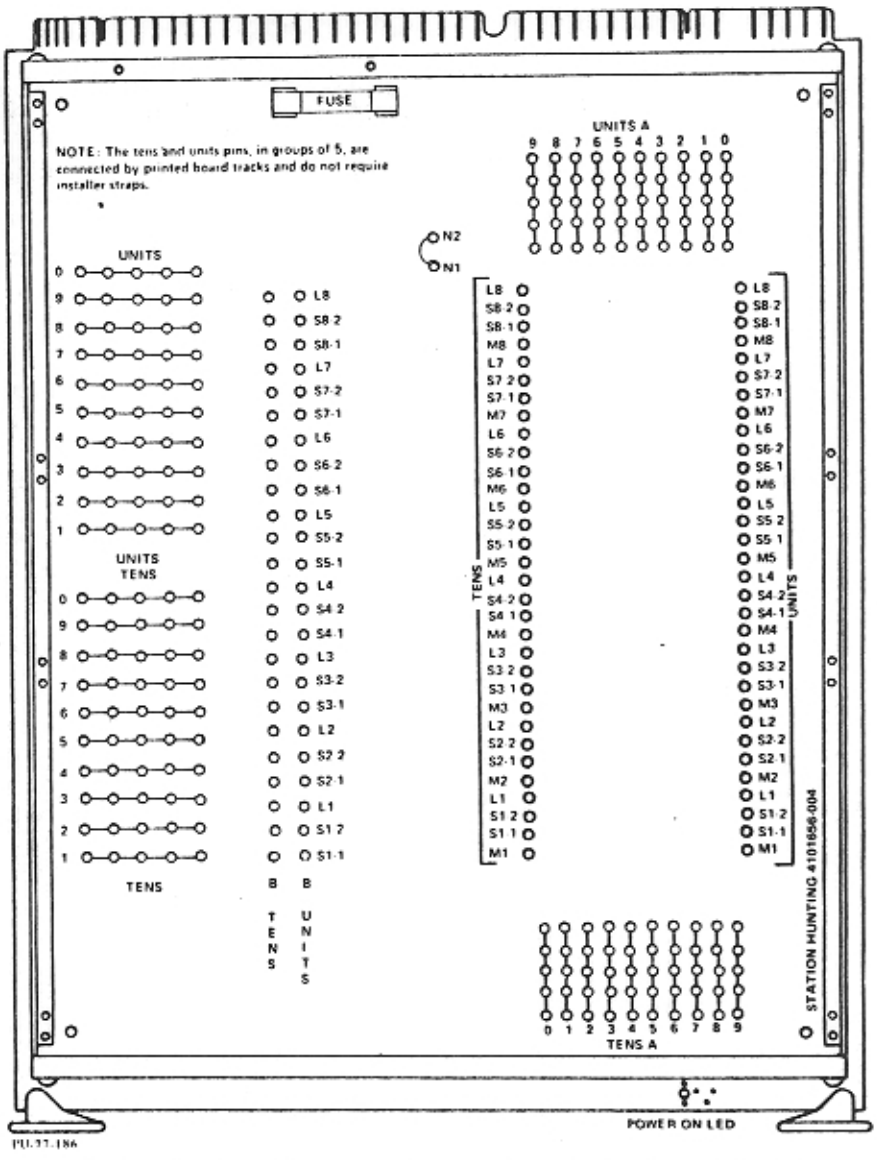

FIGURE 1.03 Station Hunt Strapping (TD-4101656-002/004)

FEATURE STRAPPING
TD-100
DIAL/DIRECTED CALL PICKUP SERVICE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the strapping and PROM programming for the TD-100 dial/directed call pickup feature. Included are explanations and illustrations for strapping the memory PCB and the common control feature 3 PCB. This information is applicable to memory PCB's TD-4101616-003 and -004, the common control feature 3 PCB TD-4103226-001, and the dial/directed call pickup assembly, TD-4103116-001. It should be referred to when dial and or directed call pickup service is added to a new system, or when installing or replacing the common control feature 3 PCB in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. Dial/directed call pickup service is an optional feature of the TD-100 EPABX. Either or both services can be provided by adding the dial/directed call pickup assembly to the system. In cabinets equipped with a TD-4101506-022 motherboard, the dial/directed call pickup assembly mounts in position 26 of the trunk subrack. In systems equipped with a TD-4101716-003 motherboard, the assembly mounts in position 14 of the channel subrack.

Dial call pickup allows a station user in an assigned dial call group to dial an access code and answer any ringing station within the assigned group. If the stations are not in the same group, the station attempting to answer the call receives busy tone. Station grouping flexibility permits all stations to be assigned to the same group or divided into as many as 62 groups.

Directed call pickup permits a station user to answer any ringing station in the system. The user consults an external busy lamp field (or determines what line is ringing by other means) and dials an access code; after receiving second dial tone, the station user dials the number of the ringing station and answers the call.

The dial/directed call pickup assembly is made up of a common control feature 3 PCB equipped with a dial/directed call pickup piggyback board TD-4103116-001 and a PROM PCB which accommodates a custom programmed PROM (programmable read only memory) device. The PROM contains station grouping information for the dial call pickup feature. It is normally programmed in the factory according to information received from the customer.

2.02 Information Required. A customer request form should be used to record the programming of the PROM for dial call pickup service. The form and instructions for its completion are included in ITT practice MA-000-002. The form must be filled out and submitted to ITT Telecommunications when ordering the dial/directed call pickup assembly with factory programming.

2.03 Memory PCB Strapping. Strapping for the memory PCB, in systems equipped for dial/directed call pickup, is shown in figure 1.00.

2.04 Common Control Feature 3 PCB Strapping. Arrangement of the dial/directed call pickup assembly is shown in figure 1.01. As illustrated, strapping terminals on the common control feature 3 PCB are used to assign the desired access code or codes. The codes for either feature may be one or two digits. They cannot be the same, and they must not conflict with access codes for other system features. Strap these terminals per steps a and/or b.

a. Dial call pickup. The HUNDREDS digit assignment terminal for dial call pickup is terminal 24. The TENS digits assignment terminal is terminal 18. Strap these terminals as follows:

1. Single digit access. For single digit access:

(a) Strap the terminal (13-17, or 19-23) corresponding to the access digit, to the HUNDREDS digit assignment terminal, 24.

(b) Strap terminal 24 to the TENS digit assignment terminal, 18.

2. Two digit access. For two digit access:

(a) Strap the terminal (13-17, or 19-23) corresponding to the hundreds digit, to the HUNDREDS digit assignment terminal, 24.

(b) Strap the terminal (1-5, or 7-11) corresponding to the tens digit, to the TENS digit assignment terminal, 18.

b. Directed call pickup. The HUNDREDS digit assignment terminal for directed call pickup is terminal 12. The TENS digit assignment terminal is terminal 6. Strap these terminals as follows:

1. Single digit access. For single digit access:

(a) Strap the terminal (13-17, or 19-23) corresponding to the access digit, to the HUNDREDS digit assignment terminal, 12.

(b) Strap terminal 12 to the TENS digit assignment terminal, 6.

2. Two digit access. For two digit access:

(a) Strap the terminal (13-17, or 19-23) corresponding to the hundreds digit, to the HUNDREDS digit assignment terminal, 12.

(b) Strap the terminal (1-5, or 7-11) corresponding to the tens digit, to the TENS digit assignment terminal, 6.

EXAMPLE: Figure 1.01 shows strapping where a single digit (5) is used for dial call pickup access, and two digits (45) are used for directed call pickup access.

3.00 PROM PROGRAMMING

3.01 General. The dial/directed call pickup assembly contains one PROM which is normally programmed at the factory to accommodate customer requirements. This PROM may be programmed in the field when required. Programming consists of two distinct phases: writing the program and installing the program in the

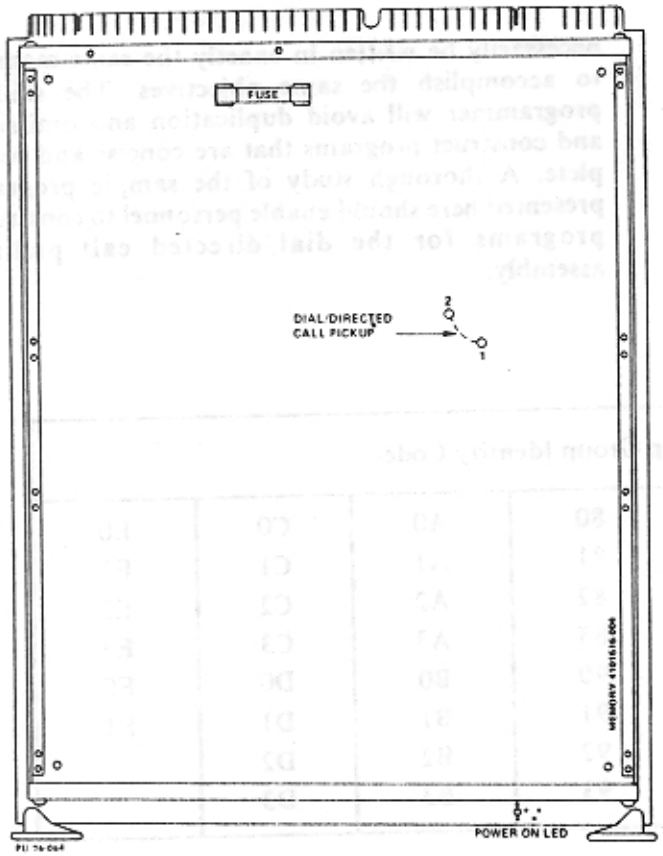

FIGURE 1.00 Memory PCB Strapping (TD-4101616-003/004)

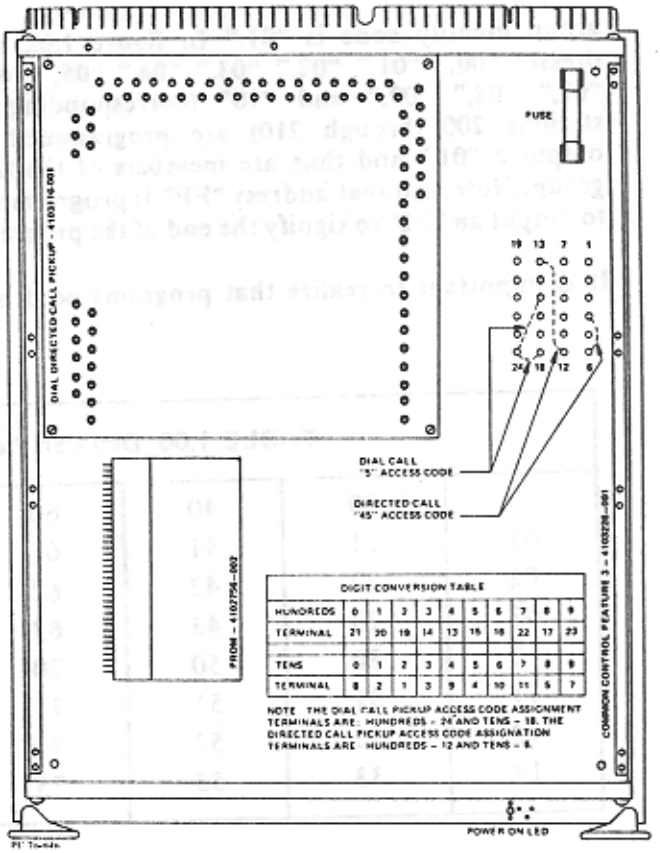

FIGURE 1.01 Dial/Directed Call Pickup Strapping

PROM. ITT practice AA-000-011, entitled PROM Programming, contains detailed instructions for the operation of a programmer.

3.02 Information Required. A request for programming form should be used to record the desired station grouping for dial call pickup service. The form and instructions for its completion are contained in ITT practice MA-000-002. The form should be filled out and submitted to ITT Telecommunications when ordering the dial/directed call pickup assembly with factory programmed PROM's.

3.03 Writing the Program. Each TD-100 station number is contained within a series of one hundred three-digit numbers, typically 200 through 299. Assigning stations to dial call pickup groups is done on the basis of the tens and units digits of the station number.

A total of 62 group identity codes are available and are listed in table 1.00. To assign a station to any of the 62 groups, it is necessary to program the group identity code at the address corresponding to the tens and units digits of the station number.

Not every station must be placed in a group, but any one station may appear in only one group. A group theoretically may contain from 2 to 100 stations, but functional practicality will dictate the maximum group size. At address "FF," an "F2" must be programmed to signify the end of the program.

Figure 1.02 is a sample completed request for programming, and figure 1.03 is a sample dial call pickup program which will execute the requests presented in figure 1.02. A comparison of these samples and table 1.00 will reveal the program writing methods.

For example, in figure 1.02, there is a request to place stations 200 through 201 in a dial call pickup group. In table 1.00, the first available

group identity code is "01." In figure 1.02, addresses "00," "01," "02," "03," "04," "05," "06," "07," "08," "09," and "10" (corresponding to stations 200 through 210) are programmed to output a "01," and thus are members of the first group. Note also that address "FF" is programmed to output an "F2" to signify the end of the program.

It is important to realize that programs need not necessarily be written in exactly the same manner to accomplish the same objectives. The skilled programmer will avoid duplication and omission and construct programs that are concise and complete. A thorough study of the sample program presented here should enable personnel to construct programs for the dial/directed call pickup assembly.

TABLE 1.00 Dial Call Pickup Group Identity Codes

	20	40	60	80	A0	C0	E0
01	21	41	61	81	A1	C1	E1
02	22	42	62	82	A2	C2	E2
03	23	43	63	83	A3	C3	E3
10	30	50	70	90	B0	D0	F0
11	31	51	71	91	B1	D1	F1
12	32	52	72	92	B2	D2	
13	33	53	73	93	B3	D3	

DIAL/DIRECTED CALL PICKUP

REQUEST FOR PROGRAMMING

Request for (Company Name): MODERN TELEPHONE COMPANY			Customer P.O. Number: 407-1-76	Special Instructions
Address: 1000 MAIN STREET			ITT S.T. Number:	
City: MIDDLEBURG	State: TENNESSEE	Zip Code: 38340	Date: NOVEMBER 14, 1977	
Telephone: (615) 555-4411	Originator: JOE H. REELS		SHEET 1 OF 1	

DIAL CALL PICKUP GROUP NUMBER	STATION NUMBERS IN GROUP
1	200-210
2	211, 212, 214, 216, 218, 230, 240, 252, 277, 289
3	213, 215, 217, 219-229, 231-239
4	240, 241
5	242-251
6	253-276
7	278-280
8	281-288

NOTES: LINES 290-299 NOT EQUIPPED

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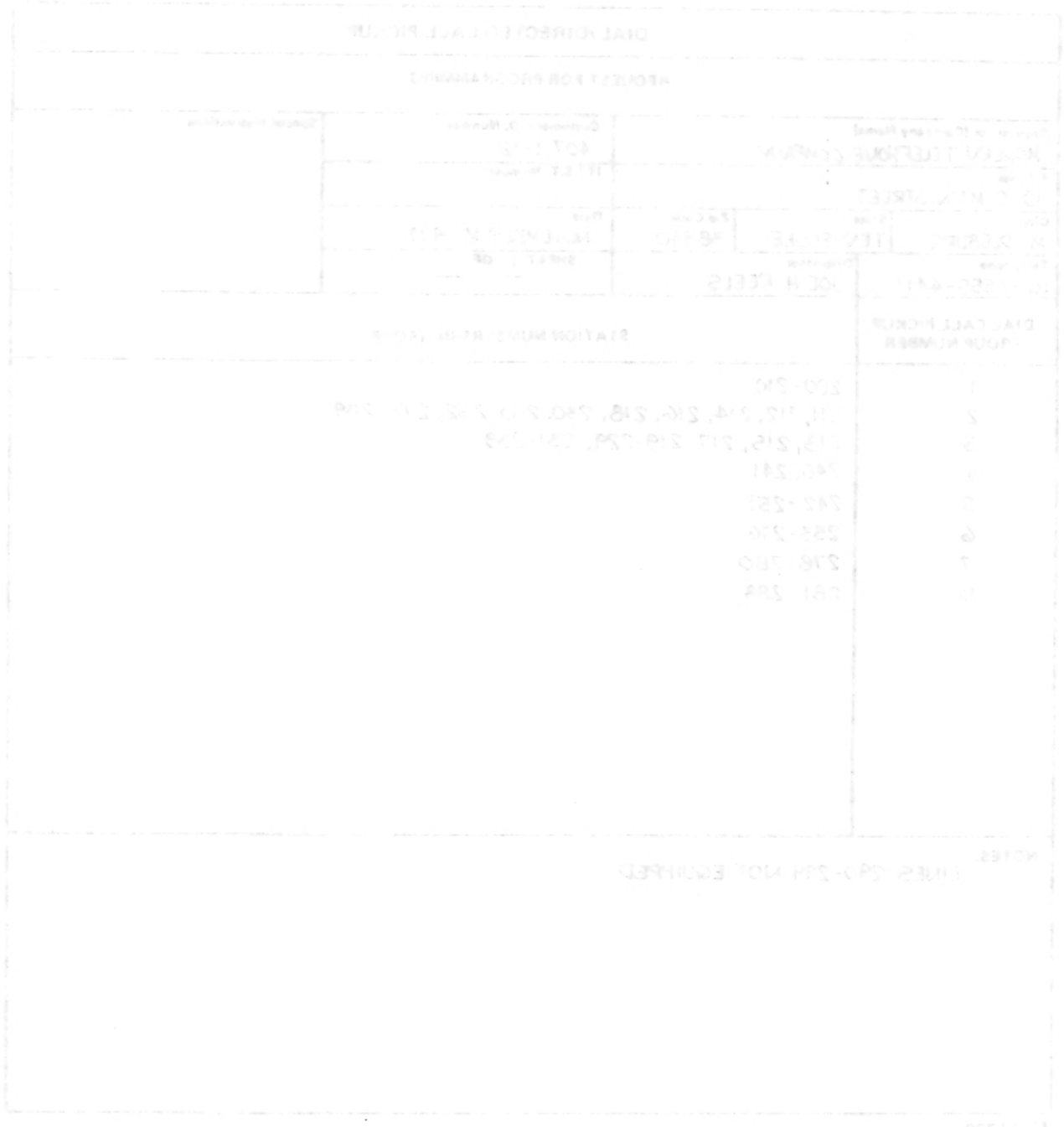
FIGURE 1.02 Sample Dial/Directed Call Pickup Request for Programming



DIAL CALL PICKUP PROM PROGRAMMING

ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS
00	01	1st Group	31	03	3rd Group	67	12	6th Group
01	01		32	03		68	12	
02	01		33	03		69	12	
03	01		34	03		70	12	
04	01		35	03		71	12	
05	01		36	03		72	12	
06	01		37	03		73	12	
07	01		38	03		74	12	
08	01		39	03		75	12	
09	01		40	10	4th Group	76	12	
10	01		41	10		78	13	7th Group
11	02	2nd Group	42	11	5th Group	79	13	
12	02		43	11		80	13	
14	02		44	11		81	20	8th Group
16	02		45	11		82	20	
18	02		46	11		83	20	
30	02		47	11		84	20	
40	02		48	11		85	20	
52	02		49	11		86	20	
77	02		50	11		87	20	
89	02		51	11		88	20	
13	03		53	12		FF	F2	END OF PROGRAM
15	03		54	12				
17	03		55	12				
19	03		56	12				
20	03		57	12				
21	03		58	12				
22	03		59	12				
23	03		60	12				
24	03		61	12				
25	03		62	12				
26	03		63	12				
27	03		64	12				
28	03		65	12				
29	03		66	12				

NOTE: All addresses not listed are not programmed.

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FIGURE 1.03 Sample Dial Call Pickup PROM Programming

FEATURE STRAPPING
2-WAY DID TRUNK (LOOP)
(TD-4103266-001)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 2-Way DID (direct inward dialing) trunk (Loop), TD-4103266. This information is applicable to loop DID trunk PCB's TD-4103266-001. It should be referred to when strapping a 2-way DID trunk (loop) for a new installation, or when adding or replacing a loop DID trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to loop DID trunk strapping can be found in the following documents.

a. OB-410-160 Class of Service PCB Strapping

b. OB-410-161 Memory PCB Strapping

c. OB-410-163 Processor II PCB Strapping

d. OB-410-345 2-Way DID Translator PCB Strapping or OB-410-354 2-Way DID & Room Number Translator PCB Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire is required.

2.00 STRAPPING

2.01 General. The 2-way DID trunk (loop) provides service both-ways between the TD-100 EPABX and a distant office. Incoming calls use the system register to dial access stations within the EPABX. These same trunks may be used for outgoing calls as well.

In the standard wired (option X) subrack, the 2-way DID trunk (loop) can be inserted in positions 15 through 24 of trunk motherboard, TD-4101506-003. With option Y wiring, the trunks can be inserted in card positions 1 through 10 and 15 through 24 of trunk motherboard TD-4101506-003. This trunk must be used in conjunction with the following PCB's:

a. Class of Service PCB TD-4101606-010

b. Memory PCB TD-4101616-005 or later

c. Processor 2 PCB TD-4101636-010

If the incoming DID numbers require translation, either a 2-way DID translator PCB, TD-4103456-001 or 2-way DID and room number translator PCB, TD-4103456-001 or later must be equipped. In addition, the trunk motherboard must be changed per modification kit 16192( )79.

Each 2-way DID trunk (loop) provides strapping for a variety of features. These strapping options are explained in the following paragraphs. Pin location and straps are shown in the accompanying illustration.

2.02 Information Required. The following information is required to strap the 2-way DID trunk (loop).

a. Type of start pulsing signal

b. Trunk group to which the trunk is to be assigned

c. Miscellaneous features required

When replacing a trunk in a working system, it should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The trunk record chart should show all applicable trunk features It should be updated any time trunks are replaced, changed, or added to the system.

2.03 Procedure. Perform the following steps, as required, to arrange the 2-way DID trunk (loop) to meet local operating requirements.

a. Trunk groups. The TD-100 DID trunk must be assigned to a trunk group to allow the processor to seize it (refer to figure 1.01).

1. To assign the trunk to trunk group 1, strap

   Terminal E15 to terminal E16.

2. To assign the trunk to trunk group 2, strap

   Terminal E14 to terminal E16.

3. To assign the trunk to trunk group 3, strap

   Terminal E14 to terminal E16 and
   Terminal E15 to terminal E16.

4. To assign the trunk to trunk group 4, strap

   Terminal E13 to terminal E16 to terminal E15 and
   Terminal E14 to terminal E16.

5. To assign the trunk to trunk group 5, strap

   Terminal E13 to terminal E16 and
   Terminal E15 to terminal E16.

6. To assign the trunk to trunk group 6, strap

   Terminal E13 to terminal E16 and
   Terminal E14 to terminal E16.

b. Type of start pulsing signal (refer to figure 1.01).

1. Immediate start. If the distant office is to start pulsing or expects pulsing to start immediately after seizure, strap

   Terminal E6 to terminal E9.

2. Wink start. If the distant office momentarily reverses or expects a momentary reversal of the tip and ring leads as a start pulsing indication, strap

   Terminal E7 to terminal E9.

3. Delay dial. If pulsing is to start after a predetermined timed interval after seizure, strap

   Terminal E8 to terminal E9.

c. Terminating load (refer to figure 1.01).

1. If a 900 ohm termination is required, strap

   Terminal E105 to terminal E106.

2. If a 600 ohm termination is required, strap

   Terminal E100 to terminal E101
   Terminal E102 to terminal E103
   Terminal E102 to terminal E104
   Terminal E105 to terminal E106
   Terminal E107 to terminal E108.

d. Busy indication (refer to figure 1.01). When a busy indication is to be sent to the CO when the busy switch is operated, strap

TRUNK RECORD CHART
2-WAY DID TRUNK LOOP TD-4103266

Incoming Access Digits	71	71	71												73	→	→	→							
Outgoing Access Digits	71	71	71												73	→	→	→							
Card Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Trunk Groups (1-6)	1	1	1												3	3	3	3	3						
Intercept - Busy Tone	✓	✓	✓												✓	✓	✓	✓	✓						
Intercept - Attendant																									
Immediate Start	✓	✓	✓												✓	✓	✓	✓	✓						
Wink Start																									
Delay Dial																									
Distant Office Release Timing (200, 300, 400, 600 ms)	600	600	600												300	300	300	300	300						
Enable Release Timing (6 or 13 seconds)	6	6	6												6	6	6	6	6						
Attendant Recall (2 or 8 seconds)	8	8	8												8	8	8	8	8						
Inhibit Attendant Recall																									
Trunk Reservation															✓	✓	✓								
600-ohm Termination																									
900-ohm Termination	✓	✓	✓												✓	✓	✓	✓	✓						

PU-77-246

FIGURE 1.00 Typical Trunk Record Chart

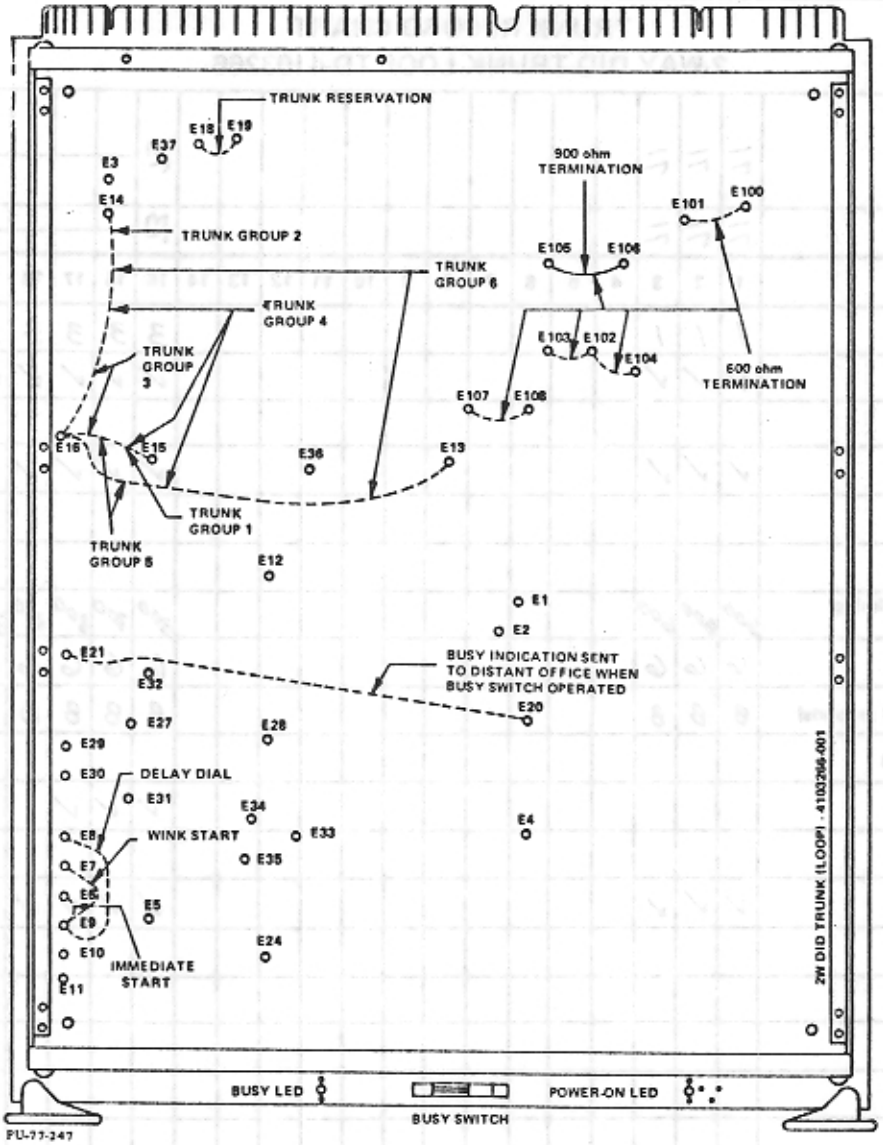

FIGURE 1.01 2-Way DID Trunk (Loop) Strapping (TD-4103266-001)

Terminal E20 to terminal E21.

e. Trunk reservation (refer to figure 1.01) To allow the attendant to reserve the 2-way trunk for incoming calls or for attendant access, strap

Terminal E18 to terminal E19.

f. On immediate start incoming calls, if the call is to be advanced to busy tone if the trunk is not set to a register within 400 milliseconds, strap

Terminal E5 to terminal E36.

On wink start or delay dial incoming calls, if the call is to be advanced to busy tone if the trunk is not set to a register within 400 milliseconds, strap

Terminal E9 to terminal E36.

g. Answer supervision (refer to figure 1.02).

1. If answer supervision is expected from the central office, strap

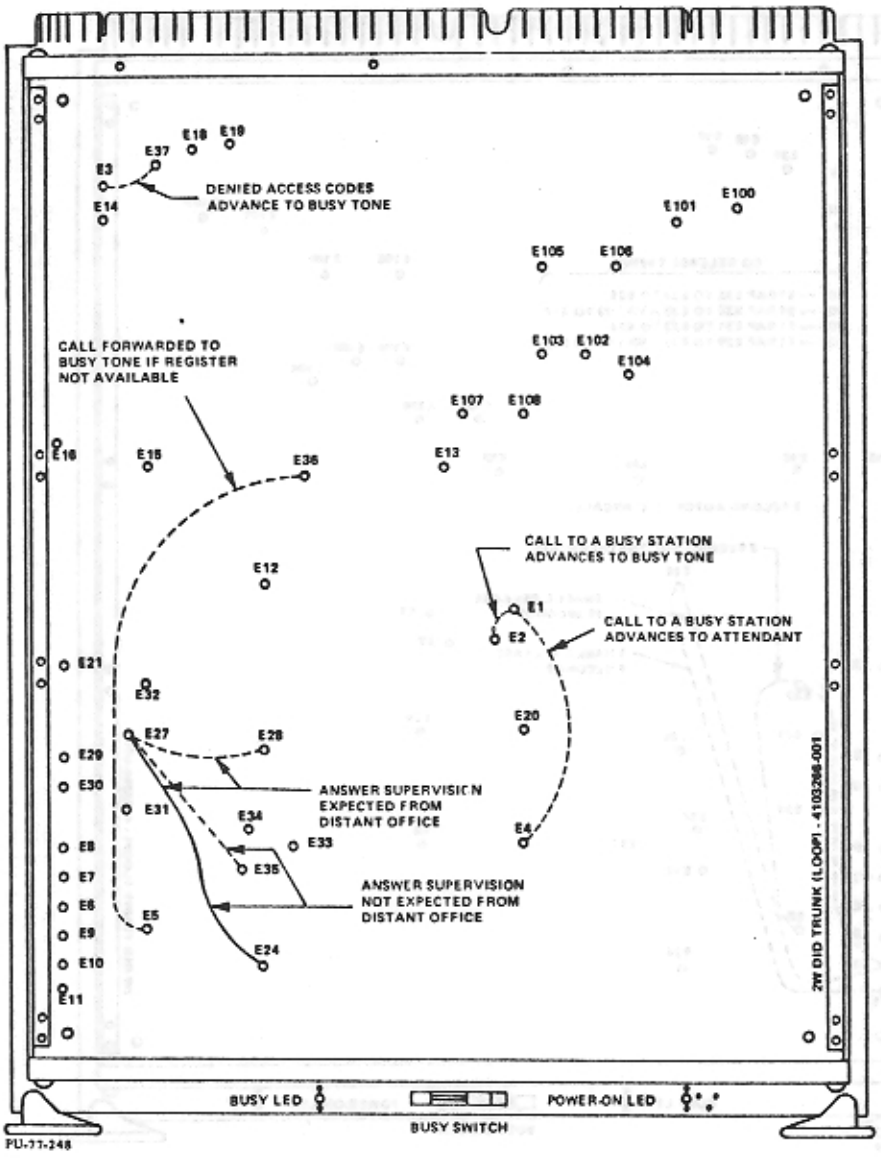

FIGURE 1.02 2-Way DID Trunk (Loop) Strapping (TD-4103266-001)

Terminal E24 to terminal E27 to terminal E28.

2. If answer supervision is not expected from the distant office, strap

   Terminal E24 to terminal E27 to terminal E35.

h. Called station busy (refer to figure 1.02).

1. If calls to a busy station are to be advanced to the attendant, strap

   Terminal E1 to terminal E4.

2. If calls to a busy station are to advance to busy tone, strap

   Terminal E1 to terminal E2.

i. Denied codes (refer to figure 1.02). If denied codes are to be advanced to busy tone, strap

Terminal E3 to terminal E37.

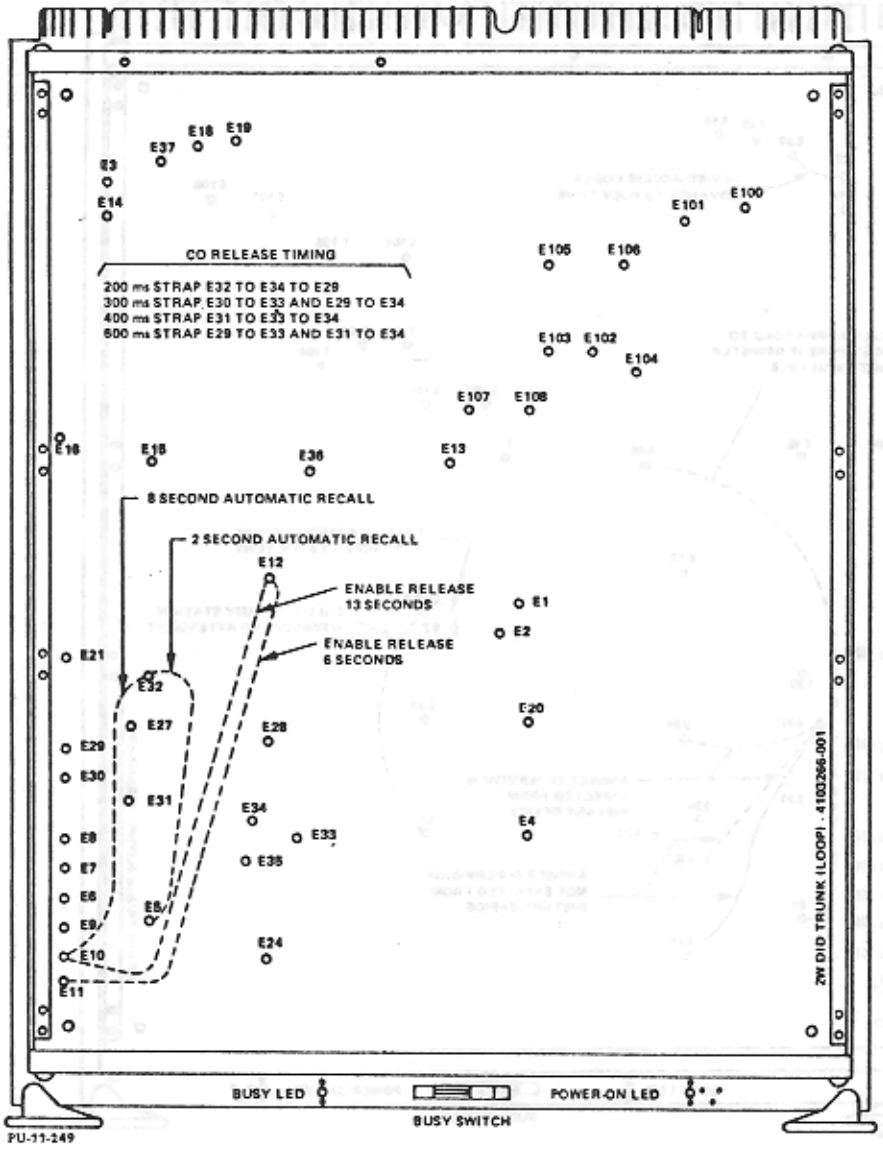

FIGURE 1.03 2-Way DID Trunk (Loop) Strapping (TD-4103266-001)

j. Enable release (refer to figure 1.03). The enable release feature enables the DID trunk to disregard a release signal from the distant office during dialing. This prevents the trunk from dropping the call prematurely.

1. To prevent release for 6 seconds, strap

   Terminal E11 to terminal E12.

2. To prevent release for 13 seconds, strap

   Terminal E10 to terminal E12.

k. Release timing (refer to figure 1.03). To prevent the DID trunk from recognizing a momentary release signal from the distant office, strap one of the following.

1. To prevent the trunk from releasing until receiving a release signal with a duration of 200 ms or longer, strap

   Terminal E32 to terminal E34 to terminal E29.

2. To prevent the trunk from releasing until receiving a release signal with a duration of 300 ms or longer, strap

   Terminal E30 to terminal E33
   Terminal E29 to terminal E34.

3. To prevent the trunk from releasing until receiving a release signal with a duration of 400 ms or longer, strap

   Terminal E31 to terminal E33 to terminal E34.

4. To prevent the trunk from releasing until receiving a release signal with a duration of 600 ms or longer, strap

   Terminal E29 to terminal E33
   Terminal E31 to terminal E34.

NOTE: One of the above timing periods must be strapped for proper operation of the trunk.

1. Automatic recall (refer to figure 1.03). An incoming trunk call is routed back to the attendant if the called EPABX station goes on-hook and the trunk remains off-hook. Strap for this feature as follows.

   1. To recall the attendant in 2 seconds, strap

      Terminal E5 to terminal E32.

   2. To recall the attendant in 8 seconds, strap

      Terminal E10 to terminal E32.

FEATURE STRAPPING
TD-100
2-WAY DID (E & M) TRUNK (TD-4103276-001)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 2-way DID (E & M) trunk PCB. This strapping is applicable to the 2-way DID (E & M) trunk PCB's numbered TD-4103276-001. It should be referred to when strapping a 2-way DID (E & M) trunk for a new installation, or when adding or replacing a 2-way DID (E & M) trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to 2-way DID (E & M) trunk strapping can be found in the following documents.

a. OB-410-160 - Class of Service PCB Strapping.

b. OB-410-161 - Memory PCB Strapping.

c. OB-410-163 - Processor 2 PCB Strapping.

d. OB-410-345 - 2-Way DID Translator PCB Strapping or OB-410-354 - Combined 2-Way DID & Room Number Translator PCB Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The 2-way DID (E & M) trunk may be used for incoming or outgoing calls with E & M signaling capabilities. The 2-way DID trunk is used in conjunction with dial pulse or TEL-TOUCH® registers and the common DID translator. The translator is used on incoming calls only. In the standard wired (option X) trunk subrack, the 2-way DID (E & M) trunk mounts in positions 15 through 24 of the trunk motherboard TD-4101506-003. With option Y wiring, the trunks can be mounted in positions 1 through 10 and 15 through 24 of the TD-4101506-003. When 2-way DID translation is required, the trunk motherboard must be modified per modification kit 16192( )79.

The 2-way DID (E & M) trunk must be used in conjunction with the following PCB's:

a. Class of Service PCB - TD-4101606-010.

b. Memory PCB - TD-4101616-005 or later.

c. Processor 2 PCB - TD-4101636-010.

d. 2-Way DID Translator PCB - TD-4103456-001, or 2-Way DID & Room Number Translator PCB - TD-4103546-001.

Each 2-way DID (E & M) trunk provides strapping terminals for a variety of features. These strapping options are explained in the following

paragraphs. Pin location and straps are shown in the accompanying illustrations.

2.02 Information Required. The following information is required to strap the 2-way DID (E & M) trunk.

a. Type of start pulsing signal.

b. Group to which the tie trunk is assigned.

c. Type of trunk operation (immediate start, wink start, delay dial).

d. Miscellaneous features required.

It should be possible to obtain the above information by consulting a trunk record chart similar to the one shown in figure 1.00. On new installations, the installer should complete such a chart and leave it with the system as a permanent record. The chart should show all applicable trunk features. It should be updated any time trunks are replaced, changed, or added to the system.

2.03 Procedure. Perform the following steps, as required, to arrange the 2-way DID (E & M) trunk to meet local operating requirements.

a. E & M Signaling (refer to figures 1.01, 1.02, and 1.03).

1. If the trunk is to operate with a CDQ-2W interconnect device, strap:

   Terminal E27 to terminal E28
   Terminal E33 to terminal E46.

2. If the trunk is to operate with a CDQ-2X interconnect device, or if the signaling equipment requires ground on the M lead and battery on the E lead when idle, and battery on the M lead and ground on the E lead when seized, strap the following in addition to the straps in step 1, for condition 1 (figure 1.02):

   Terminal E30 to terminal E26
   Terminal E27 to terminal E34
   Terminal E31 to terminal E29
   Terminal E35 to terminal E46.

3. If the signaling equipment requires battery on the M lead and an open E lead when idle, and ground on the M lead and battery on the E lead when seized, strap the following in addition to the straps in step 1, for condition 2 (figure 1.03):

   Terminal E27 to terminal E31
   Terminal E29 to terminal E34
   Terminal E30 to terminal E31
   Terminal E35 to terminal E46.

b. Trunk timing and miscellaneous strapping (refer to figures 1.04 and 1.05).

1. Intercept. On an immediate start incoming call, if the call is to advance to busy tone when the trunk is not set to a register in 400 ms, strap:

   Terminal E3 to terminal E6.

   On a wink start or delay dial incoming call, if the call is to advance to busy tone when the trunk is not set to a register in 400 ms, strap:

   Terminal E16 to terminal E6.

2. Enable release. The enable release feature permits the tie trunk to disregard a release signal from the distant office during dialing. Enable release timing is strapped as follows:

   a. For release after 6 seconds, strap:

      Terminal E4 to terminal E18.

   b. For release after 13 seconds, strap:

      Terminal E5 to terminal E18.

3. Momentary release. To prevent the DID trunk from recognizing any momentary release signal from the CO, determine the timing interval, then strap as follows:

   a. For 200 ms, strap:

TRUNK RECORD CHART
2-WAY DID (E & M) TRUNK TD-4103276

Incoming Access Digits	71	71	71												73 →									
Outgoing Access Digits	71	71	71												73 →									
Card Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Trunk Groups (1-6)	1	1	1												3	3	3	3	3					
E & M Signaling (Condition 1)	✓	✓	✓												✓	✓	✓	✓	✓					
(Condition 2)																								
CDQ-2W Operation																								
Intercept - Busy Tone	✓	✓	✓												✓	✓	✓	✓	✓					
Intercept - Attendant																								
Immediate Start	✓	✓	✓												✓	✓	✓	✓	✓					
Wink Start																								
Delay Dial																								
Distant Office Release Timing (200, 300, 400, 600 ms)	600	600	600												300	300	300	300	300					
Enable Release Timing (6 or 13 seconds)	6	6	6												6	6	6	6	6					
Attendant Recall	✓	✓	✓												✓	✓	✓	✓	✓					
Inhibit Attendant Recall																								
Trunk Reservation															✓	✓	✓							
2dB Insertion Loss																								
600 ohm Termination																								
900 ohm Termination	✓	✓	✓												✓	✓	✓	✓	✓					

PU-77-260

FIGURE 1.00 Typical Trunk Record Chart

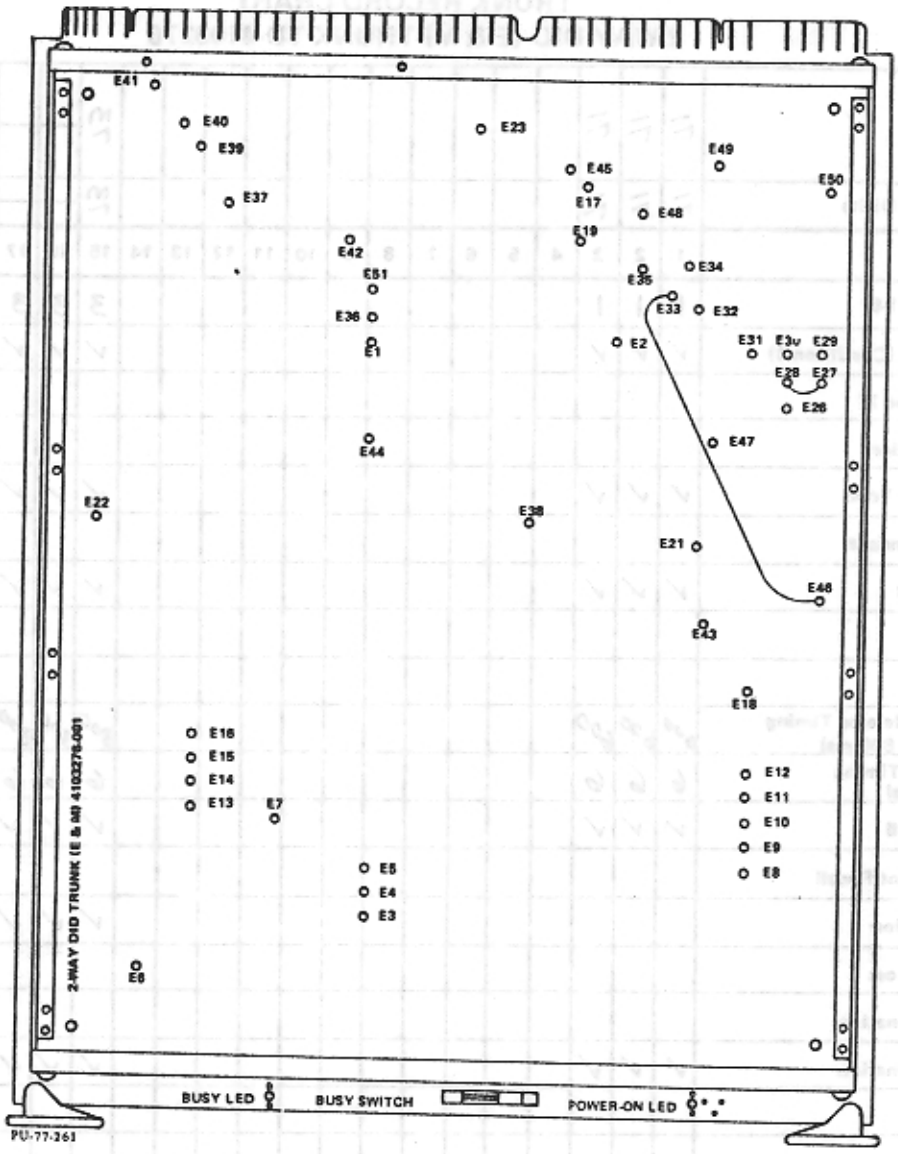

FIGURE 1.01 2-Way DID Trunk E & M/CDQ-2W Strapping (TD-4103276-001)

Terminal E8 to terminal E9
Terminal E9 to terminal E10.

b. For 300 ms, strap:

Terminal E8 to terminal E12
Terminal E9 to terminal E10.

c. For 400 ms, strap:

Terminal E8 to terminal E9
Terminal E9 to terminal E11.

d. For 600 ms, strap:

Terminal E8 to terminal E10
Terminal E9 to terminal E11.

NOTE: One of the aforementioned release time periods must be strapped for proper operation.

4. Attendant recall. An incoming trunk call is routed back to the attendant automatically if the trunk party remains off-hook for more than 2 or 8

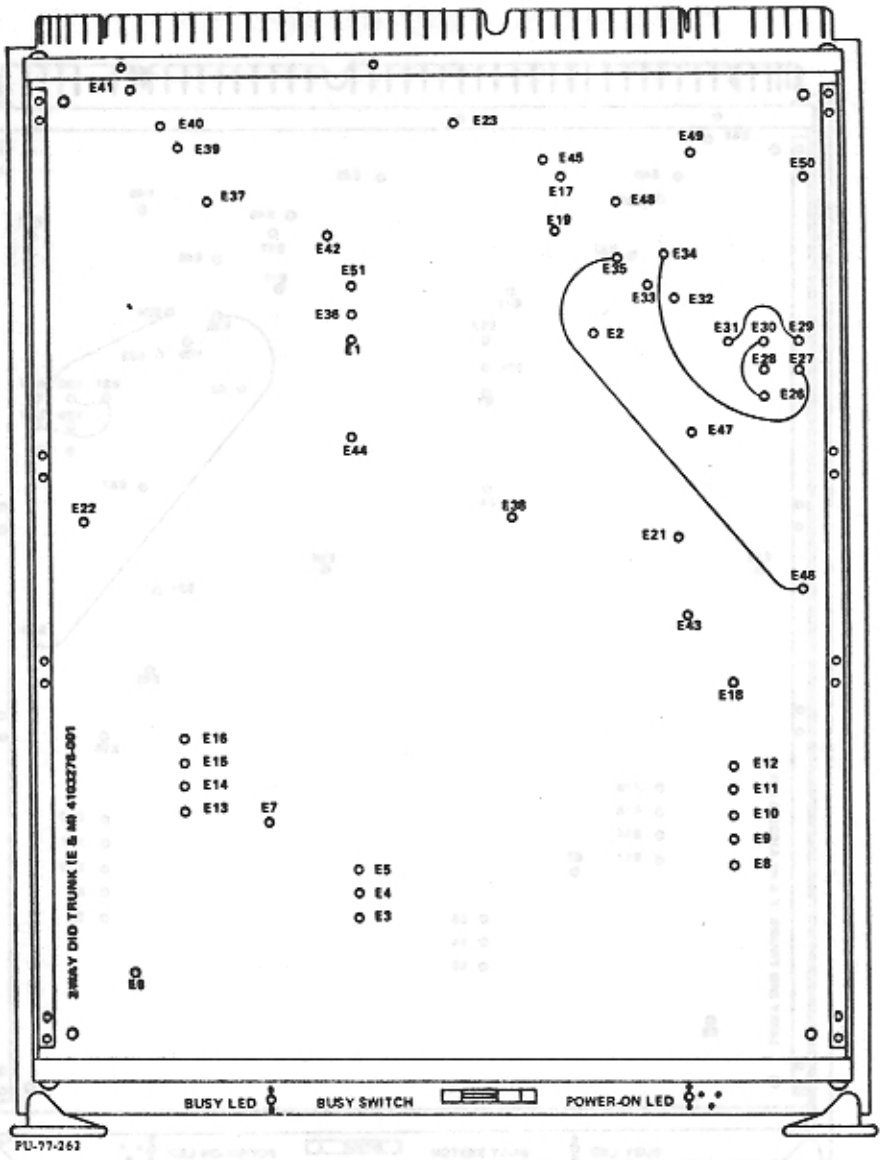

FIGURE 1.02 CDQ-2X and E & M Signaling, Condition I (TD-4103276-001)

seconds (depending upon the strapping) after the EPABX station user goes on-hook.

a. For 2-second recall, strap:

Terminal E3 to terminal E21.

b. For 8-second recall, strap:

Terminal E4 to terminal E21.

5. Busy indication. When a busy indication is to be sent to the CO when the busy switch is operated on the trunk PCB, strap:

Terminal E37 to terminal E43.

6. Called station busy.

a. If calls to a busy station are to advance to the attendant, strap:

Terminal E42 to terminal E36.

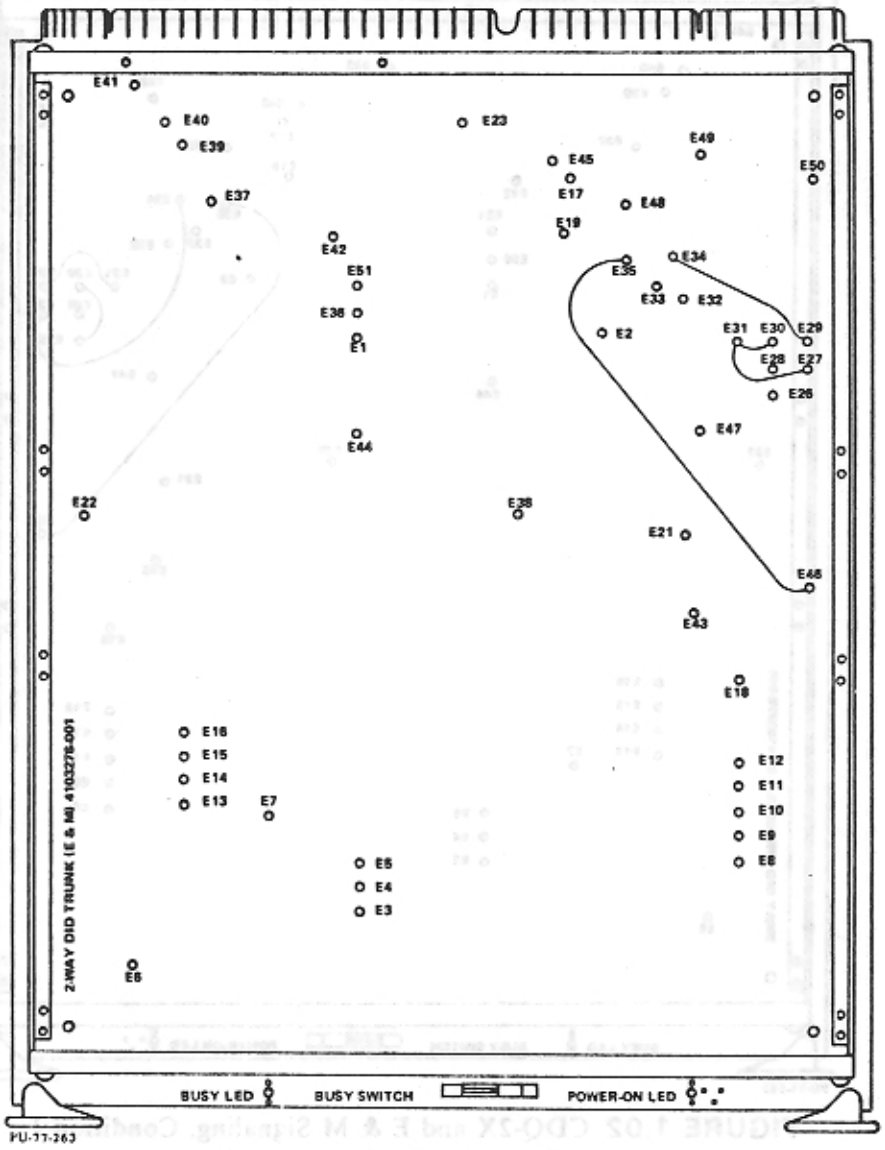

FIGURE 1.03 E & M Signaling, Condition 2 (TD-4103276-001)

b. If calls to a busy station are to advance to a busy tone, strap:

Terminal E7 to terminal E42.

7. Trunk reservation. To allow the attendant to restrict a two-way trunk to incoming service only, strap:

Terminal E39 to terminal E41.

8. 2dB insertion loss. To provide 2dB insertion loss on a tandem call connecting to an outgoing central office trunk or tie trunk, strap:

Terminal E1 to terminal E51.

c. Miscellaneous Strapping (refer to figure 1.05).

1. Type of start pulsing signal.

a. Immediate start. If the distant PABX is to start pulsing or

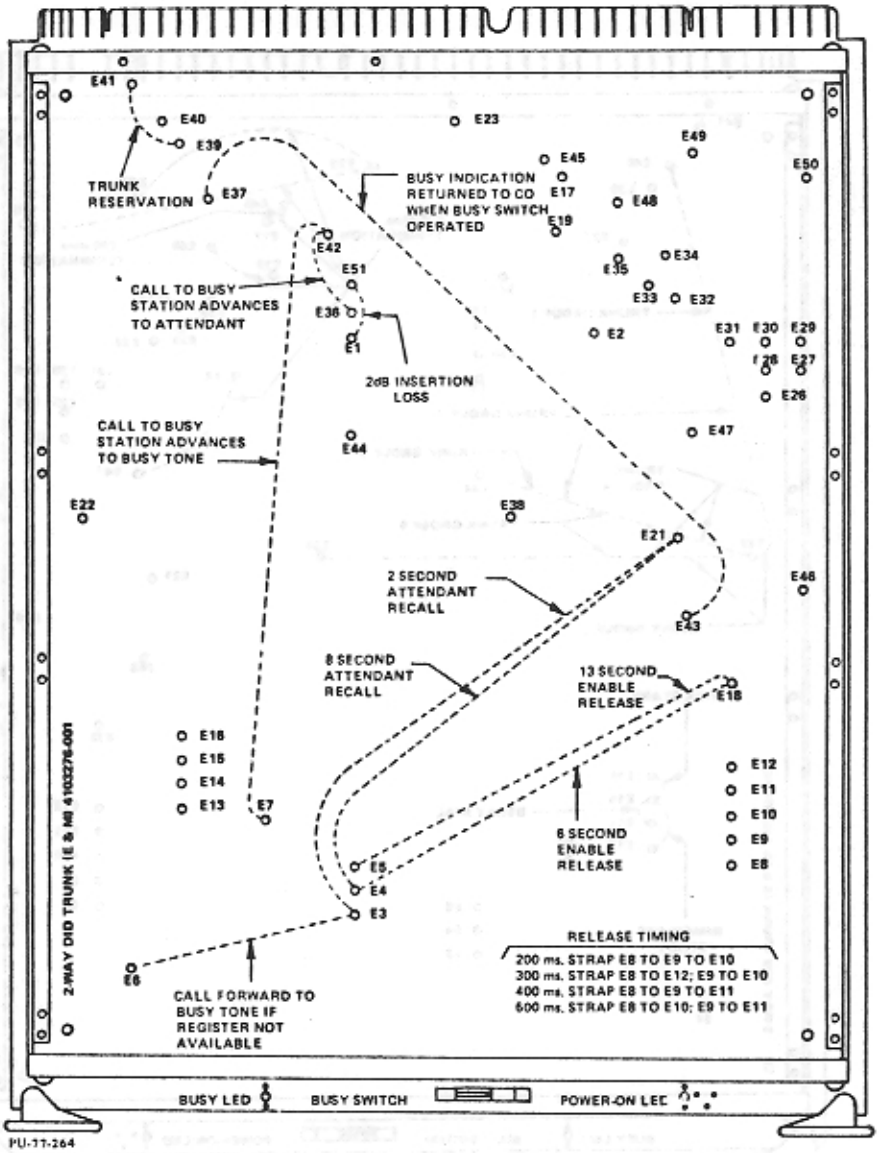

FIGURE 1.04 Trunk Timing and Miscellaneous Strapping

expects to start on seizure, strap:

Terminal E13 to terminal E15.

b. Delay dial. If the distant PABX is to delay or expects a delay between seizure and start of pulsing, strap:

Terminal E14 to terminal E15.

c. Wink start. If the distant PABX momentarily reverses or expects a momentary reversal of the tip and ring as an indication to start pulsing, strap:

Terminal E15 to terminal E16.

2. Trunk groups. The TD-100 tie trunks must be assigned to a trunk group to allow the processor to seize them.

a. To assign the trunk to group 1, strap:

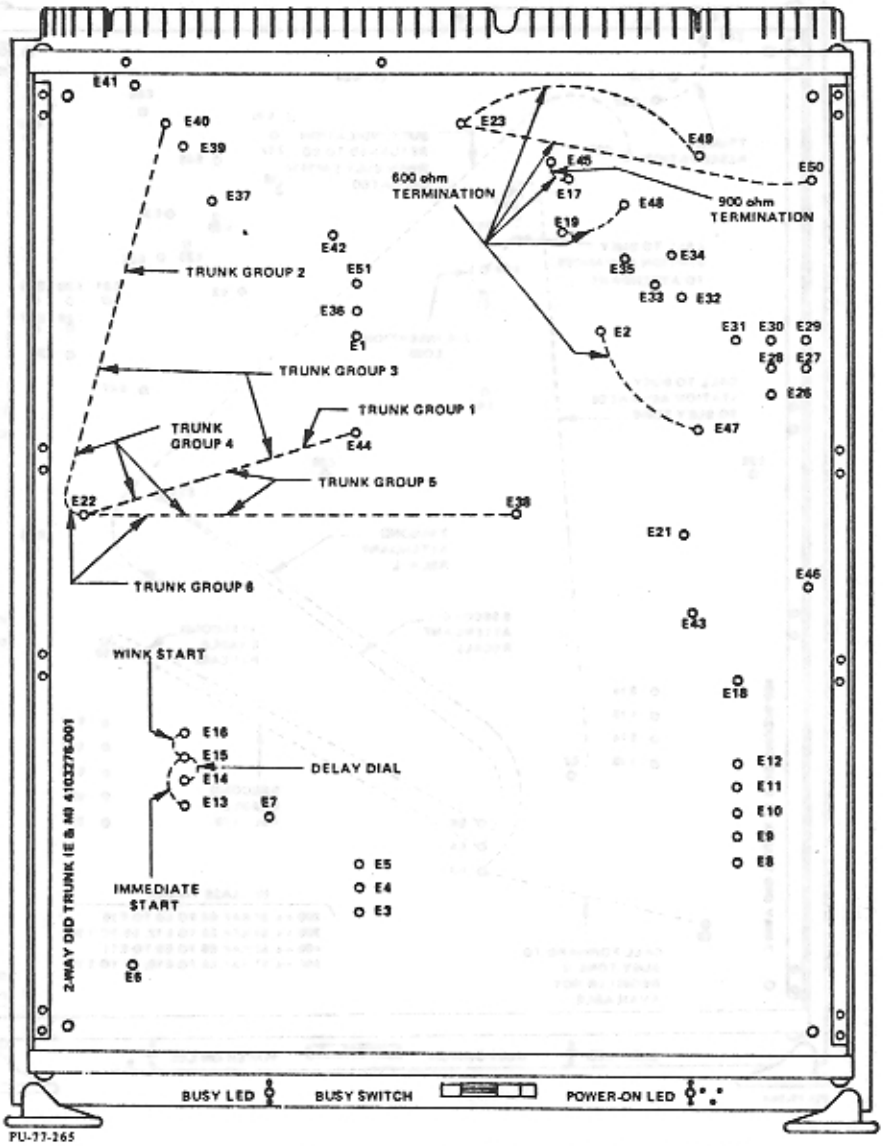

FIGURE 1.05 Miscellaneous Strapping

Terminal E22 to terminal E44.

b. To assign the trunk to group 2, strap:

Terminal E22 to terminal E40.

c. To assign the trunk to group 3, strap:

Terminal E22 to terminal E40.
Terminal E22 to terminal E44.

d. To assign the trunk to group 4, strap:

Terminal E22 to terminal E40.
Terminal E22 to terminal E38.
Terminal E22 to terminal E44.

e. To assign the trunk to group 5, strap:

Terminal E22 to terminal E38.
Terminal E22 to terminal E44.

f. To assign the trunk to group 6, strap:

Terminal E22 to terminal E38.
Terminal E22 to terminal E40.

3. To provide 600-ohm termination, strap:

Terminal E2 to terminal E47.

Terminal E17 to terminal E45.
Terminal E19 to terminal E48.
Terminal E23 to terminal E49.
Terminal E23 to terminal E50.

4. To provide 900-ohm termination, strap:

Terminal E17 to terminal E45.

FEATURE STRAPPING
TD-100
EXECUTIVE ACCESS TRUNK PCB
(TD-4103346-001)

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1.00 Executive Access Trunk PCB Strapping (TD-4103346-001) 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 executive access trunk PCB. This information is applicable to executive access trunk PCB's numbered TD-4103346-001. It should be referred to when strapping the executive access trunk for a new installation, or when adding or replacing an executive access trunk in a working system.

1.02 Related Strapping Documents. Additional information which may apply to the executive access trunk strapping can be found in section OB-410-160, Class of Service PCB Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The executive access trunk is a local one-way incoming CO trunk (ground start only) which serves as a direct line from the CO to the TD-100 EPABX. The trunk appears as a tie line and makes all EPABX services available to the calling party. It can only be used in TD-100 systems equipped with TEL-TOUCH® registers and from CO stations equipped for tone dialing.

In the standard wired trunk subrack (x option), it may be mounted in positions 15 through 24. In specially wired trunk subracks (y option) equipped with trunk motherboard TD-4101506-003 and the memory PCB, TD-4101616-005, it can be mounted in positions 1 through 10 as well as 15 through 24.

2.02 Information Required. The following information is required to strap the executive access trunk PCB.

a. Whether STC interconnect device will be used.

b. Miscellaneous features required.

2.03 Executive Access Trunk (TD-4103346-001). Perform the following steps, as required, to arrange the executive access trunk to meet local operating requirements (refer to figure 1.00).

a. Signaling. To arrange the trunk for operation without an STC interconnect device, strap:

Terminal 19 to terminal 20.

NOTE: If an STC interconnect device is to be used, omit the strap from terminal 19 to 20.

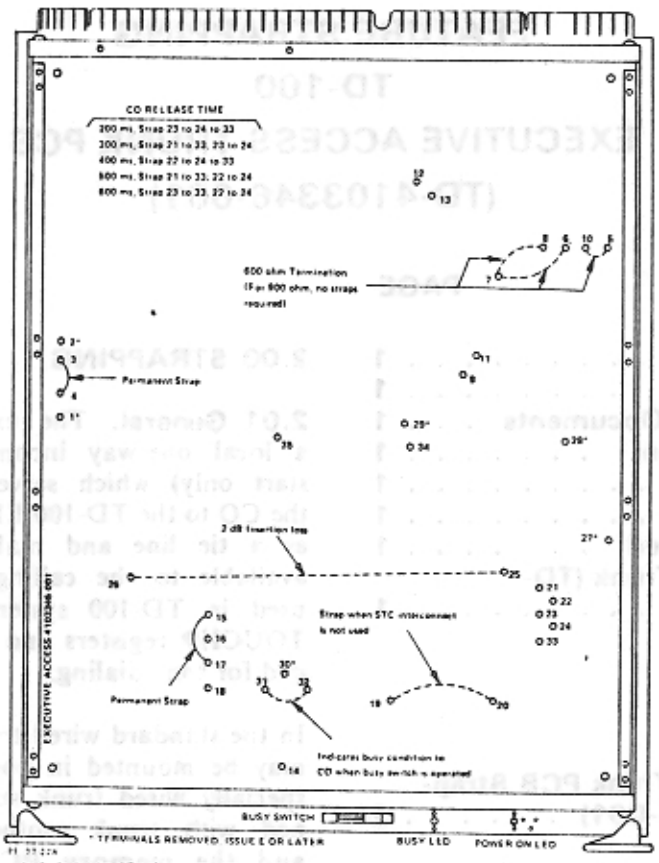

FIGURE 1.00 Executive Access PCB Strapping (TD-4103346-001)

b. Release Time. If the trunk is to disregard a momentary release signal from the CO, determine the time period, then strap as follows:

1. For 200 ms, strap:

   Terminal 23 to terminal 24
   Terminal 24 to terminal 33.

2. For 300 ms, strap:

   Terminal 21 to terminal 33
   Terminal 23 to terminal 24.

3. For 400 ms, strap:

   Terminal 22 to terminal 24
   Terminal 24 to terminal 33.

4. For 500 ms, strap:

   Terminal 21 to terminal 33
   Terminal 22 to terminal 24.

5. For 600 ms, strap:

   Terminal 23 to terminal 33
   Terminal 22 to terminal 24.

NOTE: One release time period must be strapped for proper operation.

c. 2dB Insertion Loss. To provide 2dB insertion loss on a tandem call to an outgoing central office trunk or tie trunk, strap:

Terminal 25 to terminal 26.

d. To provide 600-ohm termination, strap:

Terminal 10 to terminal 5

Terminal 7 to terminal 8
Terminal 7 to terminal 6.

NOTE: To provide 900-ohm termination, no straps are required.

e. To make busy the incoming portion of the trunk when the busy switch is operated, strap:

Terminal 31 to terminal 32.

f. The following are permanent straps:

Terminal 3 to terminal 4
Terminal 15 to terminal 17.

g. Some terminals are not used at the present time and do not require strapping. These terminals are 1, 2, 9, 11, 12, 13, 14, 16, 18, 27, 28, 29, 30, 34 and 35.

Terminals 1, 2, 27, 28, 29 and 30 are removed from assembly TD-4103346-001, Issue E or later.

FEATURE STRAPPING
TD-100
2-WAY DID TRANSLATOR
(TD-4103456-001)

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1.00 2-Digit DID Translation Strapping (TD-4103456-001) 2
1.01 3-Digit Translation Strapping (TD-4103456-001) 2
1.02 Vacant Number Intercept Strapping (TD-4103456-001) 3

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 2-Way DID translator PCB. This information is applicable to 2-way DID translator assemblies numbered TD-4103456-001. It should be consulted when strapping the translator PCB during a new installation, when adding a new 2-way DID trunk, or when replacing the translator PCB in a working system.

1.02 Related Strapping Document. Additional information which will affect the 2-way DID translator will be found in OB-410-160, TD-100 Class of Service Strapping.

1.03 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient quantity of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. The 2-way DID translator is used in position 12 of the channel subrack TD-4101716-003. (TD-100 systems equipped with standard Z wiring require modification kit 16192( )79 to place the 2-way DID translator PCB in service.) It provides translation of digits from the central office to TD-100 equipment numbers. Strapping terminals are provided to accommodate 2-way DID trunks arranged for 2-, 3-, or 4-digit reception.

2.02 Information Required. The following information is required in order to strap the 2-way DID translator.

a. Number of digits to be received from the CO via each 2-way DID trunk.

b. Specific digits (dialed numbers) to be received from the CO via each 2-way DID trunk.

c. Digit to be assigned as hundreds digit of translated number (must be either 2 or 3).

2.03 2-Digit Translation. If any 2-way DID trunk is to receive only two digits from the CO, strap the 2 DIGIT terminal to one of the appropriate H2 or H3 terminals as required.

EXAMPLE: Figure 1.00 shows the strapping required when one or more 2-way DID trunks will receive only two digits from the CO. In this example, the hundreds digit generated will be 2.

2.04 3-Digit Translation. If any 2-way DID trunks are to receive three digits from the CO, strap from the HUNDREDS ter-

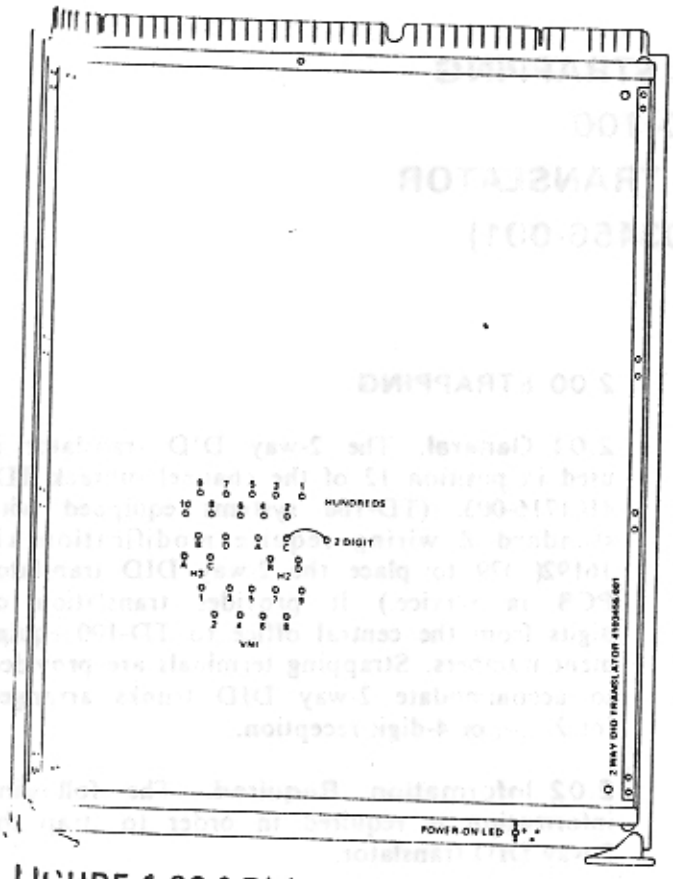

FIGURE 1.00 2-Digit DID Translation Strapping (TD-4103456-001)

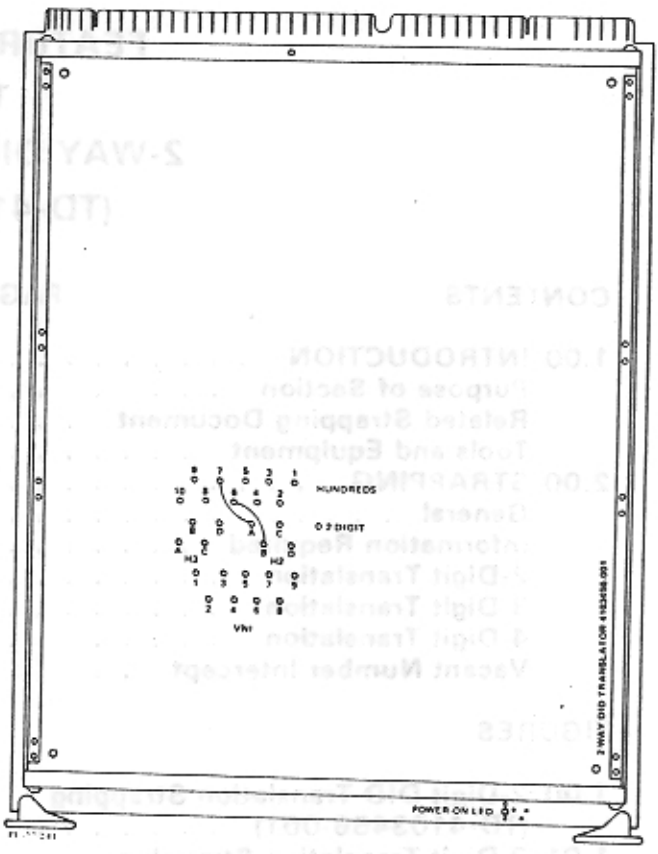

FIGURE 1.01 3-Digit Translation Strapping (TD-4103456-001)

minal corresponding to the hundreds digit to be received to one of the appropriate H2 or H3 terminals as required.

EXAMPLE: Figure 1.01 shows the strapping required when two different digits are to be translated. In this example, 7 and 6 will be translated to 2.

2.05 4-Digit Translation. Strapping for 4-digit translation is identical to 3-digit translation strapping. Since the thousands digit is addsorbed, strap the HUNDREDS terminal corresponding to the hundreds digit to be received, to one of the appropriate H2 or H3 terminals as required.

2.06 Vacant Number Intercept. All unused hundreds terminals should be strapped for vacant number intercept. Strap from each unused HUNDREDS terminal to one of the VNI 1 through 9 terminals.

EXAMPLE: Figure 1.02 shows the strapping required to translate a hundreds digit 1 to 2, and route all received hundreds digits other than 1 to intercept.

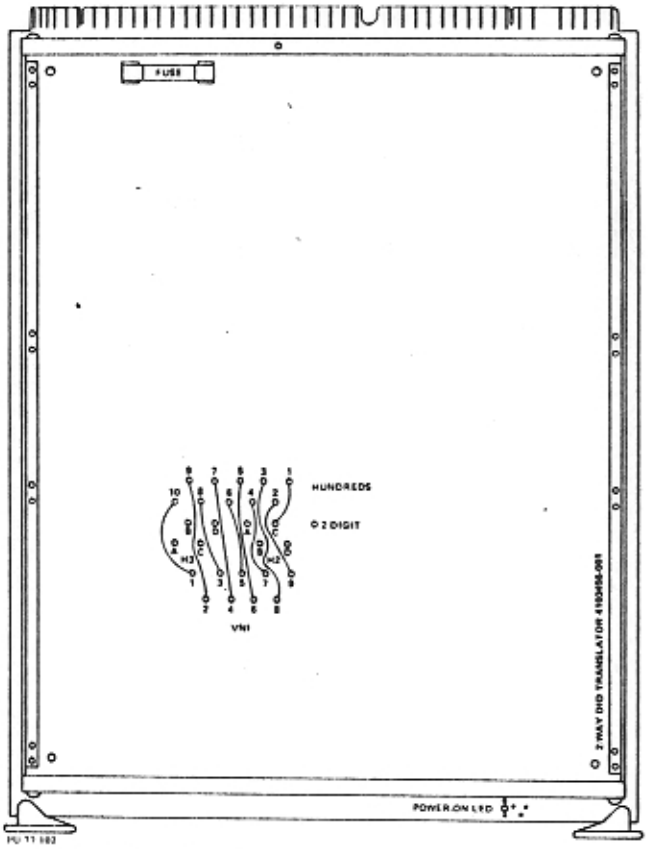

FIGURE 1.02 Vacant Number Intercept Strapping (TD-4103456-001)

FEATURE STRAPPING
TD-100
COMBINED 2-WAY DID AND ROOM NUMBER TRANSLATOR PCB
(TD-4103546-001)

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1.00 Typical Combined 2-Way DID and Room Number Translator Strapping (TD-4103546-001) . . . 2

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 combined 2-way DID and room number translator. This information is applicable to translator PCB's numbered TD-4103546-001. This document should be consulted when installing a room number translator PCB in a new installation, or when adding, replacing, or checking a translator PCB in a working system.

1.02 Tools and Equipment. No tools or equipment are required to perform the strapping in this document, as the room number translator PCB is completely strapped in the factory prior to shipping. However, should it become necessary to replace any straps in the field, the following items are required:

a. A 24 AWG wire-wrapping tool.

b. A wire-stripping tool.

c. 24 AWG (tinned) copper wire.

2.00 STRAPPING

2.01 General. Number translator is an optional feature of the TD-100 EPABX. This feature may be provided by adding the combined 2-way DID and room number translator PCB to the system. The translator PCB is used in position 12 of the -003 channel subrack. (TD-100 systems equipped with standard Z wiring require modification kit 16192( )79 to place the combined 2-way DID and room number translator in service.) Designed primarily for hotel/motel applications, the translator receives dialed digits both from internal (TD-100) stations and from external stations via 2-way DID trunks, and translates these dialed digits to TD-100 equipment numbers.

The translator PCB contains three programmable read only memories (PROM's). These PROM's are factory-programmed with routines peculiar to each installation site. PROM programming and translator strapping are interdependant, therefore strapping of the translator PCB is also site-peculiar.

2.02 Information Required. A customer request form is used to determine programming and strapping of the translator PCB. The instructions for completing the request form are included in ITT Practice MA-000-002.

2.03 Purpose of Strapping Terminals. Arrangement of the strapping terminals on the translator PCB is shown in figure 1.00. Straps shown represent factory strapping for a typical customer request. A brief explanation of each group of terminals is as follows.

a. H (hundreds) 1-9 and T (tens) 1-9. Terminals H (hundreds) 1-9 and T (tens) 1-9 represent the decoded hundreds and tens digits from the system register. The terminals are used to enable and disable the number translation as required.

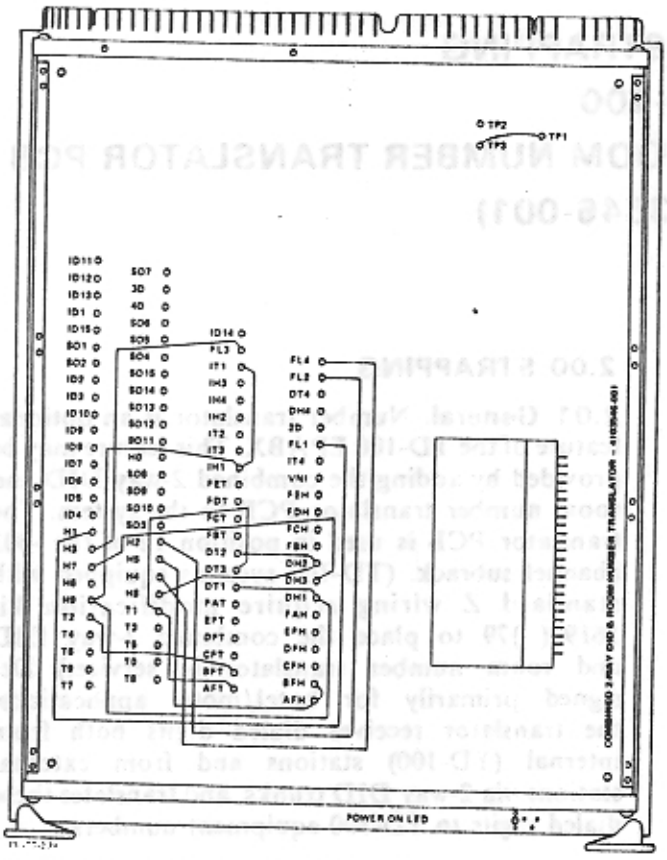

FIGURE 1.00 Typical Combined 2-Way DID and Room Number Translator Strapping (TD-4103546-001)

b. FL (floor) 1-4. Terminals FL (floor) 1-4 represent the four hundreds digits (often associated with hotel floors 1 through 4) that may require translation.

c. 2-digit service terminals. The following terminals are the 2-digit service terminals. Provided in pairs consisting of one XXHX and one XXT terminal, they are used to enable translation of a 2-digit service code (restaurant, laundry, desk, etc.) to a 3-digit TD-100 equipment number.

HUNDREDS	TENS
AFH	AFT
BFH	BFT
CFH	CFT
DFH	DFT
EFH	EFT
FAH	FAT
FBH	FBT
FCH	FCT
FDH	FDT
FEH	FET

d. Inhibit translation terminals. The IH1-IH4 (inhibit hundreds 1 through inhibit hundreds 4) and IT1-IT4 (inhibit tens 1 through inhibit tens 4) terminals are used to inhibit translation on blocks of one hundred, or blocks of ten dialed numbers.

e. DID access deny terminals. The DH1-DH4 (deny hundreds 1 through deny hundreds 4) terminals and DT1-DT4 (deny tens 1 through deny tens 4) terminals are used to route 2-way DID trunk calls to intercept when certain hundreds or tens digits are received via those DID trunks.

f. Permanent straps and unused terminals. For normal system operation, terminal TP1 is permanently connected to terminal TP3. Terminals ID1-ID15 (identity 1 through identity 15) and SO1-SO15 (status-out 1 through status-out 15) are reserved for future use and not strapped at this time. The VNI (vacant number intercept) 2D, 3D, and 4D (2, 3, and 4 digit) terminals are reserved for future use.

2.04 Strapping Example. An example of combined 2-way DID and room number translation strapping is shown in figure 1.00. The purpose of each strap is explained in the following paragraphs.

a.	TP1 to TP3.	This strap is permanently installed for normal system operation.
b.	H1 to FL1. H2 to FL2.	These straps assign hundreds digits 1 through

	H3 to FL3. H4 to FL4.	4 to the PROM sections devoted to the first 4 floors (or building sections) served by the EPABX.
c.	H5 to AFH. AFH to BFH. T1 to AFT. T2 to BFT.	These straps assign codes 51 and 52 for translation.
d.	H9 to IH1. IH1 to IT1.	These straps inhibit translation of all dialed numbers from 900 through 999.
e.	H9 to DH1. DH1 to DT1. H8 to DH2. DH2 to DT2. H7 to DH3. T1 to DT3.	These straps route incoming DID trunk calls to intercept on receipt of 8 or 9 as the hundreds digit, or 71 as the hundreds and tens digit.

FEATURE STRAPPING
TD-100
ASSIGNED NIGHT ANSWER
(TD-4104046-001)

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1.01 Processor 2 Strapping (TD-4101636-010) 2
1.02 ANA PCB Strapping (TD-4104046-001) 3

1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 assigned night answer (ANA) PCB. Included are explanations and illustrations for strapping the ANA PCB and the processor 2 PCB. This information is applicable to ANA PCB's numbered TD-4104046-001 and processor 2 PCB's numbered TD-4101636-003, -004, -005, and -010.

1.02 Tools and Equipment. To perform the strapping described in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. By strapping the ANA PCB and the processor 2 PCB, incoming calls via a maximum of 10 trunks will be routed to preselected stations when the NIGHT switch on the console is placed in the ON position. Strapping on the ANA PCB determines which stations will serve as night answer stations. ANA trunks are determined by their position in the trunk subrack. The trunks in positions 1 through 10 are factory wired for this feature. The ANA PCB is used in position 2 of the channel subrack.

2.02 Information Required.

a. Determine which of the trunks in positions 1 through 10 are to be assigned to night answer stations.

b. Select the station to be assigned to each night answer trunk.

2.03 Pocessor 2 Strapping. Referring to figure 1.00 or 1.01 as required, strap terminal ANA to terminal NT.

2.04 ANA Strapping. Each trunk is assigned a tens and units number that corresponds to its position in the trunk subrack. For example, the trunk in position two is assigned a units number, "2," and a tens number "2"; the trunk in position ten is assigned a units number, "10," and a tens number, "10."

Also provided are five groups of bunching pins, BP1-BP5. Each of these groups of five terminals may be used as required for additional grouping tie points.

2.05 Unused Terminals. Terminals P1 through P10 and terminal PN are reserved for future use.

EXAMPLE: Figure 1.02 shows the strapping required to assign trunks one through five to stations X81 through X85.

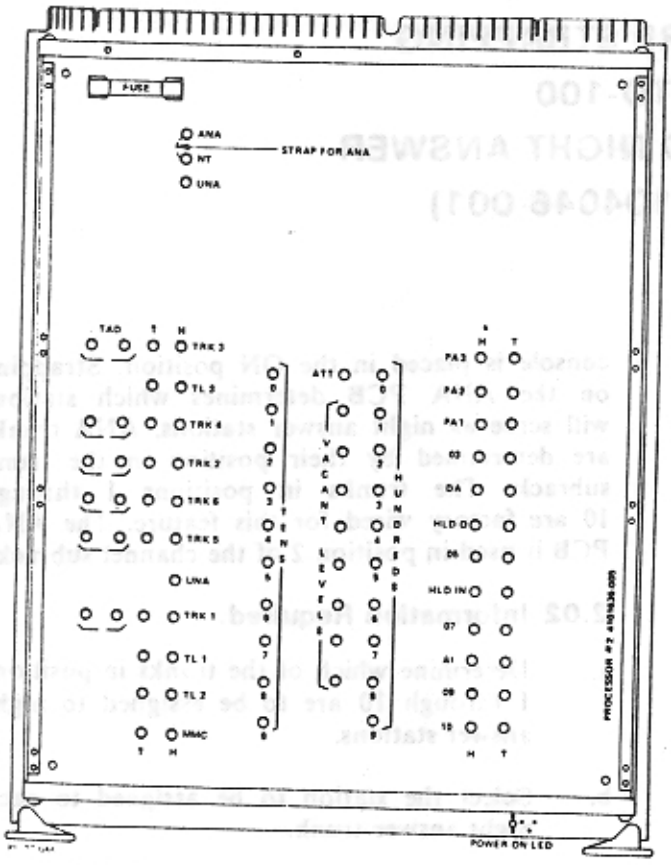

FIGURE 1.00 Processor 2 Strapping
(TD-4101636-003, -004, -005)

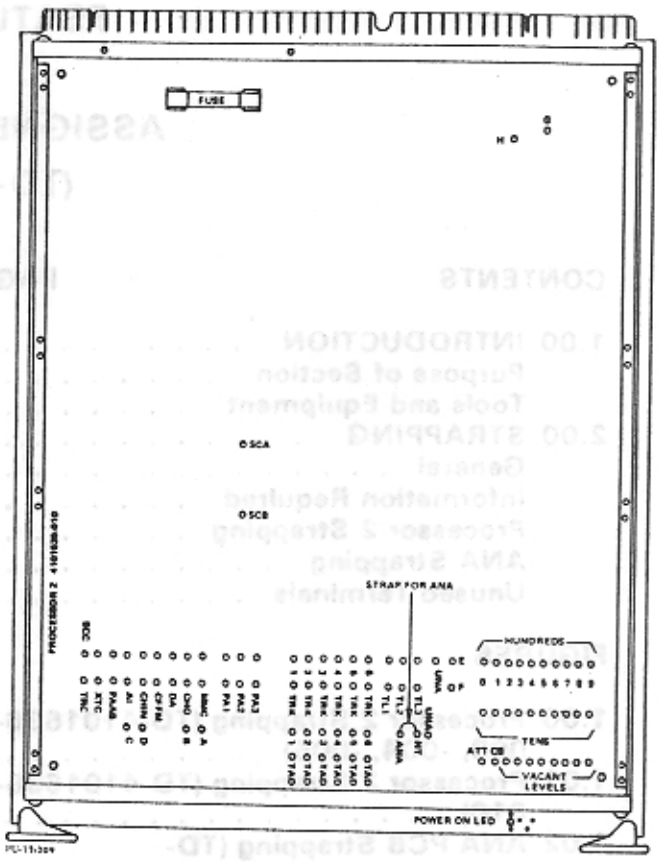

FIGURE 1.01 Processor 2 Strapping
(TD-4101636-010)

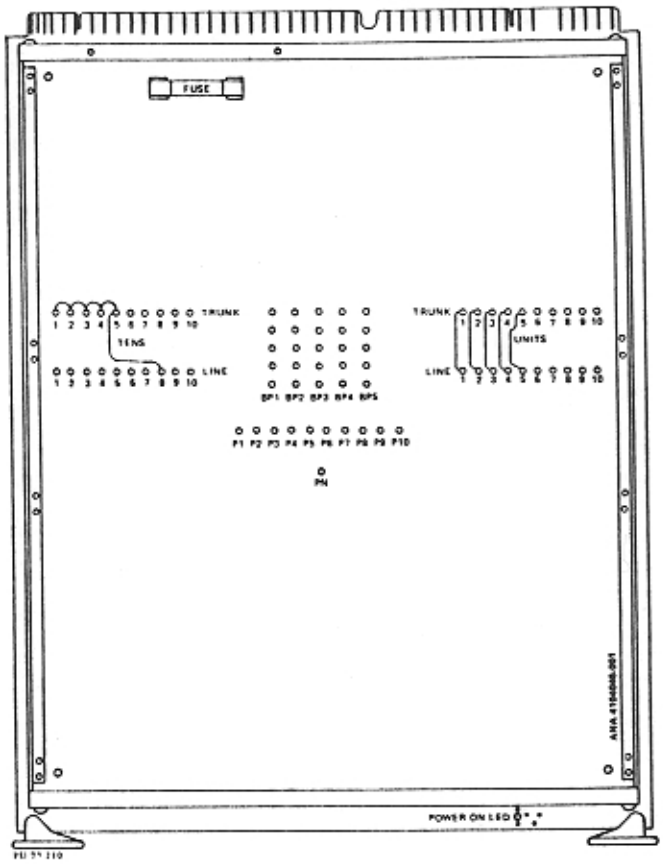

FIGURE 1.02 ANA PCB Strapping
(TD-4104046-001)

FEATURE STRAPPING
TD-100
DIAL/DIRECTED CALL PICKUP SERVICE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the strapping and PROM programming for the TD-100 dial/directed call pickup feature. Included are explanations and illustrations for strapping the memory PCB and the dial/directed call pickup PCB. This information is applicable to memory PCB's TD-4101616-003 and -004, and the dial/directed call pickup PCB, TD-4104306-001. It should be referred to when dial and/or directed call pickup service is added to a new system, or when installing or replacing the dial/directed call pickup PCB in a working system.

1.02 Tools and Equipment. To perform the strapping in this document, a 24 AWG wire-wrapping tool, a wire-stripping tool, and a sufficient supply of 24 AWG (tinned) wire are required.

2.00 STRAPPING

2.01 General. Dial/directed call pickup service is an optional feature of the TD-100 EPABX. Either or both services can be provided by adding the dial/directed call pickup PCB to the system. In cabinets equipped with a TD-4101506-002 motherboard that has been modified per 16052( ) 79, the dial/directed call pickup assembly mounts in position 26 of the trunk subrack. In systems equipped with a TD-4101716-003 motherboard that has been modified per 16015( )79, the assembly mounts in position 14 of the channel subrack.

Dial call pickup allows a station user in an assigned dial call group to dial an access code and answer any ringing station within the assigned group. If the stations are not in the same group, the station attempting to answer the call receives busy tone. Station grouping flexibility permits all stations to be assigned to the same group or divided into as many as 62 groups.

Directed call pickup permits a station user to answer any ringing station in the system. The user consults an external busy lamp field (or determines what line is ringing by other means) and dials an access code; after receiving second dial tone, the station user dials the number of the ringing station and answers the call.

The dial/directed call pickup PCB is equipped with a PROM PCB which accommodates a custom programmed PROM (programmable read only memory). The PROM contains station grouping information for the dial call pickup feature. It is normally programmed in the factory according to information received from the customer.

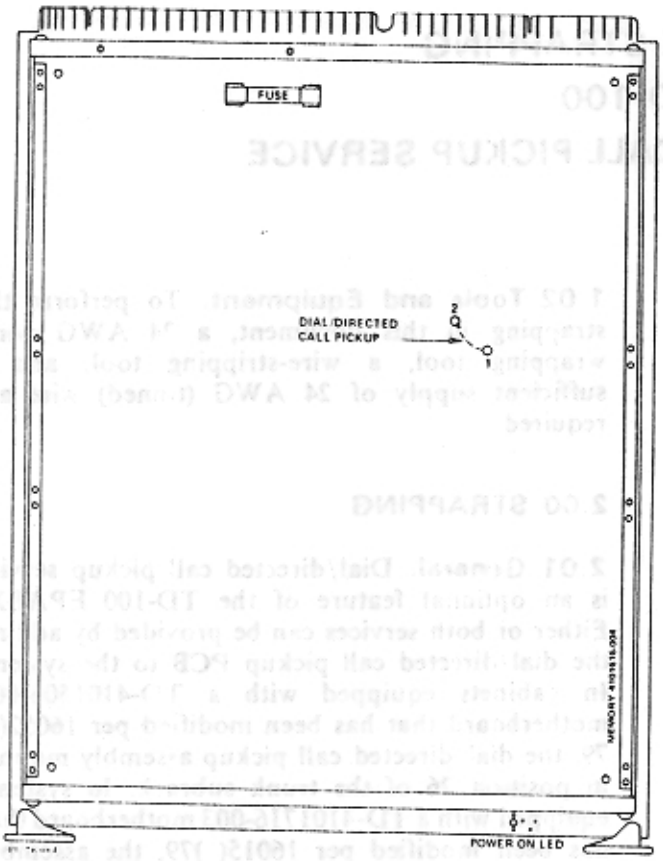

FIGURE 1.00 Memory PCB Strapping (TD-4101616-003/004)

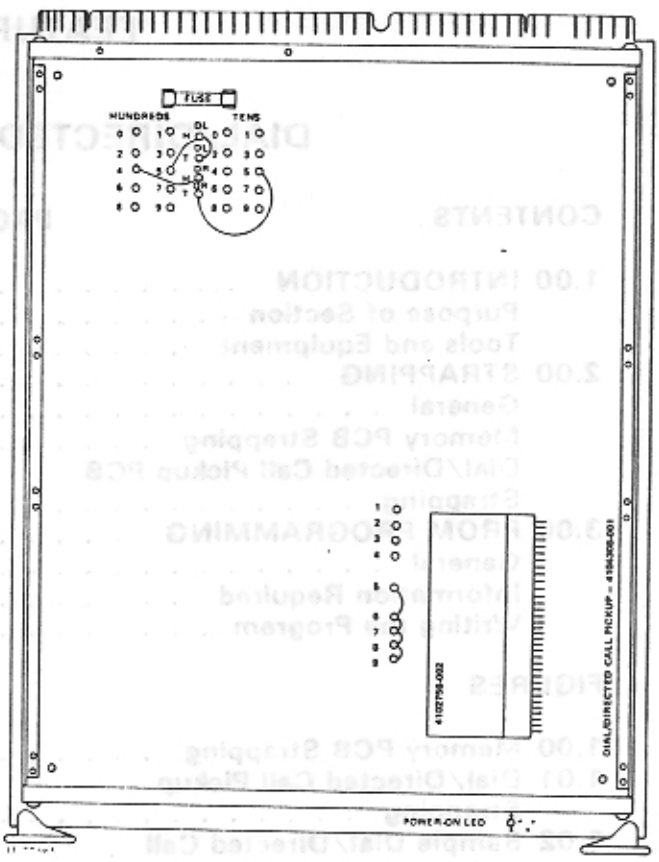

FIGURE 1.01 Dial/Directed Call Pickup Strapping

2.02 Memory PCB Strapping. Strapping for the memory PCB, in systems equipped for dial/directed call pickup, is shown in figure 1.00.

2.03 Dial/Directed Call Pickup PCB Strapping. The layout of the dial/directed call pickup PCB is shown in figure 1.01. As illustrated, strapping terminals on the PCB are used to assign the desired access code or codes. The codes for either feature may be one or two digits. They cannot be the same, and they must not conflict with access codes for other system features. Strap these terminals per steps a and/or b.

a. Dial call pickup. The HUNDREDS digit assignment terminal for dial call pickup is DL H (hundreds). The TENS digit assignment terminal is DL T (tens). Strap these terminals as follows:

1. Single digit access. For single digit access:

   (a) Strap the HUNDREDS terminal (0-9) corresponding to the access digit, to terminal DL H.

   (b) Strap terminal DL H to terminal DL T.

2. Two digit access. For two digit access:

   (a) Strap the HUNDREDS terminal (0-9) corresponding to the hundreds digit, to terminal DL H.

   (b) Strap the TENS terminal corresponding to the tens digits, to terminal DL T.

DIAL/DIRECTED CALL PICKUP

REQUEST FOR PROGRAMMING

Request for (Company Name): MODERN TELEPHONE COMPANY			Customer P.O. Number: 407-1-76	Special Instructions
Address: 1000 MAIN STREET			ITT S.T. Number:	
City: MIDDLEBURG	State: TENNESSEE	Zip Code: 38340	Date: NOVEMBER 14, 1977	
Telephone: (615) 555-4411	Originator: JOE H. REELS		SHEET 1 OF 1	

DIAL CALL PICKUP GROUP NUMBER	STATION NUMBERS IN GROUP
1	200-210
2	211, 212, 214, 216, 218, 230, 240, 252, 277, 289
3	213, 215, 217, 219-229, 231-239
4	240, 241
5	242-251
6	253-276
7	278-280
8	281-288

NOTES: LINES 290-299 NOT EQUIPPED.

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FIGURE 1.02 Sample Dial/Directed Call Pickup Request for Programming

DIAL CALL PICKUP PROM PROGRAMMING

ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS	ADDRESS	DATA	REMARKS
00	01	1st Group	31	03	3rd Group	67	12	6th Group
01	01		32	03		68	12	
02	01		33	03		69	12	
03	01		34	03		70	12	
04	01		35	03		71	12	
05	01		36	03		72	12	
06	01		37	03		73	12	
07	01		38	03		74	12	
08	01		39	03		75	12	
09	01		40	10	4th Group	76	12	
10	01		41	10		78	13	7th Group
11	02	2nd Group	42	11	5th Group	79	13	
12	02		43	11		80	13	
14	02		44	11		81	20	8th Group
16	02		45	11		82	20	
18	02		46	11		83	20	
30	02		47	11		84	20	
40	02		48	11		85	20	
52	02		49	11		86	20	
77	02		50	11		87	20	
89	02		51	11		88	20	
13	03		53	12		FF	F2	END OF PROGRAM
15	03		54	12				
17	03		55	12				
19	03		56	12				
20	03		57	12				
21	03		58	12				
22	03		59	12				
23	03		60	12				
24	03		61	12				
25	03		62	12				
26	03		63	12				
27	03		64	12				
28	03		65	12				
29	03		66	12				

NOTE: All addresses not listed are not programmed.

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FIGURE 1.03 Sample Dial Call Pickup PROM Programming

FEATURE STRAPPING
TD-100
LINE CIRCUIT WITH CO TO CO CONNECTION PCB (TD-4104456-001)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes the feature strapping for the TD-100 line circuit with CO to CO connection PCB (printed circuit board) TD-4104456-001. It is recommended that this section be referred to when strapping the PCB for a new installation or when making an addition or replacement for an existing system.

1.02 Tools and Equipment. To perform the strapping described in this section requires a 24 AWG wire-wrapping tool, a wire-stripping tool, and a supply of 24 AWG (tinned) wire.

2.00 STRAPPING

2.01 General. Each line circuit with CO to CO connection PCB contains three individual line circuits and one CO to CO connection circuit. The TD-100 is arranged to accommodate as many as 20 regular line circuit PCB's and each may be replaced with a line circuit with CO to CO connection PCB. The line circuit PCB's and line circuit with CO to CO connection PCB's are used in positions 2 through 21 of the line subrack.

2.02 Information Required. Before strapping the line circuit with CO to CO connection PCB, the following information must be determined.

a. The type and quantity of station instruments (single-line or key set) to be assigned to each line.

b. The lines which will require a 2000 ohm loop.

After determining the aforementioned, a line record chart similar to the one depicted in figure 1.00 should be consulted. The chart should include applicable line features. Any time a line circuit PCB or line circuit with CO to CO connection PCB is replaced, changed, or added to the system, the record chart should reflect these changes. Note that the first two line positions are used for the CO to CO connection.

2.03 Procedure. Two feature strappings are provided on the line circuit with CO to CO connection PCB (refer to figure 1.01). When only single-line telephone sets are used on a line, a strap must be added on the appropriate line circuit. When a single-line telephone set and a key telephone set are used on the same line, the strap is not installed. For A-lead operation, the single-line telephone set must be modified and the A-lead connection made in the same manner as for a key telephone set. Strap A-B should preferably be made at the distributing frame between leads A and A1 of the corresponding line circuit to prevent unnecessary service interruption. When it is required to extend the loop limit of a single-line telephone set from 1000 ohms to 2000 ohms, the strap shown in figure 1.01 must be added. Strap from Y to X or from Y to Z; do not install both straps.

> NOTE: This strap increases the battery feed of the third line circuit (fifth position) on the PCB from 48V to 72V.

Station Line Record Chart (Lines 00-24)

LINE	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
BOARD POSITION	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
CIRCUIT ON BOARD			1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Number of Rotary Dial Telephones — Key Sets																									
Number of Rotary Dial Telephones — Single Line Sets																									
Number of Tel-Touch Telephones — Key Sets	Used for CO to CO Connection	Used for CO to CO Connection		1	6																				
Number of Tel-Touch Telephones — Single Line Sets			2																						
Number of Key Set Ringers (1-5)				1	2																				
Number of Single Line Set Ringers (1 or 2)			1																						
Strapped for Single Line Operation			✓																						
Strapped to provide 72V feed (5th circuit on each board only)					✓																				
Connected for Power Failure Transfer				✓																					
Power Failure Transfer Circuit Used (1-9)				2																					
Trunk Used (1-54)				3																					
Connected for Assigned Night Answer																									
Trunk Used (1-24)																									

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FIGURE 1.00 Typical Station Line Record Chart

b. Directed call pickup. The HUNDREDS digit assignment terminal for directed call pickup is DR H (hundreds). The TENS digit assignment terminal is DR T (tens). Strap these terminals as follows:

1. Single digit access. For single digit access:

   (a) Strap the HUNDREDS terminal (0-9) corresponding to the access digit to terminal DR H.

   (b) Strap terminal DR H to terminal DR T.

2. Two digit access. For two digit access:

   (a) Strap the HUNDREDS terminal (0-9) corresponding to the hundreds digit, to terminal DR H.

   (b) Strap the TENS terminal (0-9) corresponding to the tens digit, to terminal DR T.

EXAMPLE: Figure 1.01 shows strapping where a single digit (5) is used for dial call pickup access, and two digits (45) are used for directed call pickup access.

   (c) Miscellaneous strapping. For proper operation of the dial/directed call pickup PCB, strap terminals 5, 6, 7, 8 and 9 together. Terminals 1, 2, 3 and 4 are reserved for future use.

3.00 PROM PROGRAMMING

3.01 General. The dial/directed call pickup PCB contains one PROM which is normally programmed at the factory to accommodate customer requirements. This PROM may be programmed in the field when required. Programming consists of two distinct phases: writing the program and installing the program in the PROM. ITT practice AA-000-011, entitled PROM Programming, contains detailed instructions for the operation of a programmer.

3.02 Information Required. A request for programming form should be used to record the desired station grouping for dial call pickup service. The form and instructions for its completion are contained in ITT practice MA-000-002. The form should be filled out and submitted to ITT Telecommunications when ordering the dial/directed call pickup PCB with factory programmed PROM's.

3.03 Writing the Program. Each TD-100 station number is contained within a series of one hundred three-digit numbers, typically 200 through 299. Assigning stations to dial call pickup groups is done on the basis of the tens and units digits of the station number.

A total of 62 group identity codes are available and are listed in table 1.00. To assign a station to any of the 62 groups, it is necessary to program the group identity code at the address corresponding to the tens and units digits of the station number.

Not every station must be placed in a group, but any one station may appear in only one group. A group theoretically may contain from 2 to 100 stations, but functional practicality will dictate the maximum group size. At address "FF," an "F2" must be programmed to signify the end of the program.

Figure 1.02 is a sample completed request for programming, and figure 1.03 is a sample dial call pickup program which will execute the requests presented in figure 1.02. A comparison of these samples and table 1.00 will reveal the program writing methods.

For example, in figure 1.02, there is a request to place stations 200 through 201 in a dial call pickup group. In table 1.00, the first available group identity code is "01." In figure 1.03, addresses "00," "01," "02," "03," "04," "05," "06," "07," "08," "09," and "10" (corresponding to stations 200 through 210) are programmed to output a "01," and thus are members of the first group. Note also that address "FF" is programmed to output an "F2" to signify the end of the program.

It is important to realize that programs need not necessarily be written in exactly the same manner to accomplish the same objectives. The

skilled programmer will avoid duplication and omission and construct programs that are concise and complete. A thorough study of the sample program presented here should enable personnel to construct programs for the dial/directed call pickup PCB.

TABLE 1.00 Dial Call Pickup Group Identity Codes

	20	40	60	80	A0	C0	E0
01	21	41	61	81	A1	C1	E1
02	22	42	62	82	A2	C2	E2
03	23	43	63	83	A3	C3	E3
10	30	50	70	90	B0	D0	F0
11	31	51	71	91	B1	D1	F1
12	32	52	72	92	B2	D2	
13	33	53	73	93	B3	D3	

FEATURE STRAPPING
TD-100
QUAD TRANSFER TRUNK/STATION ADD-ON LINKS PCB
(TD-4104066-001)

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1.00 INTRODUCTION

1.01 Purpose of Section. This section describes strapping for the TD-100 quad transfer trunk/station add-on links PCB. This information is applicable only to quad transfer trunk/station add-on assemblies numbered TD-4104066-001. It should be consulted when installing the quad transfer trunk/station add-on links PCB in a new installation, or when adding or replacing it in a working system.

2.00 STRAPPING

2.01 General. The quad transfer trunk/station add-on links board contains four link circuits which, under normal service, function as transfer links, but are multiplexed upon request to function as add-on links. The transfer link allows a station connected to a trunk to transfer the trunk to another station; the add-on link allows a station connected to a trunk to add-on another station to enable a three-way conversation.

The PCB mounts in position 22 of the TD-4101716-003 or later channel motherboard of the TD-100 equipment cabinet. The quad transfer trunk/station add-on links board, TD-4104066-001 must be used in conjunction with the memory PCB, TD-4101616-005 or later.

2.02 Procedure. Refer to figure 1.00. To enable trunk transfer and add-on operation, a permanent strap is installed between terminal A and terminal C. Terminal B is reserved for future use.

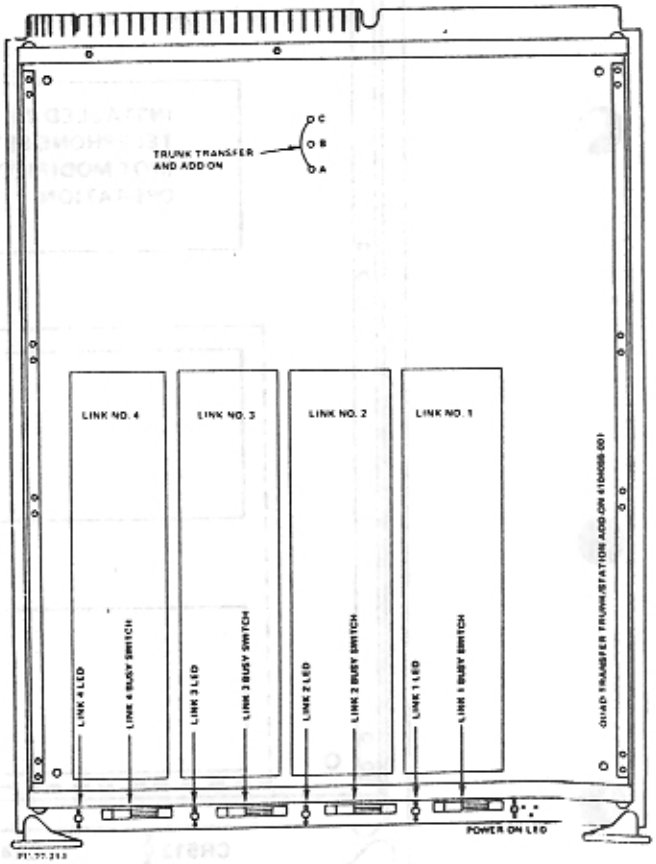

FIGURE 1.00 Quad Transfer Trunk/Station Add-On PCB Strapping (TD-4104066-001).

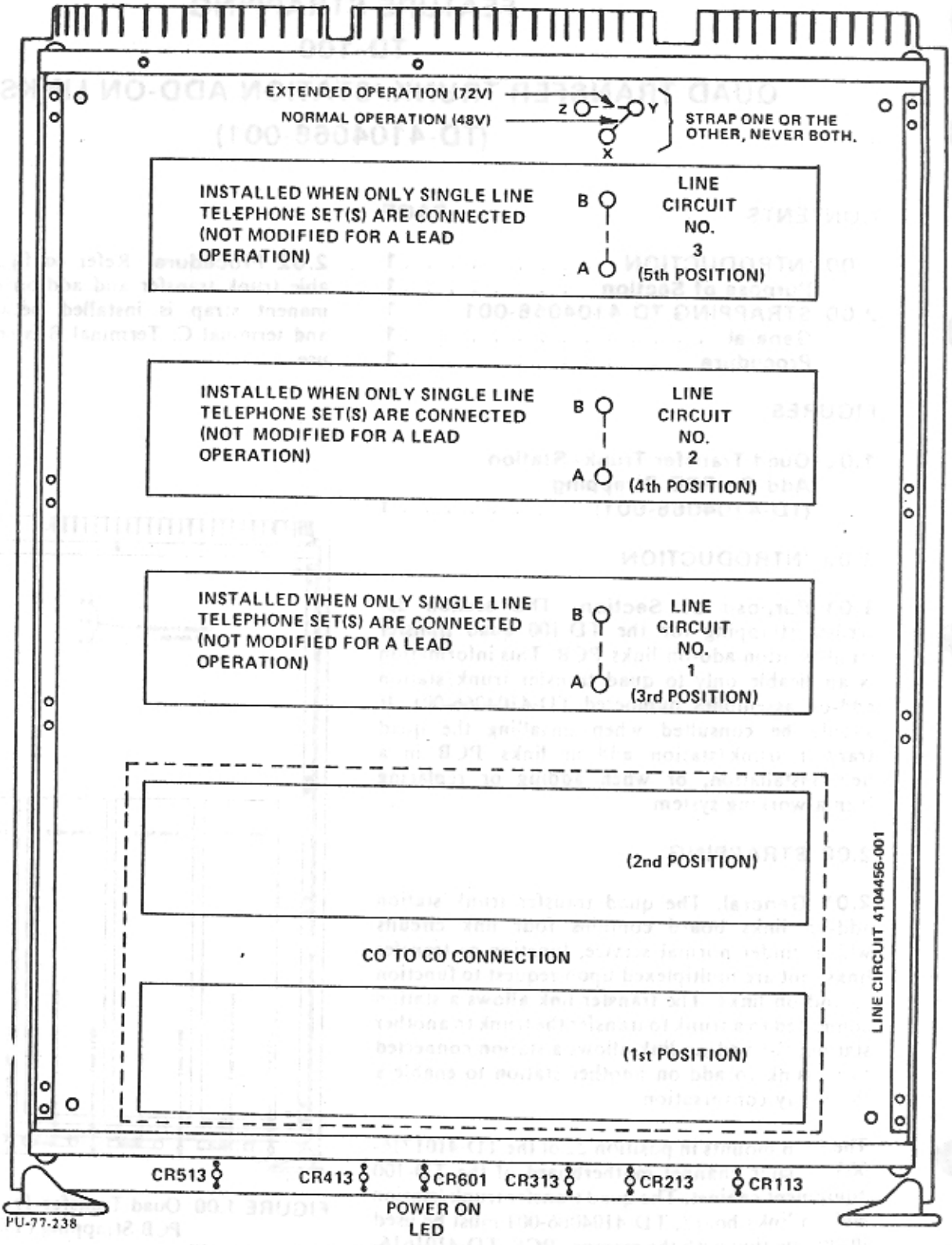

FIGURE 1.01 Line Circuit with CO to CO Connection Board Strapping (TD-4104456-001)

TO: USERS OF THIS MANUAL

This manual contains information concerning TD-100 operation. It includes all documents prefixed by the letters OL. A summary of the contents of the documents follows:

OL-401-601, MASTER NARRATIVE INDEX. This section lists all available TD-100 EPABX narratives.

OL-401-602, INTRODUCTION TO NARRATIVES. This section provides an introduction to the individual circuit narratives for the TD-100 EPABX. A description of general system operation is presented, with additional information to facilitate the understanding of individual circuit narratives. Notable items include,

System Design Philosophy. . . . . .paragraph 2.00
Call Description . . . . . .paragraph 3.00
System and Document Numbers. . . . . .paragraphs 4.00 and 5.00
Decimal, Binary, and Hexadecimal Numbers. . . . . .paragraph 6.00
Internal Lead Abbreviations . . . . . .paragraph 7.00

OL-410-XXX, CIRCUIT NARRATIVE. Each narrative contains a detailed description of the operation of the circuit involved. To determine the number of a particular narrative, add the prefix "OL" to the circuit number and drop the seventh digit. For example, the CO trunk schematic is number 4101537; the narrative for the CO trunk is OL-410-153.

OL-410-228	Toll Restrictor
OL-410-258	Quad Transfer and Add-on Links
OL-410-294	Room Number Translator
OL-410-295	Recorder Disconnect
OL-410-311	Dial Call/Directed Call Pickup
OL-410-320	Access Test Set (Late)

INTRODUCTION TO NARRATIVES
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section is intended to serve as an introduction to the TD-100 Electronic Private Automatic Branch Exchange circuit narratives. Also provided herein is information pertinent to the use of those narratives, including design philosophy and general system operation. The system numbering plan and drawing numbering plan are presented as is an explanation of binary and hexadecimal number systems and TD-100 lead designations.

1.02 Purpose of Equipment. The TD-100 EPABX is an electronic switching system suitable for Provate Automatic Exchange or Private Automatic Branch Exchange service. It is designed to provide service for a maximum of 100 stations.

2.00 DESIGN PHILOSOPHY

2.01 General. The TD-100 uses the principles of time division multiplexing for supervision and control of the switching functions, and pulse amplitude modulation for the common highway speech transmission path. The design philsophy is based on the modular concept, with each circuit being contained on a plug-in printed circuit board (PCB). This system of flexible standard PCB units and additional plug-in optional boards makes possible a readily adaptable and expandable system. A basic operational diagram of the TD-100 is shown in figure 1.00.

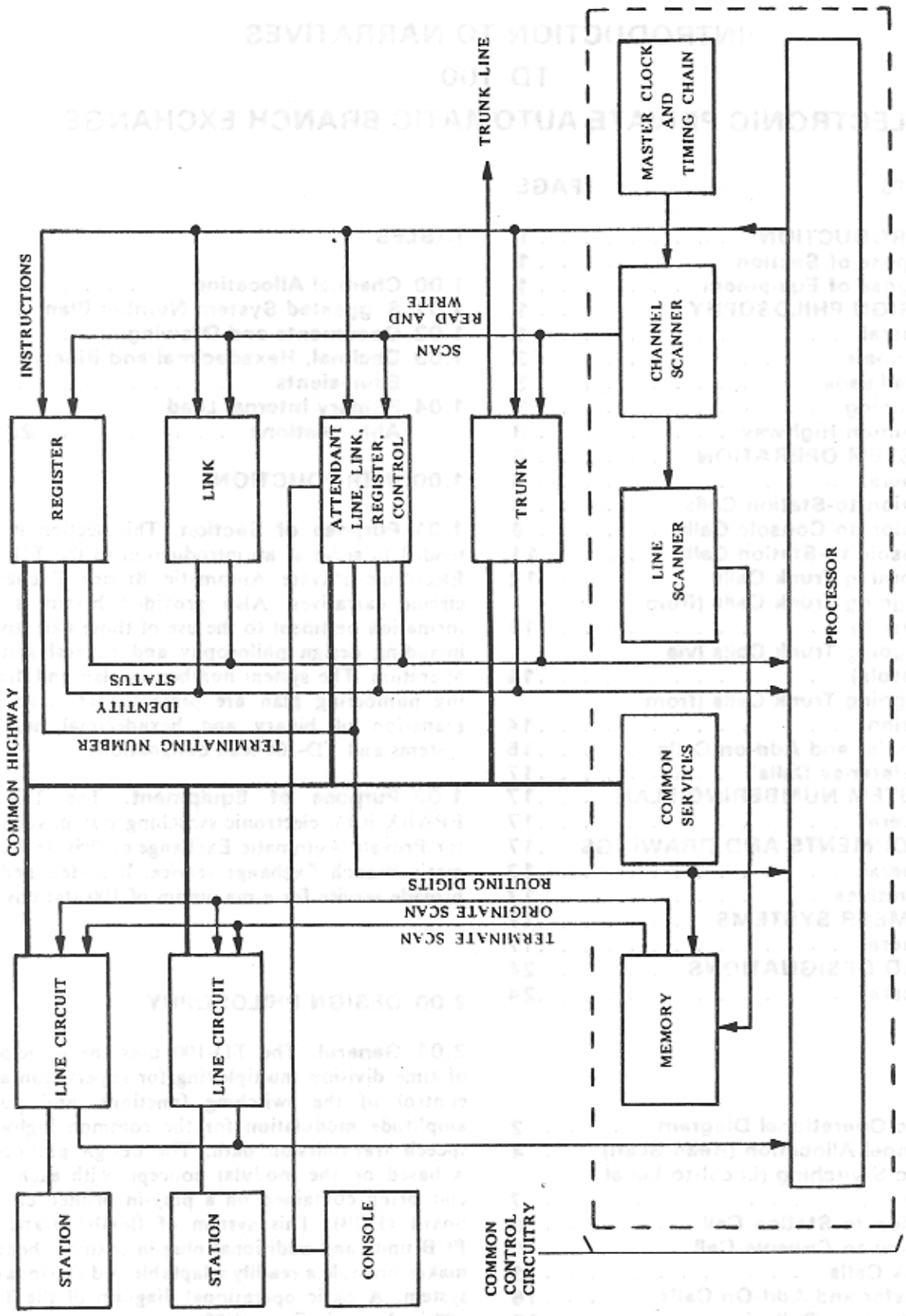

FIGURE 1.00 Basic Operational Diagram

2.02 Channels. All talking circuits, such as trunks, links, registers, etc, are considered to be channels and are assigned a time slot. There are 64 time slots; 61 are used for speech carrying circuits (including one for line scanning) and three are vacant. Figure 1.01 shows the channel allocations and table 1.00 gives a detailed listing of each channel.

2.03 Data Leads. Common data leads are to connect the various channels to the common control circuitry. Two sets of common data leads are used; one to transmit channel identity and status and, in the case of registers, the called number to the common control circuitry. A second set is used to transmit channel instruction information to the channels (see figure 1.00). For a glossary of TD-100 lead designations, see paragraph 7.00 of this document.

With this arrangement of common data leads, certain boards of the same physical size can be plugged into like positions (e.g., a register board may be plugged into an option position and function as a register). Since positions are assigned one, two three, or four time slots each, depending upon the number of circuits on the board, care must be exercised when choosing a position. For example, a four-link board inserted into a three time slot position would allow only three linkes to be used.

2.04 Scanning. Two scanning networks are used. One scanning network scans the 64 channels, and a second scanning network scans the 100 line circuits and 10 tie-trunks.

Each channel is scanned in sequence, with the access time for each channel being 1 microsecond; therefore, the 64 channels are scanned in 64 microseconds (15.625 kHz rate). During each scan of the 64 channels, the line scanner scans one line circuit. One of the channel time slots is used to increment the line scanner; therefore, a complete scan of the 100 line circuits and 10 tie lines, takes approximately 7.04 milliseconds. A master clock with fundamental frequency of 16 MHz drives a timing chain (frequency dividers), which provides the timing required in the system.

The channel scan is divided into two operations, a "read" scan and a "write" scan. The "read" scan permits channel identity and status and, in the case of registers, the called number, to be transmitted from the channel to the common control circuitry. The "write" scan, which occurs three time slots later, allows channel instruction data to be transmitted form the common control circuitry to the channel.

When a channel receives a 1 microsecond "read" scan, the following data is transmitted, in parallel format, to the common control circuitry.

a. Channel identity (trunk, link, register, etc.).

b. Channel status (idle, busy, etc.).

c. Called number (for registers only).

When a station goes off-hook, the request for service is detected by the processor during the line scan; the line circuit's number is temporarily stored in the memory and the processor starts checking for an idle register. On finding an idle register, the processor marks the line circuit's number out of the temporary storage and into the channel of the register. On completion of dialing, the called line is tested and, if idle, the called and calling station numbers are applied to the memory temporary store, and a free link is found. The called and calling station numbers are transferred to the link's time slot as the link is seized to maintain supervision of both stations; the register is then released.

2.05 Common Highway. All speech paths are multiplexed onto a common highway. The 64 channels are scanned sequentially for 1 microsecond each.

In each line circuit, a hybrid circuit converts the two-wire balanced telephone line to a two-wire unbalanced line (transmit and receive). Two line switches, TxT (transmit terminator) and RxT (receive terminator), connect the hybrid transmit and receive leads to the common highway for the terminator. Two unity gain amplifiers complete the transmission paths.

Enabling of the line circuits is done by converting the calling and called station number into a decimal form.(in the memory circuitry), and enabling each line circuit by a combination of its units and tens digits in conjunction with a receive enable signal (RXEN). During the allocated time slot, the two station numbers are decoded and the appropriate

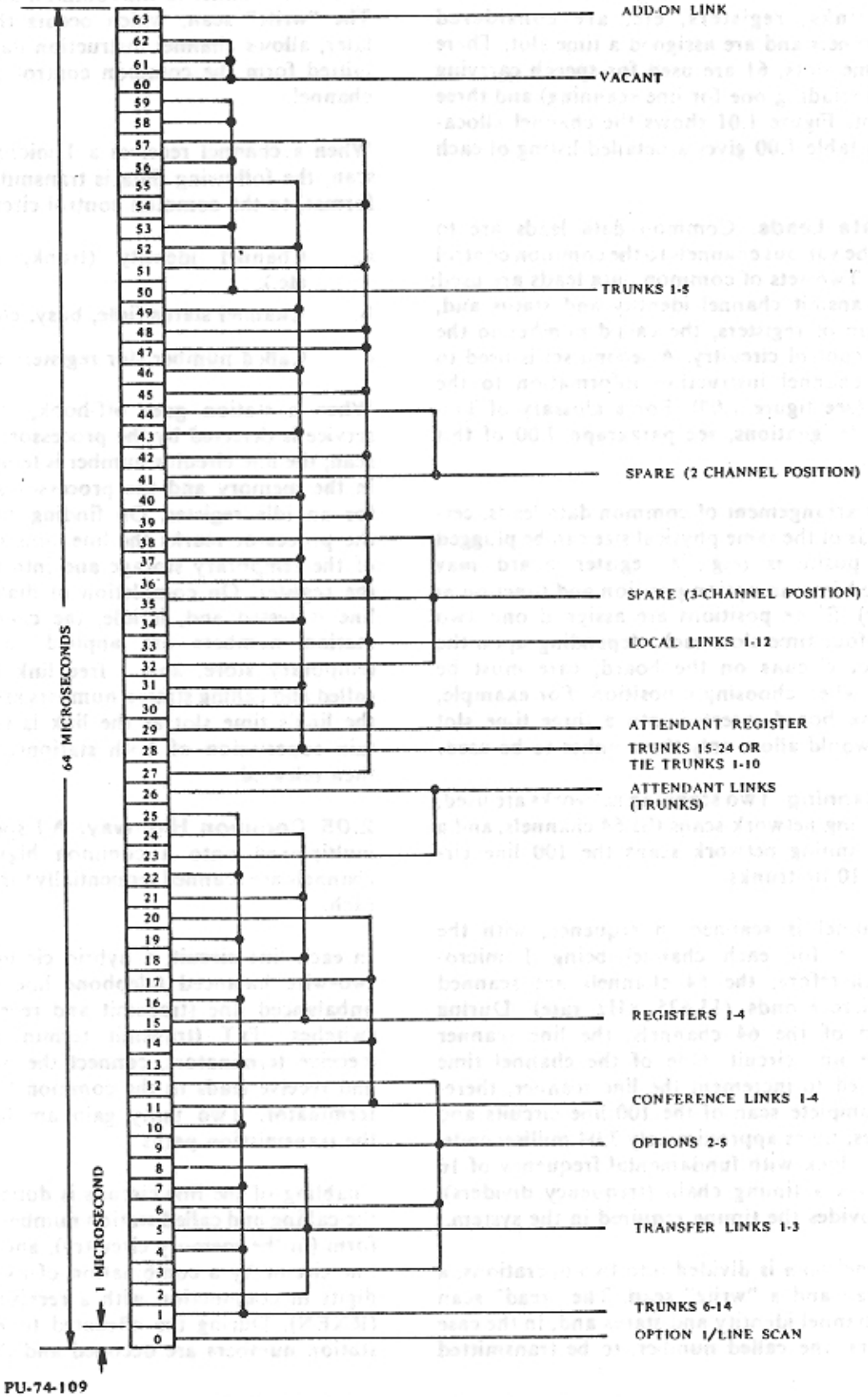

FIGURE 1.01 Channel Allocation (Read Scan)

TABLE 1.00 Channel Allocation

CHANNEL	FUNCTION		BOARD POSITION	CABINET SUBRACK
	READ	WRITE		
0	OPTION 1	LINE SCAN	OPTION 1	2
1	TRUNK 6		TRUNK 6	3
2	TRANSFER LINK 1	ADD-ON LINK	XFER. ADD ON	2
3	OPTION 2	OPTION 1	OPTION 2	2
4	TRUNK 7	TRUNK 6	TRUNK 7	3
5	TRANSFER LINK 2	TRANSFER LINK 1	XFER. ADD ON	2
6	OPTION 3	OPTION 2	OPTION 3	2
7	TRUNK 8	TRUNK 7	TRUNK 8	3
8	TRANSFER LINK 3	TRANSFER LINK 2	XFER. ADD ON	2
9	OPTION 4, INCREMENT LINE SCAN	OPTION 3	OPTION 4	2
10	TRUNK 9	TRUNK 8	TRUNK 9	3
11	CONFERENCE LINK 1	TRANSFER LINK 3	CONF. LINK	2
12	OPTION 5	OPTION 4	OPTION 5	2
13	TRUNK 10	TRUNK 9	TRUNK 10	3
14	CONFERENCE LINK 2	CONFERENCE LINK 1	CONF. LINK	2
15	REGISTER 1	OPTION 5	REG. 1	2
16	TRUNK 11	TRUNK 10	TRUNK 11	3
17	CONFERENCE LINK 3	CONFERENCE LINK 2	CONF. LINK	2
18	REGISTER 2	REGISTER 1	REGISTER 2	2
19	TRUNK 12	TRUNK 11	TRUNK 12	3
20	CONFERENCE LINK 4	CONFERENCE LINK 3	CONF. LINK	2
21	REGISTER 3	REGISTER 2	REGISTER 3	2
22	TRUNK 13	TRUNK 12	TRUNK 13	3
23	ATTENDANT LINK 1	CONFERENCE LINK 4	A.REG. & LK. 1	2
24	REGISTER 4	REGISTER 3	REG. 4	2
25	TRUNK 14	TRUNK 13	TRUNK 14	3
26	ATTENDANT LINK 2	ATTENDANT LINK 1	A.REG. & LK. 1	2
27	LOCAL LINK 1	REGISTER 4	LOC. LK. 1-4	2
28	TRUNK 15	TRUNK 14	TRUNK 15	3
29	ATTENDANT REGISTER	ATTENDANT LINK 2	A.REG. & LK. 1	2
30	LOCAL LINK 2	LOCAL LINK 1	LOC. LK. 1-4	2
31	TRUNK 16	TRUNK 15	TRUNK 16	3
32	SPARE (3 CHANNEL 1-1)	ATTENDANT REGISTER	1 CHANNEL	2
33	LOCAL LINK 3	LOCAL LINK 2	LOC. LK. 1-4	2
34	TRUNK 17	TRUNK 16	TRUNK 17	3
35	SPARE (3 CHANNEL 1-2)	SPARE (3 CHANNEL 1-1)	1 CHANNEL	2
36	LOCAL LINK 4	LOCAL LINK 3	LOC. LK. 1-4	2
37	TRUNK 18	TRUNK 17	TRUNK 18	3
38	SPARE (3 CHANNEL 1-3)	SPARE (3 CHANNEL 1-2)	1 CHANNEL	2
39	LOCAL LINK 5	LOCAL LINK 4	LOC. LK. 5-8	2
40	TRUNK 19	TRUNK 18	TRUNK 19	3
41	SPARE (2 CHANNEL 2-1)	SPARE (3 CHANNEL 1-3)	3 CHANNEL	2
42	LOCAL LINK 6	LOCAL LINK 5	LOC. LK. 5-8	2
43	TRUNK 20	TRUNK 19	TRUNK 20	3
44	SPARE (2 CHANNEL 2-2)	SPARE (2 CHANNEL 2-1)	3 CHANNEL	2
45	LOCAL LINK 7	LOCAL LINK 6	LOC. LK. 5-8)	2
46	TRUNK 21	TRUNK 20	TRUNK 21	3
47	LOCAL LINK 12	SPARE (2 CHANNEL 2-2)	LOC. LK. 9-12	2
48	LOCAL LINK 8	LOCAL LINK 7	LOC. LK. 5-8	2
49	TRUNK 22	TRUNK 21	TRUNK 22	3
50	TRUNK 1	LOCAL LINK 12	TRUNK 1	3

TABLE 1.00 Channel Allocation (Cont.)

CHANNEL	FUNCTION		BOARD POSITION	CABINET SUBRACK
	READ	WRITE		
51	LOCAL LINK 9	LOCAL LINK 8	LOC. LK. 9-12	2
52	TRUNK 23	TRUNK 22	TRUNK 23	3
53	TRUNK 2	TRUNK 1	TRUNK 2	3
54	LOCAL LINK 10	LOCAL LINK 9	LOC. LK. 9-12	2
55	TRUNK 24	TRUNK 23	TRUNK 24	3
56	TRUNK 3	TRUNK 2	TRUNK 3	3
57	LOCAL LINK 11	LOCAL LINK 10	LOC. LK. 9-12	2
58	TRUNK 5	TRUNK 24	TRUNK 5	3
59	TRUNK 4	TRUNK 3	TRUNK 4	3
60		LOCAL LINK 11		2
61		TRUNK 5		2
62		TRUNK 4		—
63	ADD-ON LINK		XFER. ADD ON	2

TxT,TxO (transmit originator), RxT, and RxO (receive originator) switches are enabled (TxT and TxO for 1 microsecond; RxT and RxO for 1/2 microsecond, determined by RXEN). Thus, during that time slot, station 1 can transmit to station 2 via amplifier 1, and station 2 can transmit to station 1 via amplifier 2. The four switches are then inhibited for 63 microseconds before being enabled for the next 1 microsecond channel scan. When the receive switch is enabled, the transfer of energy charges a storage capacitor which discharges during the 63 microsecond inhibited period. Thus, with the high sampling rate and the storage capacitor, the transmitted voice frequencies are returned to their original form.

When the call is complete and the stations go on-hook, the assigned channel detects the on-hook conditions, and the channel is returned to idle, ready for the next call.

With a trunk-to-station or trunk-to-console call in progress, the station line circuit or console line circuit switching is the same as explained above and shown in figure 1.02. However, the trunk only appears as the originator on the common highway and is converted to the common highway by the RXEN signal during the write scan of the trunk's channel.

3.00 SYSTEM OPERATION

3.01 General. The following paragraphs give brief explanations for various types of calls through the TD-100 EPABX. Each type of call is explained in conjunction with an associated block diagram. Additional information regarding each call type is available in the associated individual circuit narratives.

3.02 Station-to-Station Calls. The assemblies utilized when making station-to-station calls are two line circuits, a local links board, a register board, the common services board, the processor boards, and the memory board as shown in figure 1.03.

Assume station 200 is calling station 201. When station 200 goes off-hook, the line scanner detects this condition on the OHO (off-hook originator) lead and stores the number in the memory. Calls to station 200 test the line and the absence of the F/B (free/busy) lead condition indicates the line circuit is now busy. With station 200 off-hook, lamp battery is applied to station 200 and the line lamp lights if station is a keyset.

The processors seize an idle register and signal the common services board to apply dial tone to

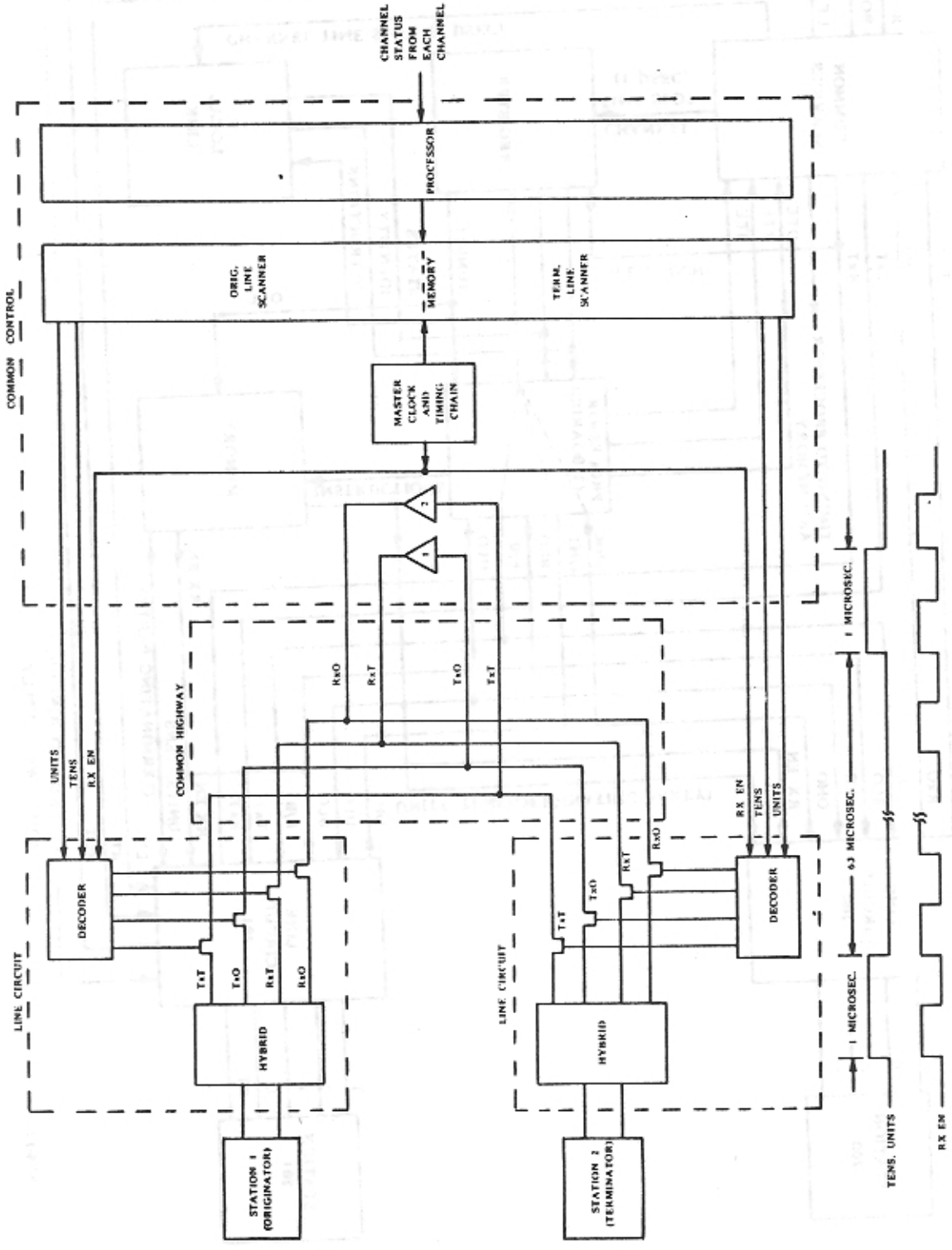

FIGURE 1.02 Basic Switching (Local-to-Local Call)

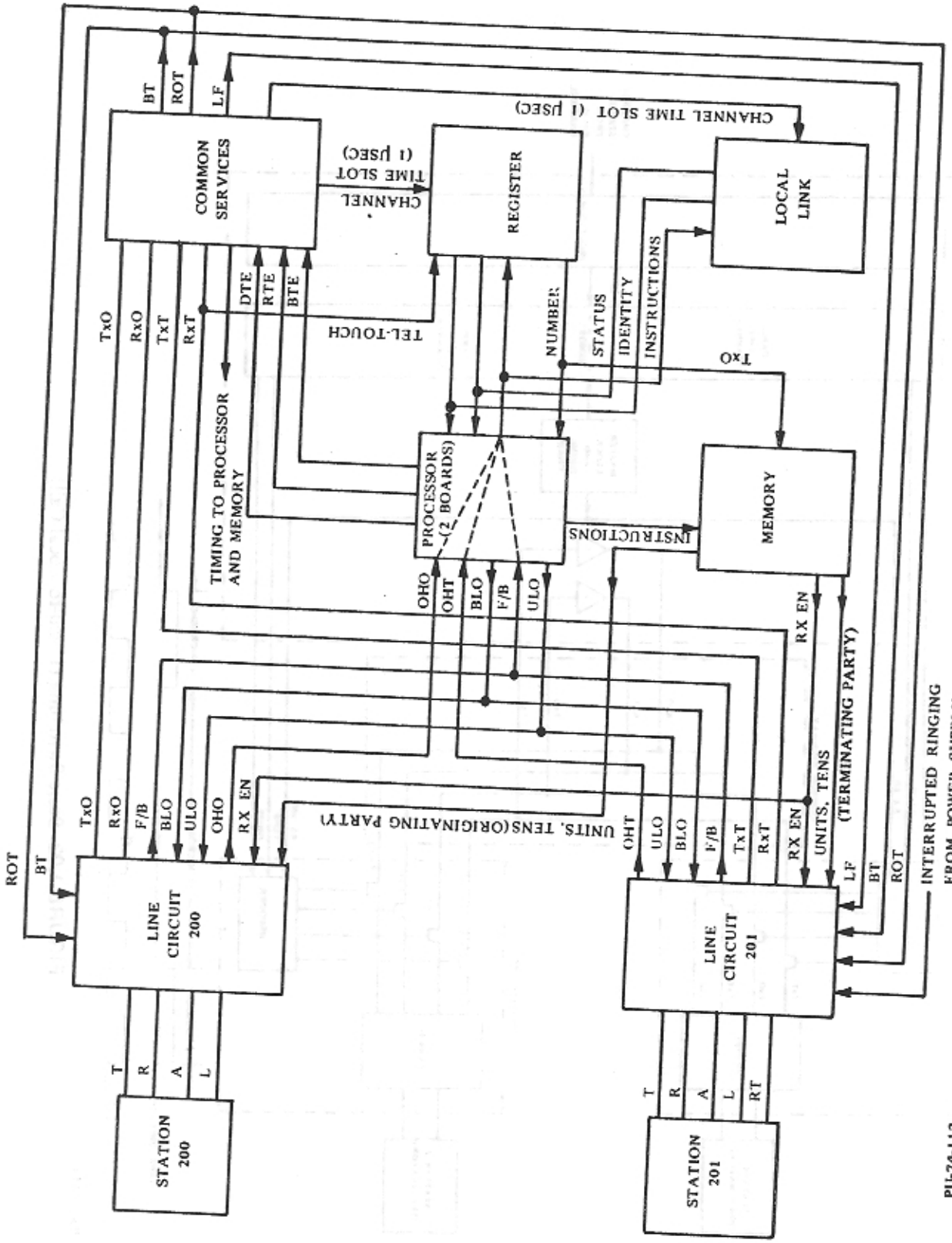

FIGURE 1.03 Station-to-Station Call

station 200 via the RxO lead of the common highway. Note that dial tone is routed to the common highway and to station 200 during the write scan of the channel allocated to the register. The units and tens output of the memory, corresponding to line 200, along with the RXEN (receive enable) signal, enables line circuit 200.

When dial tone is received, the three-digit station number (201) is dialed (dial tone is removed when the first digit is dialed). The station may send dial pulses or multifrequency tones (Tel-Touch dialing). If the station is rotary dial, the dial pulses are applied to the register via the line circuit, the OHO path, and the processor. If the station is Tel-Touch, the multifrequency tones are applied to the register via the line circuit, the TxO path of the common highway, the common services board, and the RxT path of the common highway to the register. The register counts or converts the dialed information and applies the information, in binary form to the processor and the memory. (See paragraph 6.00 for an explanation of binary and hexadecimal numbers.)

When the dialed number is received, the processor, using status information from line circuit 201, determines if the line is free or busy. If line circuit 201 is idle, the processor seizes an idle local link, releases the register, and stores the calling and called station numbers in the memory in the time slot allocated to the local line.

During the time slot allocated to the local link:

a. The called station units and tens outputs of the memory enables the ringing and lamp flashing circuits of line circuit 201, causing interrupted ringing and lamp flashing to be applied to the called station. The lamp flashing time is obtained from the common services board. The interrupted ringing is from the power supply for single sets and the power supply control box for key sets. Line 201 now is made busy to other call attempts.

b. The calling station units and tens outputs of the memory enables the talking path of line circuit 200, and ringback tone is applied to the calling station. The ringback tone from the common services board is connected into RxO path of the common highway by RTE (ring tone enable) signal from the processor.

When the called station answers, ringing and lamp flashing is removed from the called station and the OHT (off-hook terminator) signal to the link causes the processor to remove the ringback tone from the calling station. At this time, the line lamps at the calling and called stations will be lit. Supervision between the station line circuits is now maintained by the local link.

During the write scan of the local link, the units and tens outputs of the memory for the calling and called stations are applied to the calling and called line circuits, respectively. In conjunction with the RXEN signal, the talking circuits of both line circuits are enabled during the 1 microsecond time slot. The TxO, RxO, TxT, and RxT paths of both line circuits are enabled and the common services board connects the TxT path to the RxO path. Thus, during 1 microsecond out of every 64 microseconds, the talking paths of the two stations are connected.

When the call is complete and a station goes on-hook, the condition is detected in the link. After a nominal 300 milliseconds, the link status changes and is fed to the processor on the read scan. The processor releases the local link and that time slot is free for another call. The lamp battery to the station is removed and the line lamp extinguishes. When the first stations goes on-hook, the remaining station is locked out and receives busy tone as long as it is off-hook.

Assume that when the originating station had dialed the desired number, the called station was busy. The processor would return a BLO (busy lockout) signal to the line circuit and busy tone (BT) would be applied to the calling station.

If the originating station had dialed an unavailable number, the processor would return a ULO (unassigned lock-out) and a BLO signal to the line circuit and ROT (recorder tone) from the common services board would be applied to the calling station.

3.03 Station-to-Console Calls. The assemblies utilized when making a station-to-console call are a line circuit board, a register board, an attendant line and control board, the attendant register and links board, the common services board, the processor boards, and the memory board as shown in figure 1.04.

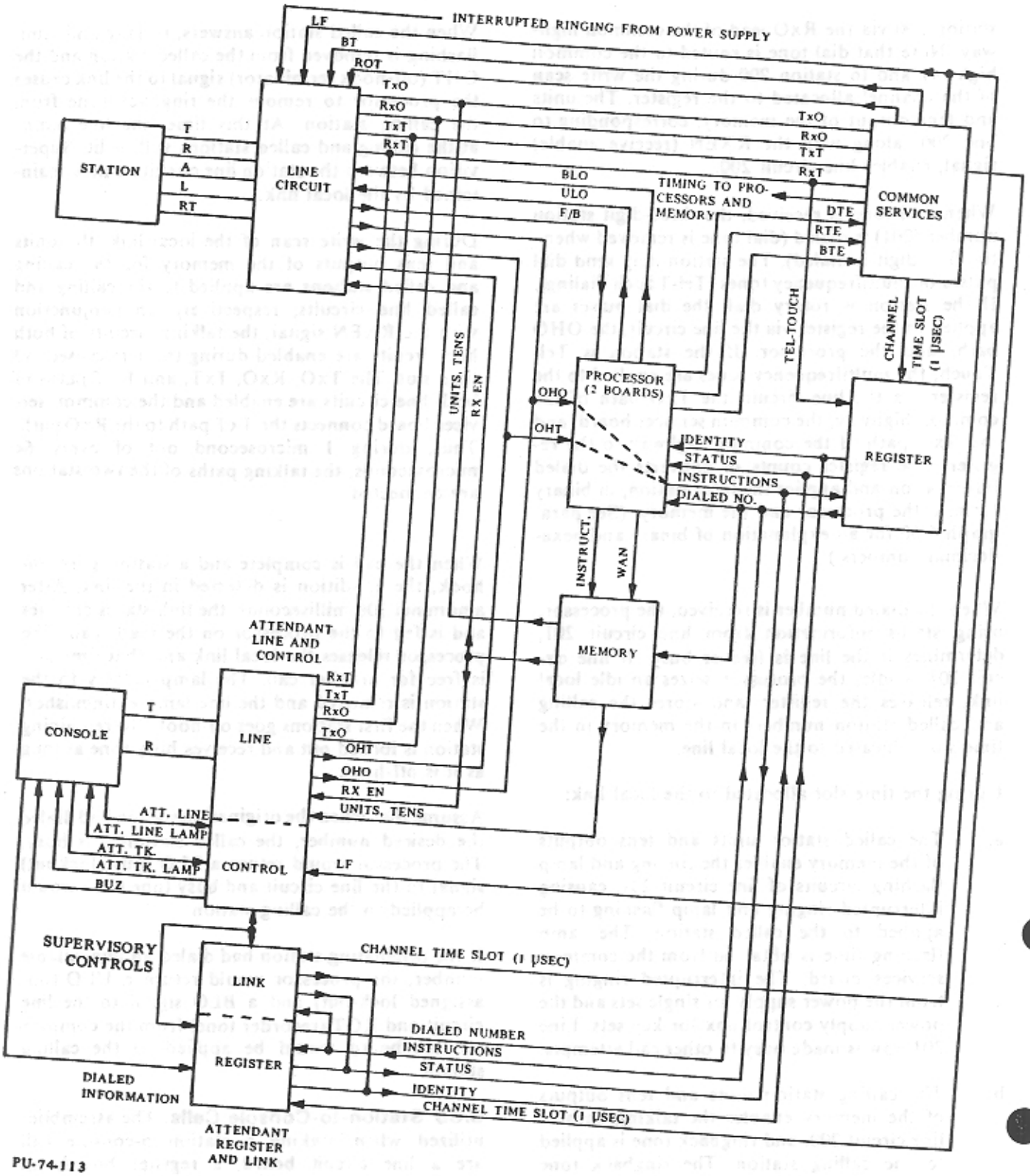

FIGURE 1.04 Station-to-Console Call

When the originating station goes off-hook, the line circuit scanner detects the OHO output, and the number of the calling station is stored in the memory. The F/B signal to the processors indicates the line circuit is now busy. With the station off-hook, lamp battery is applied to the station and the line lamp will be lit if the station is a keyset.

The processor seizes an idle register and applies the DTE (dial tone enable) signal to the common services board, which applies dial tone to the station via the RxO path of the common highway and the line circuit. Note that dial tone is routed to the common highway and to the station only during the write scan of the register (one every 64 microseconds). The units and tens outputs of the memory, corresponding to the originating station number, along with the RXEN signal, enable the line circuit.

When dial tone is received, the station dials the digit 0 and dial tone is removed. As in the case of station-to-station calls, the station may send dial pulses or multifrequency tones (Tel-Touch dialing). The register converts the dialed information into binary form and applies the information to the processors. (See paragraph 6.00 for an explanation of binary and hexadecimal numbers.)

The processor selects a link on the attendant register and links board and releases the register. The calling station's number is stored in the memory in the time slot allocated to the link. The attendant line and control circuit causes the console buzzer to sound steadily (BUZ output) and the ATL output causes the appropriate attendant trunk (ATT TK) lamp on the console to flash. Ringback tone is returned to the calling station via the common highway.

When the attendant answers by depressing the flashing ATT TK push button, the attendant line and control inhibits the BUZ output and changes the ATT TK lamp from flashing to steady. At the same time, ringback tone is removed from the calling station and the processor's WAN (write attendant number) signal to the memory causes the memory to store the attendant's number and apply units and tens outputs to the attendant line and control during the write scan of the link. During the 1 microsecond time slot allocated to the link, the memory originator units and tens outputs and the RXEN output connect the station line circuit talking path to the common highway, and the terminator units and tens outputs and the RXEN output connect the attendant line and control talking path to the common highway. Thus, for the 1 microsecond write scan of the link, the station and console talking paths are connected.

When the call is complete and the station goes on-hook or the console disconnects, the processor releases the link and that time slot is free for another call. If the station remains off-hook, it is locked out and receives busy tone. With the station and console disconnected, the station line lamp and the console ATT TK lamp extinguish.

3.04 Console-to-Station Calls. The assemblies utilized when making a console-to-station call are basically the same as those making a station-to-console call as shown in figure 1.04. The main differences are that on a station-to-console call a register board is used and a link on the attendant register and links board is used, while on a consol-to-station call, only the register on the attendant register and links board is used, while on a console-not required). Also, on the console, the ATT TK push buttons are used for station-to-console calls, and the ATT LINE (attendant line) push button is used for console-to-station calls.

When the attendant presses the ATT LINE push button to originate the call, the attendant line and control seizes the register in the attendant register and links board, and the register identity and status to the processor causes the attendant number to be stored in the memory (as the call originator). The memory units and tens outputs, along with the RXEN signal, enable the talking path of the attendant line and control during the time allocated to the attendant register. At this time, the DTE signal from the processor causes the application of dial tone to the console via the RxO path of the common highway and the attendant line and control. Also, when the attendant pressed the ATT LINE push button, the attendant line and control caused the ATT LINE lamp on the console to light.

Upon hearing dial tone, the attendant dials the three-digit station number (note that the three-digit number utilizes DC marking to the register from the console). The register detects the dialed information and applies the information, in binary form, to the processor and the memory. Dial tone is removed when the first digit is dialed. The

processor determines if the called station is free or busy. If free, the number of the called station is stored in the memory as the terminator number. During the write scan of the time slot allocated to the register, the memory terminator units and tens output, in conjunction with the RXEN signal, enables the called station line circuit to apply ringing and lamp flashing to the called station. The lamp flash timing is obtained from the common services PCB. The interrupted ringing is obtained from the power supply for single line sets and the power supply box for the key sets. Also, the memory originator units and tens outputs, in conjunction with the RXEN signal, enable the attendant line and control, and ringback tone from the common services is returned to the console via the RxO path of the common highway.

When the called station answers, ringing and lamp flashing is removed from the called station, and the OHT signal to the processors causes ringback tone to be removed from the console. The station line lamp will be lit if the station is a keyset. Thus, during the write scan allocated to the attendant register, the console and station talking paths are connected via the common highway and the common services.

When the called station goes on-hook or the console disconnects, the processor releases the attendant register. If the station remains off-hook after the attendant disconnects, it is locked-out and receives busy tone. The console ATT LINE lamp extinguishes and the station line lamp remains lit until it is returned to on-hook. The time slot allocated to the attendant register is now idle, ready for another call.

As in the case of a console-to-station call, busy tone would have been returned to the console if the station was busy when called. However, in this case, the busy tone from the common services is applied to the console via the RxO path of the common highway and the attendant line and control.

3.05 Incoming Trunk Calls. Incoming trunk calls to the console can be transferred to a station by the attendant.

The assemblies utilized on incoming calls to the console are a trunk board, an attendant line and control board, the common services board, the processor boards, and the memory board. When incoming calls are transferred to a station, the rest of the circuitry illustrated in figure 1.05 is utilized. On an incoming trunk call, the ringing is detected by the trunk, and the trunk status to the processor changes preventing the trunk from being seized for an outgoing call. At the same time, the trunk BUZ (buzzer) output causes the console buzzer to sound steadily and the appropriate trunk lamp on the console to flash.

When the call is answered by the attendant pressing the appropriate trunk push button, the TS input from the console causes the trunk to change its status to the processor. At the same time, the BUZ output changes to inhibit the console buzzer and cause the appropriate trunk lamps on the console to light.

The processor WAN (write attendant number) signal to the memory causes the memory to provide units and tens outputs to the attendant line and control circuit during the time slot allocated to the trunk. Thus, with the units and tens signals, in conjunction with the RXEN signal, the talking path of the attendant line and control is connected to the common highway for the 1 microsecond write time slot for the trunk. The trunk talking path is also connected to the common highway by the RXEN signal during the 1 microsecond period. The common services circuit connects the TxO path to the TxT path and connects the TxT path to the RxO path. Thus, during the 1 microsecond write time slot of the trunk, the trunk and console talking paths are connected.

When the console disconnects from the trunk and the central office has released the trunk, the trunk status to the processor changes and the trunk is free for another call.

Assume that instead of disconnecting, the attendant is to transfer the trunk call to a station.

To transfer an incoming trunk call to a station, the trunk must first be put on hold. When the attendant presses the ATT LINE push button on the console, the trunk is automatically put on hold as indicated by the appropriate trunk lamps on the console.

The attendant then keys the digits of the station of which the trunk is to be transferred, as explained in paragraph 3.04. The attendant can press

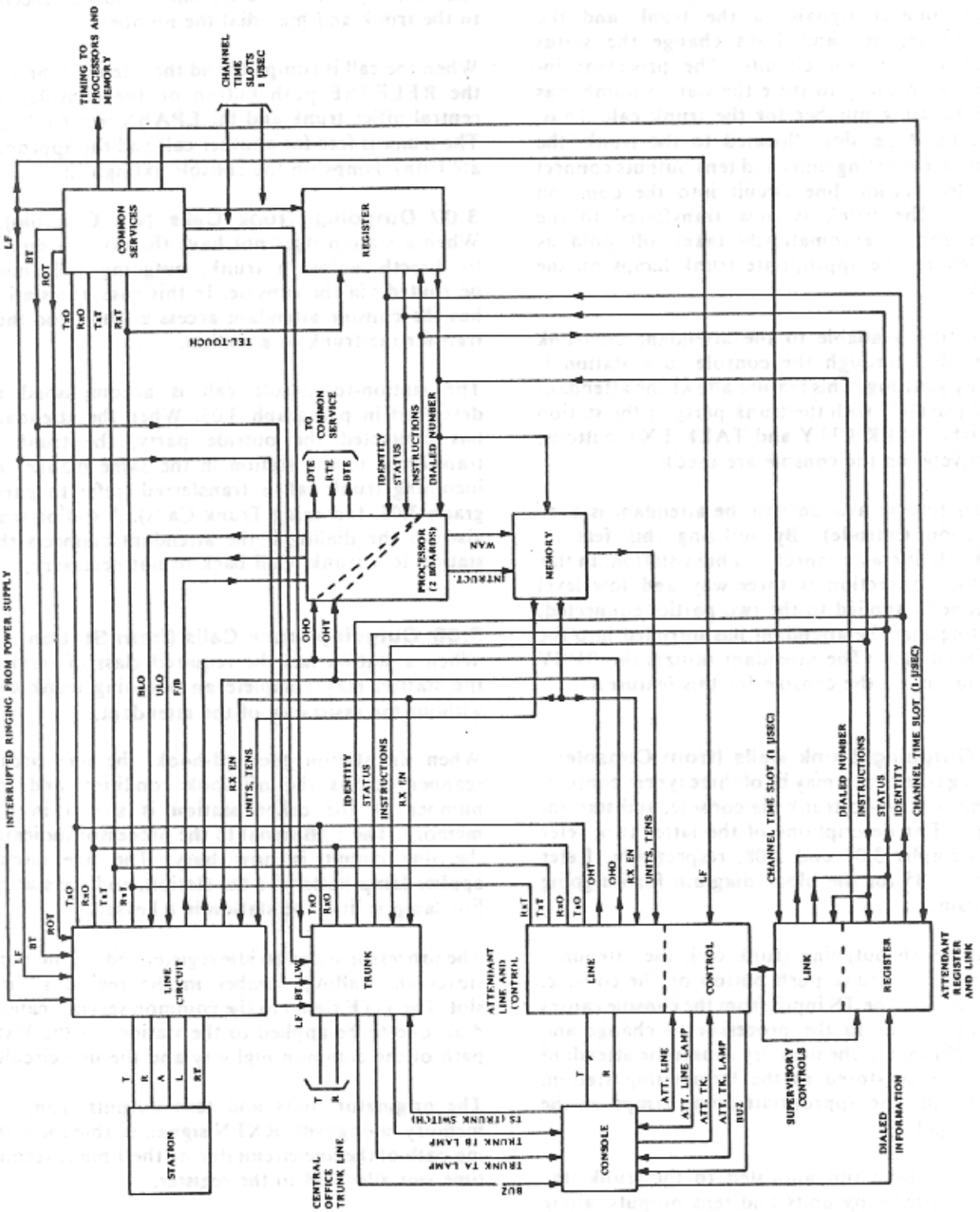

FIGURE 1.05 Trunk Calls

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the CONNECT bar on the console before or after the called party answers. The attendant line and control connect signals to the trunk and the attendant register and links change the status outputs of the two circuits. The processor instructs the memory to store the station number as the terminating number for the trunk call. Thus, during the time slot allocated to the trunk, the memory terminating units and tens outputs connect the called station line circuit into the common highway. The trunk is now transferred to the station and is automatically taken off hold as indicated by the appropriate trunk lamps on the console.

One feature available to the attendant on trunk calls routed through the console to a station is two-way splitting. This feature allows the attendant to talk privately with the trunk party or the station party (the TALK CITY and TALK EXT buttons, respectively, on the console are used).

Another feature available to the attendant is busy verification (intrude). By utilizing this feature, the attendant may connect to a busy station. In this case, the connection is three-way and low level busy tone is applied to the two parties connected, indicating that the attendant has intruded into the established call. (The attendant utilizes the BUSY VER button on the console for this feature.)

3.06 Outgoing Trunk Calls (from Console). Outgoing trunk calls may be of three types: console-to-trunk, station-to-trunk via console, and station-to-trunk. For descriptions of the latter two, refer to paragraphs 3.07 and 3.08, respectively. Refer to figure 1.05 for the block diagram for outgoing trunk calls.

To initiate an outgoing trunk call, the attendant presses an idle trunk push button on the console. When pressed, the TS input from the console causes the trunk status to the processor to change and the WAN input to the memory causes the attendant number to be stored as the terminating station. At this time, the appropriate trunk lamps on the console light.

During the time slot allocated to the trunk, the memory originating units and tens outputs, along with the RXEN signal, connect the attendant line and control to the common highway (the trunk is automatically connected into the common highway during its write scan and does not require units and tens inputs). The attendant is now connected to the trunk and may dial the number.

When the call is complete and the attendant presses the RELEASE push button on the console, the central office trunk and the EPABX trunk release. The trunk is free for another call and the appropriate trunk lamps on the console extinguish.

3.07 Outgoing Trunk Calls (via Console). When a station does not have the class of service to directly access a trunk, outgoing calls must be routed via the console. In this case, the station has the console attendant access a trunk and then transfer the trunk to a station.

The station-to-console call is accomplished as described in paragraph 3.03. When the attendant has contacted the outside party, the trunk is transferred to the station in the same manner as incoming trunk call is transferred (refer to paragraph 3.05, Incoming Trunk Calls). A station may also do the dialing if the attendant connects the station to a trunk. Call back to not necessary.

3.08 Outgoing Trunk Calls (from Station). When a station has the required class of service, the station may complete an outgoing trunk call without the assistance of the attendant.

When the station goes off-hook, the line circuit scanner detects the off-hook condition and the number of the called station is stored in the memory. The F/B signal to the processor indicates the line circuit is now busy. The line circuit applies lamp battery to the station, and the station line lamp is lit if the station is a keyset.

The processor seizes an idle register and the memory stores the calling number in the register's time slot. The DTE signal to the common services causes dial tone to be applied to the station via the RxO path of the common highway and the line circuit.

The originator units and tens outputs from the memory, along with RXEN signal, enable the talking path of the line circuit during the 1 microsecond time slot allocated to the register.

When dial tone is received, the station dials 9 if only one trunk group is equipped or 9 (X) if two or more trunk groups are equipped. Dial tone is

now removed, and as in the case of station-to-station calls, the register may receive dial pulse or multifrequency tones (Tel-Touch dialed) from the station. The register counts the dialed information and applies it to the processor and memory. The processor detects the 9 or 9 (X) count and, using the status and identity input from each channel, searches for an idle trunk.

If a trunk is not idle, the BLO output from the processor causes the line circuit to be locked out and apply busy tone to the station, indicating a trunk is not free. The station then goes on-hook. If a trunk is idle, the processor seizes the trunk, releases the register, and instructs the memory to transfer the station number from the register's time slot to the trunks time slot. Thus, the units and tens outputs of the memory for the line circuit now occur during the write time slot allocated to the trunk. The talking paths of the line circuit and the trunk are now connected via the common highway and the common services during the 1 microsecond time slot allocated to the trunk. The station now receives dial tone from the central office and may complete the call.

When the call is complete, the station is on-hook, and the central office has released the trunk line, the lamp battery to the station is removed, and the station line lamp extinguishes. The trunk is released and that time slot is again free.

3.09 Transfer and Add-On Calls. The transfer feature allows a station connected to a trunk to transfer the trunk call to another station. The add-on feature allows a station connected to a trunk call to add-on another station, making it a three-way call (refer to figure 1.06).

Note, as explained in paragraph 3.05, the console attendant may transfer a trunk to a station (the transfer and add-on links are not used in this case). However, when a station transfers a trunk to another station or makes a three-way call between the trunk and two stations, the transfer and add-on links are used.

Assume a trunk call has been transferred to a station by the console attendant, as explained in paragraph 3.05, and the station wished to transfer the trunk call to another station. The station flashes the hookswitch, the hookswitch flash is detected by the trunk; the trunk call is automatically put on hold, and the trunk status to the processor changes to indicate the hold condition and request a register.

As the station has remained off-hook and connected to the line circuit, the processor seizes a free register and the station is connected to the register during the register's time slot. The station then dials the three-digit number of the station to which the trunk call is to be transferred. The register counts the dialed information (dial pulses or multifrequency tones) and applies this information to the processor and the memory. The processor determines if the called station is free or busy. If the called station is busy, 4 seconds of busy tone is returned to the calling station and the station is reconnected to the trunk and busy tone is removed.

If the called station is free, the processor seizes a free transfer link and releases the register. The calling and called station numbers are stored in the memory for the transfer link's time slot. The memory units and tens outputs for the two line circuits allow ringing and lamp flashing to be applied to the called station and ringback tone to be applied to the calling station. If a transfer link was not available, 4 seconds of busy tone would be returned to the calling station and the station would be reconnected to the trunk.

When the called station answers, ringing is removed, the called station line lamp changes from flashing to steady illumination and ringback tone is removed from the calling station. The two stations are connected during the 1 microsecond time slot allocated to the transfer link. The calling station informs the called station that a trunk call is to be transferred; the calling station then goes on-hook.

The processor detects this condition and the called station number is transferred from the transfer link's time slot to the time slot allocated to the trunk, and the hold condition is removed; the processor also releases the transfer link. The trunk call is now transferred to the second station, and the trunk and station are connected during the 1 microsecond time slot allocated to the trunk.

When the call is complete, the station going on-hook and the central office releasing the trunk returns the circuits to the idle condition (trunk's time slot is free).

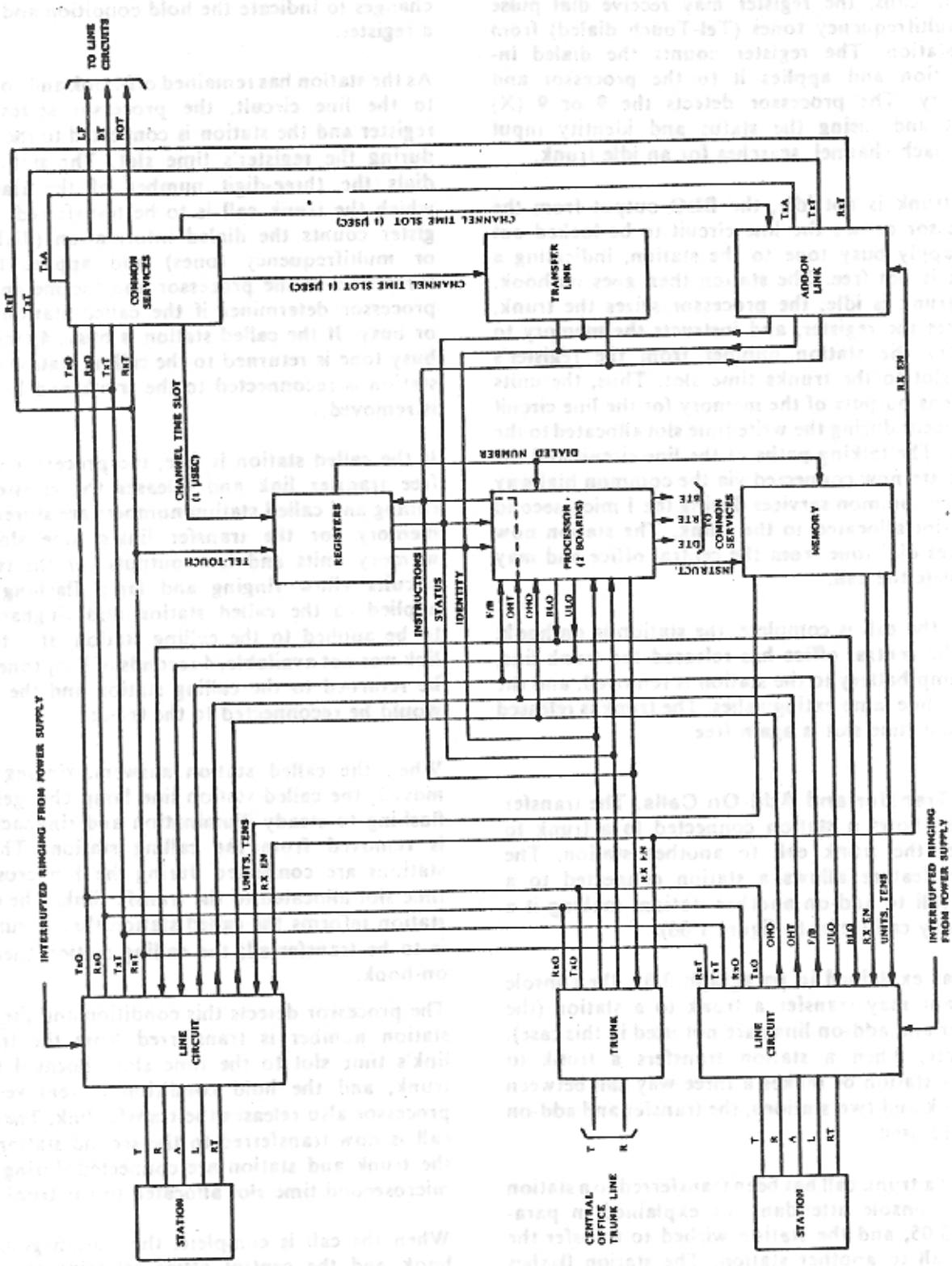

FIGURE 1.06 Transfer and Add-On Calls

PU-74-115

If is also possible, using the add-on feature, to make the call a three-way connection. To make a three-way call, the first station places the trunk on hold and calls the second station utilizing a transfer link, as explained above. With the two stations connected, the originator flashes the hookswitch. If the add-on link is busy, 4 seconds of busy tone is returned to the stations. Either station can be reconnected to the trunk by remaining off-hook while the other station goes on-hook.

If the add-on link is free, the processor transfers the station-to-station call to the add-on links time slot and releases the transfer link. At the same time, the hold condition is removed from the trunk. The two station numbers are now stored in the memory for both the trunk's and the add-on link's time slots. Thus, during the add-on link's time slot, the two stations are connected, and during the trunk's time slot, the trunk and the add-on link are connected, making a three-way call.

Should one station go on-hook, the off-hook station returns to the trunk and the add-on link releases. Should the trunk go on-hook, the processor returns the trunk's and add-on link's time slots to the free state and stations off-hook are locked out and receive busy tone.

3.10 Conference Calls. By utilizing the conference feature, it is possible for the console attendant to set up a conference call between a maximum of six conferees (up to a maximum of four stations and the balance in trunks). Note that while the conference network is a six-port device, there are only four conference links available in the system, thereby restricting the number of stations in the conference to four. Refer to figure 1.07.

To set up a conference call, the console attendant must call each station to be included in the conference and connect them to the conference network via a conference link.

Each station is called, in turn, as explained in paragraph 3.04, for a console-to-station call, and are informed of the conference call and to remain off-hook; the attendant then presses the CONF button on the console. The attendant register and links' status output to the processor changes, the processor seizes a free conference link, the memory writes the station number and the next conference link number in the conference link time slot, and the processor releases the attendant register and links. The station is now connected to the conference network during the 1 microsecond conference link's time slot. A maximum of four stations can be connected in this manner, and the other two ports of the conference network may be used for trunks as desired.

A conference network is basically a short-term analogue storage network, with each station line circuit and each trunk being connected into the network for 1 microsecond every 64 microseconds (corresponding to each conference link's time slot or the trunk's time slot). With one conferee connected to the network, the console CONF lamp is lit; with six conferees connected, the CONF lamp winks. When the conference call is complete, the stations go on-hook, and the central office releases the trunks, the circuits revert to the idle condition and the console CONF lamp extinguishes.

4.00 SYSTEM NUMBERING PLAN

4.01 General. The numbering plan shown in table 1.01 is assigned for standard service; however, the plan may be changed to accommodate customer requirements.

5.00 DOCUMENTS AND DRAWINGS

5.01 General. The documents and drawings applicable to this section are listed in table 1.02. These documents and drawings are adequate to install, operate, and maintain the TD-100 EPABX.

5.02 Narratives. Each TD-100 subsystem and printed circuit board has a separate base circuit number. The narrative for each subsystem consists of that six-digit number preceeded by the prefix "OL," thus the narrative number may be readily discerned for every subsystem and PCB. Used in conjunction with the individual circuit schematics and the general operation description provided in paragraphs 3.00 through 3.10 of this document, the circuit narratives will provide a thorough description of the operation of each subsystem.

6.00 NUMBER SYSTEMS

6.01 General. The TD-100 EPABX circuitry and the description of that circuitry utilize

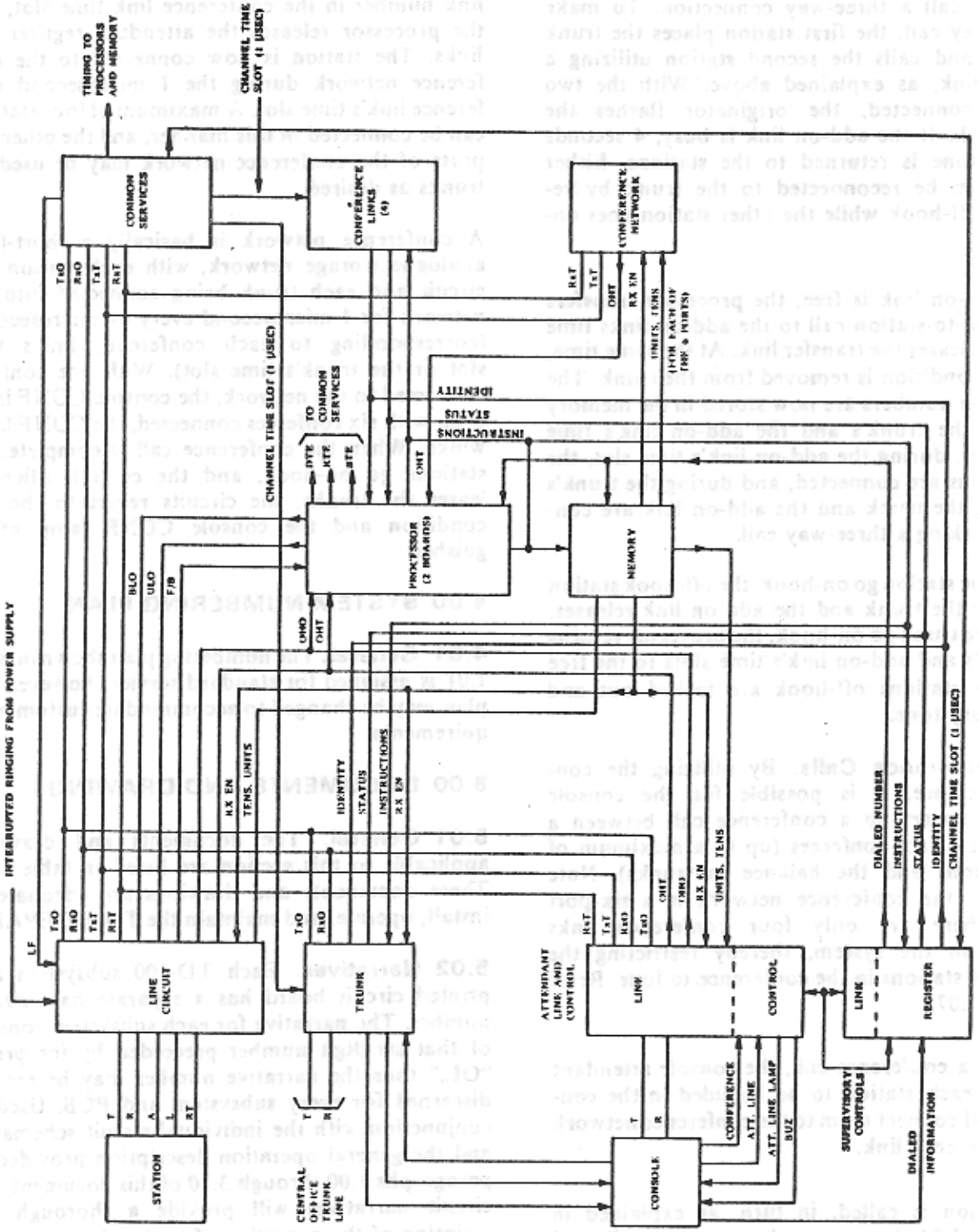

FIGURE 1.07 Conference Calls

TABLE 1.01 Suggested System Number Plan

CALL	SUGGESTED ACCESS CODE
Station-to-Station	200-299
Station-to-Console	0
Station-to-Trunk (used with one trunk group only)	9
Trunk Group 1	91
Trunk Group 2	92
Trunk Group 3	93
Trunk Group 4	94
Trunk Group 5	95
Trunk Group 6	96
Station-to-Tie Trunk (used with one tie trunk group only)	8
Tie Trunk Group 1	81
Tie Trunk Group 2	82
Tie Trunk Group 3	83
Paging Call (three paging circuits maximum)	31, 32, 33
*Paging Answer	14
Code Call	11-19
Code Call Answer	12
WATS	71
CCSA	72
Dictation	73
UNA and Call Pickup	6
Station Controlled Conference (station transfer)	5-2XX
Station Controlled Conference (trunk transfer)	Consultation Hold and 51
Meet-me Conference	53
Call Forward Follow-me	41-2XX
Call Forward Release	Dial Own Number
Busy Line Call Back	43-2XX
Busy Trunk Call Back	43-7 (1-3) 43-8 (1-3) 43-9 (1-6)
Busy Line Call Back Reset	44-2
Busy Trunk Call Back Reset	44-7 (1-3) 44-8 (1-3) 44-9 (1-6)
Speed Call	31-39
Call Hold - Enter	Consultation Hold and 42
Call Hold - Exit	Consultation Hold and 45

* For paging circuits equipped with answer access.

TABLE 1.02 Documents and Drawings

TITLE	NARRATIVE	SCHEMATIC	ASSEMBLY
Line Circuit	OL-410-151	TD-4101517	TD-4101516
Attendant Line and Control	OL-410-152	TD-4101527	TD-4101526
Standard Two-Way Trunk	OL-410-153	TD-4101537	TD-4101536
Common Control Feature #2	OL-410-154	TD-4101547	TD-4101546
Assigned Night Answer	OL-410-155	TD-4101557	TD-4101556
Conference Network	OL-410-157	TD-4101577	TD-4101576
Power Failure Transfer	OL-410-158	TD-4101587	TD-4101586
Common Services	OL-410-159	TD-4101597	TD-4101596
Class of Service and Vacant Number Intercept	OL-410-160	TD-4101607	TD-4101606
Memory	OL-410-161	TD-4101617	TD-4101616
Processor (Board 1)	OL-410-162	TD-4101627	TD-4101626
Processor (Board 2)	OL-410-163	TD-4101637	TD-4101636
Tie Trunk, Loop or Battery and Ground Signaling	OL-410-164	TD-4101647	TD-4101646
Station Hunting	OL-410-165	TD-4101657	TD-4101656
Register	OL-410-166	TD-4101667	TD-4101666
Tel-Touch Receiver	OL-410-167	TD-4101677	TD-4101676
Link (Conference and Local)	OL-410-168	TD-4101687	TD-4101686
Attendant Register and Links	OL-410-169	TD-4101697	TD-4101696
Transfer and Add-On Links	OL-410-170	TD-4101707	TD-4101706
Tie Trunk, E & M, and Duplex	OL-410-172	TD-4101727	TD-4101726
Power Supply Control	OL-410-176	TD-4101767	TD-4101766
DID Trunk	OL-410-177	TD-4101777	TD-4101776
Alarm Board	OL-410-178	TD-4101787	TD-4101786
Highway Amplifier	(See OL-410-160)	TD-4101857	TD-4101856
Access Test Set	OL-410-186	TD-4101867	TD-4101866
Private Line and Manual Intercom	OL-410-191	TD-4101917	TD-4101916
Paging Access	OL-410-192	TD-4101927	TD-4101926
Dictation Access	OL-410-193	TD-4101937	TD-4101936
Data Monitor Test Set	OL-410-207	TD-4102077	TD-4102076
Call Forward - Follow Me	OL-410-224	TD-4102247	TD-4102246
Automatic Identification Out-Dialed	OL-410-225	TD-4102257	TD-4102256
Message Register #1	OL-410-226	TD-4102267	TD-4102266
Message Register #2	OL-410-227	TD-4102277	TD-4102276
Toll Restrictor	OL-410-228	TD-4102287	TD-4102286
Traffic Measurement Test Set	OL-410-229	TD-4102297	TD-4102296
Quad Transfer and Add-On Links	OL-410-258	TD-4102587	TD-4102586
Room Number Translator	OL-410-294	TD-4102947	TD-4102946

TABLE 1.02 Documents and Drawings (Cont.)

TITLE	SECTION NUMBER
General Information	OA-000-001
General Installation	OB-000-001
Cabinet and Apparatus Installation	OB-000-002
Feature Strapping	OB-000-003
Console Installation	OB-000-004
Cable Connections at Cross-Connect Terminals	OB-000-005
Cabinet Tests and Inspections	OB-000-006
Console Operation Tests	OB-000-007
Station Operation Tests	OB-000-008
General Maintenance	OC-000-001
Access Test Set	OC-000-002
Console Maintenance	OC-000-003
Maintenance Guide	OC-000-004
Trouble Analysis Guide	OC-000-005
Power Supply Maintenance Test Procedure	OC-000-006
Trouble Isolation and PCB Replacement Instructions	OC-000-007
Station User's Guide	OG-000-001
Console Operating Instructions	OG-000-002
Station User's Instructions	OG-000-003

binary and hexadecimal number systems. The following paragraphs explain these number systems and the rationale behind their use. The number system most used in everyday life is the decimal system. This decimal system is based on 10 different marks or digits; 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. These digits are used singly or in combination to represent any count value.

Number systems may be based on other than 10 digits. The binary system is based on only two different marks or digits; 0 and 1. But, just as in the decimal system, the two digits may be used singly or in combination to represent any count value.

The hexadecimal number system is based on 16 different marks or digits; 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. These 16 marks may also be used to represent any count value. In fact, a number system can be formulated using any number (greater than one) of marks or digits; the larger the number of digits, called the base or radix, the larger may be the count value before the number of digits used to represent it must be increased.

In any positional number system, the digits have an order. Advancing a digit means increasing it by one count value. Thus, in the common decimal system, advancing the digit "0" means replacing it by "1"; advancing the digit "1" means replacing it by a "2"; etc. Advancing the digit "9" means replacing it with an "0" and advancing the next column to the left by one count value from "0" to "1," thus the double digit number "10."

This same advancing procedure is applicable to all systems. In the binary system, advancing the digit "0" means replacing it with a "1"; advancing the digit "1" means replacing it with a "0" and advancing the next column to the left from a "0" to a "1"; thus the double digit number "10."

Advancing hexadecimal numbers is handled in a similar manner, but since there are 16 distinct digits in the hexadecimal system, the count value is increased (from zero) 16 times before the double digit number "10" is encountered. Thus, the following table is derived. Table 1.03 is a

TABLE 1.03 Decimal, Hexadecimal and Binary Equivalents

DEC.	HEX.	BINARY 128	64	32	16	8	4	2	1
0	00	0	0	0	0	0	0	0	0
1	01	0	0	0	0	0	0	0	1
2	02	0	0	0	0	0	0	1	0
3	03	0	0	0	0	0	0	1	1
4	04	0	0	0	0	0	1	0	0
5	05	0	0	0	0	0	1	0	1
6	06	0	0	0	0	0	1	1	0
7	07	0	0	0	0	0	1	1	1
8	08	0	0	0	0	1	0	0	0
9	09	0	0	0	0	1	0	0	1
10	0A	0	0	0	0	1	0	1	0
11	0B	0	0	0	0	1	0	1	1
12	0C	0	0	0	0	1	1	0	0
13	0D	0	0	0	0	1	1	0	1
14	0E	0	0	0	0	1	1	1	0
15	0F	0	0	0	0	1	1	1	1
16	10	0	0	0	1	0	0	0	0
17	11	0	0	0	1	0	0	0	1
18	12	0	0	0	1	0	0	1	0
19	13	0	0	0	1	0	0	1	1
20	14	0	0	0	1	0	1	0	0
21	15	0	0	0	1	0	1	0	1
22	16	0	0	0	1	0	1	1	0
23	17	0	0	0	1	0	1	1	1
24	18	0	0	0	1	1	0	0	0
25	19	0	0	0	1	1	0	0	1
26	1A	0	0	0	1	1	0	1	0
27	1B	0	0	0	1	1	0	1	1
28	1C	0	0	0	1	1	1	0	0
29	1D	0	0	0	1	1	1	0	1
30	1E	0	0	0	1	1	1	1	0
31	1F	0	0	0	1	1	1	1	1
32	20	0	0	1	0	0	0	0	0
33	21	0	0	1	0	0	0	0	1
34	22	0	0	1	0	0	0	1	0
35	23	0	0	1	0	0	0	1	1
36	24	0	0	1	0	0	1	0	0
37	25	0	0	1	0	0	1	0	1
38	26	0	0	1	0	0	1	1	0
39	27	0	0	1	0	0	1	1	1
40	28	0	0	1	0	1	0	0	0
41	29	0	0	1	0	1	0	0	1
42	2A	0	0	1	0	1	0	1	0
43	2B	0	0	1	0	1	0	1	1
44	2C	0	0	1	0	1	1	0	0
45	2D	0	0	1	0	1	1	0	1
46	2E	0	0	1	0	1	1	1	0
47	2F	0	0	1	0	1	1	1	1
48	30	0	0	1	1	0	0	0	0
49	31	0	0	1	1	0	0	0	1
50	32	0	0	1	1	0	0	1	0
51	33	0	0	1	1	0	0	1	1
52	34	0	0	1	1	0	1	0	0
53	35	0	0	1	1	0	1	0	1
54	36	0	0	1	1	0	1	1	0
55	37	0	0	1	1	0	1	1	1
56	38	0	0	1	1	1	0	0	0
57	39	0	0	1	1	1	0	0	1
58	3A	0	0	1	1	1	0	1	0
59	3B	0	0	1	1	1	0	1	1
60	3C	0	0	1	1	1	1	0	0
61	3D	0	0	1	1	1	1	0	1
62	3E	0	0	1	1	1	1	1	0
63	3F	0	0	1	1	1	1	1	1
64	40	0	1	0	0	0	0	0	0
65	41	0	1	0	0	0	0	0	1
66	42	0	1	0	0	0	0	1	0
67	43	0	1	0	0	0	0	1	1
68	44	0	1	0	0	0	1	0	0
69	45	0	1	0	0	0	1	0	1
70	46	0	1	0	0	0	1	1	0
71	47	0	1	0	0	0	1	1	1
72	48	0	1	0	0	1	0	0	0
73	49	0	1	0	0	1	0	0	1
74	4A	0	1	0	0	1	0	1	0
75	4B	0	1	0	0	1	0	1	1
76	4C	0	1	0	0	1	1	0	0
77	4D	0	1	0	0	1	1	0	1
78	4E	0	1	0	0	1	1	1	0
79	4F	0	1	0	0	1	1	1	1
80	50	0	1	0	1	0	0	0	0
81	51	0	1	0	1	0	0	0	1
82	52	0	1	0	1	0	0	1	0
83	53	0	1	0	1	0	0	1	1
84	54	0	1	0	1	0	1	0	0
85	55	0	1	0	1	0	1	0	1
86	56	0	1	0	1	0	1	1	0
87	57	0	1	0	1	0	1	1	1
88	58	0	1	0	1	1	0	0	0
89	59	0	1	0	1	1	0	0	1
90	5A	0	1	0	1	1	0	1	0
91	5B	0	1	0	1	1	0	1	1
92	5C	0	1	0	1	1	1	0	0
93	5D	0	1	0	1	1	1	0	1
94	5E	0	1	0	1	1	1	1	0
95	5F	0	1	0	1	1	1	1	1
96	60	0	1	1	0	0	0	0	0
97	61	0	1	1	0	0	0	0	1
98	62	0	1	1	0	0	0	1	0
99	63	0	1	1	0	0	0	1	1
100	64	0	1	1	0	0	1	0	0
101	65	0	1	1	0	0	1	0	1
102	66	0	1	1	0	0	1	1	0
103	67	0	1	1	0	0	1	1	1
104	68	0	1	1	0	1	0	0	0
105	69	0	1	1	0	1	0	0	1
106	6A	0	1	1	0	1	0	1	0
107	6B	0	1	1	0	1	0	1	1
108	6C	0	1	1	0	1	1	0	0
109	6D	0	1	1	0	1	1	0	1
110	6E	0	1	1	0	1	1	1	0
111	6F	0	1	1	0	1	1	1	1
112	70	0	1	1	1	0	0	0	0
113	71	0	1	1	1	0	0	0	1
114	72	0	1	1	1	0	0	1	0
115	73	0	1	1	1	0	0	1	1
116	74	0	1	1	1	0	1	0	0
117	75	0	1	1	1	0	1	0	1
118	76	0	1	1	1	0	1	1	0
119	77	0	1	1	1	0	1	1	1
120	78	0	1	1	1	1	0	0	0
121	79	0	1	1	1	1	0	0	1
122	7A	0	1	1	1	1	0	1	0
123	7B	0	1	1	1	1	0	1	1
124	7C	0	1	1	1	1	1	0	0
125	7D	0	1	1	1	1	1	0	1
126	7E	0	1	1	1	1	1	1	0
127	7F	0	1	1	1	1	1	1	1
128	80	1	0	0	0	0	0	0	0
129	81	1	0	0	0	0	0	0	1
130	82	1	0	0	0	0	0	1	0
131	83	1	0	0	0	0	0	1	1
132	84	1	0	0	0	0	1	0	0
133	85	1	0	0	0	0	1	0	1
134	86	1	0	0	0	0	1	1	0
135	87	1	0	0	0	0	1	1	1
136	88	1	0	0	0	1	0	0	0
137	89	1	0	0	0	1	0	0	1
138	8A	1	0	0	0	1	0	1	0
139	8B	1	0	0	0	1	0	1	1
140	8C	1	0	0	0	1	1	0	0
141	8D	1	0	0	0	1	1	0	1
142	8E	1	0	0	0	1	1	1	0
143	8F	1	0	0	0	1	1	1	1

TABLE 1.03 Decimal, Hexadecimal and Binary Equivalents (Cont.)

DEC.	HEX.	BINARY 128	64	32	16	8	4	2	1
144	90	1	0	0	1	0	0	0	0
145	91	1	0	0	1	0	0	0	1
146	92	1	0	0	1	0	0	1	0
147	93	1	0	0	1	0	0	1	1
148	94	1	0	0	1	0	1	0	0
149	95	1	0	0	1	0	1	0	1
150	96	1	0	0	1	0	1	1	0
151	97	1	0	0	1	0	1	1	1
152	98	1	0	0	1	1	0	0	0
153	99	1	0	0	1	1	0	0	1
154	9A	1	0	0	1	1	0	1	0
155	9B	1	0	0	1	1	0	1	1
156	9C	1	0	0	1	1	1	0	0
157	9D	1	0	0	1	1	1	0	1
158	9E	1	0	0	1	1	1	1	0
159	9F	1	0	0	1	1	1	1	1
160	A0	1	0	1	0	0	0	0	0
161	A1	1	0	1	0	0	0	0	1
162	A2	1	0	1	0	0	0	1	0
163	A3	1	0	1	0	0	0	1	1
164	A4	1	0	1	0	0	1	0	0
165	A5	1	0	1	0	0	1	0	1
166	A6	1	0	1	0	0	1	1	0
167	A7	1	0	1	0	0	1	1	1
168	A8	1	0	1	0	1	0	0	0
169	A9	1	0	1	0	1	0	0	1
170	AA	1	0	1	0	1	0	1	0
171	AB	1	0	1	0	1	0	1	1
172	AC	1	0	1	0	1	1	0	0
173	AD	1	0	1	0	1	1	0	1
174	AE	1	0	1	0	1	1	1	0
175	AF	1	0	1	0	1	1	1	1
176	B0	1	0	1	1	0	0	0	0
177	B1	1	0	1	1	0	0	0	1
178	B2	1	0	1	1	0	0	1	0
179	B3	1	0	1	1	0	0	1	1
180	B4	1	0	1	1	0	1	0	0
181	B5	1	0	1	1	0	1	0	1
182	B6	1	0	1	1	0	1	1	0
183	B7	1	0	1	1	0	1	1	1
184	B8	1	0	1	1	1	0	0	0
185	B9	1	0	1	1	1	0	0	1
186	BA	1	0	1	1	1	0	1	0
187	BB	1	0	1	1	1	0	1	1
188	BC	1	0	1	1	1	1	0	0
189	BD	1	0	1	1	1	1	0	1
190	BE	1	0	1	1	1	1	1	0
191	BF	1	0	1	1	1	1	1	1
192	C0	1	1	0	0	0	0	0	0
193	C1	1	1	0	0	0	0	0	1
194	C2	1	1	0	0	0	0	1	0
195	C3	1	1	0	0	0	0	1	1
196	C4	1	1	0	0	0	1	0	0
197	C5	1	1	0	0	0	1	0	1
198	C6	1	1	0	0	0	1	1	0
199	C7	1	1	0	0	0	1	1	1
200	C8	1	1	0	0	1	0	0	0
201	C9	1	1	0	0	1	0	0	1
202	CA	1	1	0	0	1	0	1	0
203	CB	1	1	0	0	1	0	1	1
204	CC	1	1	0	0	1	1	0	0
205	CD	1	1	0	0	1	1	0	1
206	CE	1	1	0	0	1	1	1	0
207	CF	1	1	0	0	1	1	1	1
208	D0	1	1	0	1	0	0	0	0
209	D1	1	1	0	1	0	0	0	1
210	D2	1	1	0	1	0	0	1	0
211	D3	1	1	0	1	0	0	1	1
212	D4	1	1	0	1	0	1	0	0
213	D5	1	1	0	1	0	1	0	1
214	D6	1	1	0	1	0	1	1	0
215	D7	1	1	0	1	0	1	1	1
216	D8	1	1	0	1	1	0	0	0
217	D9	1	1	0	1	1	0	0	1
218	DA	1	1	0	1	1	0	1	0
219	DB	1	1	0	1	1	0	1	1
220	DC	1	1	0	1	1	1	0	0
221	DD	1	1	0	1	1	1	0	1
222	DE	1	1	0	1	1	1	1	0
223	DF	1	1	0	1	1	1	1	1
224	E0	1	1	1	0	0	0	0	0
225	E1	1	1	1	0	0	0	0	1
226	E2	1	1	1	0	0	0	1	0
227	E3	1	1	1	0	0	0	1	1
228	E4	1	1	1	0	0	1	0	0
229	E5	1	1	1	0	0	1	0	1
230	E6	1	1	1	0	0	1	1	0
231	E7	1	1	1	0	0	1	1	1
232	E8	1	1	1	0	1	0	0	0
233	E9	1	1	1	0	1	0	0	1
234	EA	1	1	1	0	1	0	1	0
235	EB	1	1	1	0	1	0	1	1
236	EC	1	1	1	0	1	1	0	0
237	ED	1	1	1	0	1	1	0	1
238	EE	1	1	1	0	1	1	1	0
239	EF	1	1	1	0	1	1	1	1
240	F0	1	1	1	1	0	0	0	0
241	F1	1	1	1	1	0	0	0	1
242	F2	1	1	1	1	0	0	1	0
243	F3	1	1	1	1	0	0	1	1
244	F4	1	1	1	1	0	1	0	0
245	F5	1	1	1	1	0	1	0	1
246	F6	1	1	1	1	0	1	1	0
247	F7	1	1	1	1	0	1	1	1
248	F8	1	1	1	1	1	0	0	0
249	F9	1	1	1	1	1	0	0	1
250	FA	1	1	1	1	1	0	1	0
251	FB	1	1	1	1	1	0	1	1
252	FC	1	1	1	1	1	1	0	0
253	FD	1	1	1	1	1	1	0	1
254	FE	1	1	1	1	1	1	1	0
255	FF	1	1	1	1	1	1	1	1

listing of advancing equivalent count values from "0" in decimal, hexadecimal and binary to "255" in decimal, "FF" in hexadecimal and 11111111 in binary. Note that each equivalent entry in the table is representative of the same real count value, and that by following the advancing procedure, the table may be extended indefinitely.

The conversion from hexadecimal to binary is simplified through the use of table 1.03. For example, a hexadecimal "EA" may be converted to binary simply by taking a binary coded "E," 1110, and a binary coded "A," 1010, and showing then together, 11101010. Thus the binary equivalent of a hexadecimal "EA" is derived.

Digital signaling is based on the binary number system. The two marks, "0" and "1," in the binary system may represent the two states of a switching element, "off" and "on." These two states are often referred to as zero and one, but since actual measured voltage levels may not be confined to "no voltage" and "one unit of voltage" the terms "low" and "high" become more useful.

Thus, when a particular output, gate, lead, etc. is low, this means that its logic state is zero. When is it "high," its logic state is one. The logic states may then be considered without regard for actual voltage levels.

As long as the state of only one output, gate, lead, etc. is considered, the terms low and high may be used with ease. When combinations of several leads must be described, it is more convenient to express these binary states in hexadecimal terms. For example, assume that leads L1 through L6 have the following logic states.

L1 - 0 (low)

L2 - 1 (high)

L3 - 1 (high)

L4 - 0 (low)

L5 - 1 (high)

L6 - 0 (low)

The group of leads, L1 through L6, may then be said to have a collective logic state (expressed in binary terms) of 011010. From table 1.03, this may be expressed in hexadecimal form as 1A, and in decimal form as 26.

The conversion of binary coded numbers to hexadecimal form is more efficient than the conversion of binary to decimal. This is because the radix of hexadecimal system (16) is an interger power of the radix of the binary system (2), while the radix of the decimal system (10) is not an interger power of the radix of the binary system (2). It is for these reasons that the TD-100 circuitry uses the binary number system represented in hexadecimal form.

7.00 LEAD DESIGNATIONS

7.01 General. Each internal lead within the TD-100 EPABX has an abbreviation. Selected primary lead abbreviations and their meanings are listed in the individual circuit narratives. Table 1.04 lists the primary lead abbreviations in alphabetical order and the meaning for each lead. The circuits with which each of these leads is associated is also shown; a check in the vertical column under a circuit number and in the horizontal line beside a lead abbreviation indicates a correlation between the two.

a. The L101 contacts open since the T and R loop opens.

b. An LW (lamp wink) signal appears and U103-11, CR113, and lamp L winks.

c. On third generation PCB's (003), Q110 turns on and inhibits the terminate and originate transmission paths.

Operation for a single line telephone is as previously described, except that the A lead is grounded continuously. This results in a permanent high at U110-9.

2.03 Strapping. Two strapping options are provided on each line circuit PCB. (For full strapping information, consult OB-000-003, Feature Strapping, TD-100.) These options permit the use of single-line and key telephones and extension of the loop resistance limit.

TABLE 1.00 Attendant Line and Control Terms

ABBREVIATION	MEANING	EXPLANATION
AH	Attendant Flash	Receives ground from attendant's console and generates flash signal to distant central office via trunk circuit.
AHI-1	Automatic Hold Incoming 1	Signal to attendant link 1 which puts circuit in automatic hold status.
AHI-2	Automatic Hold Incoming 2	Signal to attendant link 2 which puts circuit in automatic hold status.
AHO	Automatic Hold Outgoing	Signal which puts attendant register in automatic hold status.
AIN	Artificial Intrude	Signal generated in time slot of trunk when local station transfers a trunk to the attendant.
ALK	Attendant Line Key	Marks ground from console to seize attendant line for outgoing calls.
ALL	Attendant Line Lamp	Marks ground and provides lamp indication for attendant line key on console.
ARK	Attendant Release Key	Marks ground from attendant's console to generate release signals to trunks, attendant register and links.
ATK-1	Attendant Key 1	Attendant marks ground on this lead from console when answering incoming calls from stations on attendant trunk 1.
ATK-2	Attendant Key 2	Attendant marks ground on this lead from console when answering incoming calls from stations on attendant trunk 2.
ATL-1	Attendant Lamp 1	Provides ground marks for steady, wink, and flash lamp indication of incoming call status for ATT TRK-1 key.
ATL-2	Attendant Lamp 2	Provides ground marks for steady, wink, and flash lamp indication of incoming call status for ATT TRK-2 key.
BUZ	Buzz	Signal from attendant line and control and C.O. trunks to attendant console which is used to sound audible alarm in attendant console for incoming calls.

TABLE 1.00 Attendant Line and Control Terms (Cont.)

ABBREVIATION	MEANING	EXPLANATION
CCK	Code Call Key	Receives ground mark from console and generates code call signals.
CK	Conference Key	Receives ground mark from console and generates conference control signals to attendant register and trunks.
CONF	Conference	A ground mark conference signal generated when the attendant operates CONF key on console. A ground mark is extended to attendant register and all trunks for conference control functions.
CONK	Connect Key	Marks ground from attendant console to generate connect signals to trunks, attendant register, and links.
CONN	Connect	Signal generated when attendant operates connect bar on console. It is extended to attendant register and links for connect control function.
$\overline{\text{CONN}}$	Connect	Inverted CONN signal generated when attendant operates connect or release bar on console. It is extended to all trunks for connect control function.
DCP	DC Pulse	Signal to attendant console which is used to operate the DC relay.
HICL-1	Hold Incoming Line 1	Signal to attendant link 1 which puts circuit in a full hold status.
HICL-2	Hold Incoming Line 2	Signal to attendant link 2 which puts circuit in a full hold status.
HLD	Hold (manual)	Receives ground mark from console and is used to generate full hold signals to attendant links, registers, and trunks.
HOGL	Hold Outgoing Line	Signal which puts attendant's register in a full hold status.
HOT	Hold Trunk (automatic)	Signal common to all trunks which puts trunk on automatic hold status.
HT	Hold Trunk	Signal common to all trunks which puts trunk on full hold status.

TABLE 1.00 Attendant Line and Control Terms (Cont.)

ABBREVIATION	MEANING	EXPLANATION
ICL-1	Incoming Line 1	Signal extended to attendant link 1 used to remove ring-back tone when attendant seizes incoming line on console.
ICL-2	Incoming Line 2	Signal extended to attendant link 2 used to remove ring-back tone when attendant seizes incoming line on console.
IE	Intrude	Signal from memory which allows the attendant to intrude into a busy condition. It is generated when the attendant operates the BUSY VER key on the console and appears in either a link or trunk time slot.
ILSZ-1	Incoming Line Seize 1	Seize signal from attendant link 1 which is used to generate lamp flash for ATT TRK 1 key and also gates BUZ out to attendant's console.
ILSZ-2	Incoming Line Seize 2	Seize signal from attendant link 2 which is used to generate lamp flash for ATT TRK 2 key and also gates BUZ out to attendant's console.
IRK	Intrude Key	Receives ground mark from console and operates intrude (busy verification) control signals to memory and attendant register.
LF	Lamp Flash	Signal from common services PCB used to give lamp flash signals on console.
LW	Lamp Wink	Signal from common services PCB used to give lamp wink signals on console.
OGL	Outgoing Line	Signal which seizes attendant register. It is generated when attendant line key (ALK) is operated on console.
OHO	Off-Hook Originator	Signal generated in attendant line circuit when attendant acts as originator.
OHT	Off-Hook Terminator	Signal generated in attendant line circuit when attendant acts as terminator.
OLST11/ OLSU9	Originator Line Scan Tens 11/Originator Line Scan Units 9	Originating line scan for attendant line.

TABLE 1.00 Attendant Line and Control Terms (Cont.)

ABBREVIATION	MEANING	EXPLANATION
PAG	Page	Marks ground to seize paging circuit when attendant presses PAGE key on console.
PK	Paging Key	Receives ground mark from console and generates seize signal to paging circuit.
POR	Power On Reset	A signal from memory which resets logic on initial system power-on.
R	Ring	Tip side of transmission line from receiver/ transmitter in attendant's console.
RLSE	Release	Release signal generated when attendant operates release bar. It is extended to attendant register and links and all trunks for release control functions.
RRL	Reset Register Latch	Ground mark control signal from attendant register which is used to reset control logic in attendant's control circuit.
RXEN	Receive Enable	Gates receive audio signals into attendant line during the last half of the attendant's line scan microsecond.
RXO	Receive Originate	Attendant receives on PAM common highway when acting as originator.
RXT	Receive Terminate	Attendant receives on PAM common highway when acting as terminator.
T	Tip	Tip side of transmission line from receiver/ transmitter in attendant's console.
TCK	Talk City Key	Marks ground from attendant's console, generates hold signals to attendant register and resets associated trunk hold circuits.
TCL	Talk City Lamp	Marks ground which provides lamp indication for talk city key.
TEK	Talk Extension Key	Marks ground from attendant's console, resets hold signals to attendant register and generates hold signal to associated trunk.
TEL	Talk Extension Lamp	Ground mark which provides lamp indication for talk extension key.

TABLE 1.00 Attendant Line and Control Terms (Cont.)

ABBREVIATION	MEANING	EXPLANATION
TLST11/ TLSU9	Terminator Line Scan Tens 11/Terminator Line Scan Units 9	Terminating line scan for attendant line.
TRES	Trunk Reservation	Ground mark which changes all preselected trunks to incoming only. Generated by attendant when trunk reservation key is operated on console.
TRUC	Busy Verification	Control signal generated when attendant operates BUSY VER key on console. It is extended to attendant register and links and memory for busy verification (intrude) control functions.
TSC	Trunks Common	Marks ground when any console trunk key is pressed and is used to generate hold signals to other trunks, attendant register and links.
TXA	Transmit Attendant	Attendant transmits on PAM common highway during busy verification (intrude) status.
TXO	Transmit Originator	Attendant transmits on PAM common highway when acting as originator.
TXT	Transmit Terminator	Attendant transmits on PAM common highway when acting as terminator.
1S	1 Second	Provides 1 Hz interruption for console buzzer.

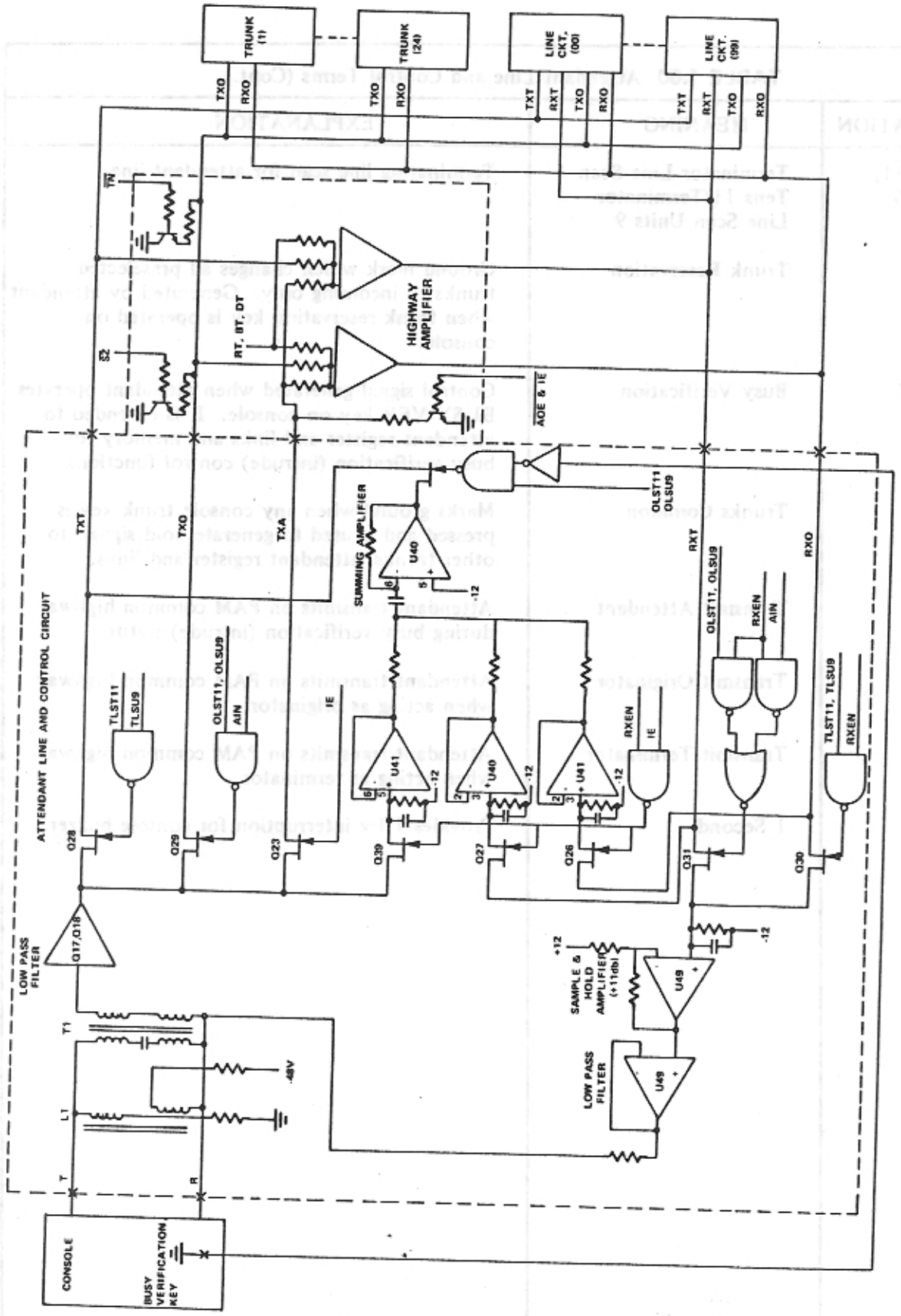

FIGURE 1.01 Attendant Line and Control Circuit

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

cuit and gates the attendant's voice frequency signals through FET Q29 onto the PAM highway via the TXO lead.

These voice signals from the attendant are buffered by the highway amplifier and received by the station on the RXO lead for .5 microseconds every 64 microseconds. The station transmits on its TXT lead onto the PAM highway; it is buffered by the highway amplifier onto the RXO lead and gated into the attendant's line circuit through FET Q31 by the AIN and RXEN signals.

The station may now transfer the trunk to the attendant by merely going on-hook. This removes the OHT signal (and thus the SI-3 signal to the trunk) which causes the status-out of the trunk to change to write attendant number. This status seizes the processor and replaces the terminating station number with the attendant's number. The transmission gates in the trunk and the attendant's line are now gated simultaneously to allow transmission between the attendant and the trunk to complete the attendant transfer.

The attendant may, after calling a busy station line, intrude into the transmission path by pressing the BUSY VER (busy verification) key on the console.

The following conditions exist when the attendant seizes the attendant line and dials the number of a busy station.

a. The attendant's number (119) is in the write scan of the attendant register as the originator.

b. The attendant register's status output is busy.

c. The called station (busy) is in the write scan of the attendant register, but is inhibited by the IDT signal from the processor. This is due to the busy status of the register.

To intrude into the busy station's speech path, the attendant presses the BUSY VER key; a ground is marked out on the IRK lead which is extended to the attendant line circuit. The IRK signal generates the following conditions.

a. The TRUC lead switches to a low logic level and is extended to the attendant register and to the memory. This causes the register status to change to intrude; the register seizes the processor and performs a number match search for the busy number which is in the trunk's or link's time slot. When it is found,

an IE signal is generated in the link or trunk channel; this signal reoccurs every 64 microseconds and is extended to the attendant line circuit. The TRUC lead, extended to the memory, enables the IE signal for as long as the BUSY VER key is pressed and allows it to reoccur every 64 microseconds.

b. NAND gate U37 is enabled as pin 5 is switched to a logic high.

c. A BTE (busy tone enable) signal is generated in the trunk's or link's time slot.

When the attendant speaks, the voice signals are gated out by the IE signal through FET (field-effect transistor) Q23 and onto the PAM highway via the TXA lead. This lead is common to both highway amplifiers; therefore, the PAM voice signals appear on both the RXT and RXO leads to enable both parties to converse with the attendant.

When either party speaks, the voice signals will be transmitted during the trunk's or link's time slot via the TXT or TXO lead. Since the IE signal is in the same time slot, the PAM voice signals are gated into the attendant's line circuit by the IE and RXEN leads through FET Q26 and/or Q27. (This is dependent upon which party is speaking.) The signals are sampled and held by U40 and U41. The attendant cannot receive at this time because the line circuit is being scanned by OLST and OLSU in the time slot of the attendant register. The voice signals, therefore, are held by C38 and/or C39 until the register's time slot.

When the attendant's line is scanned by OLST and OLSU in the register's time slot, U37 pin 4, switches high and the output (U37 pin 6) switches low if the busy verification key is still pressed. This gates the voice signals out through FET Q25 onto the PAM highway via the TXT lead; they are buffered by the highway amplifier and appear on the RXO lead. The voice signals from the parties are gated by OLST, OLSU, and RXEN through FET Q31 into the input of the sample and hold amplifier U49 pin 3. The attendant now may receive the speech signals from both parties.

2.02 Attendant Control Circuit. The following paragraphs describe the control and logic portion of the attendant line and control circuit. (See figure 1.01.)

To make an outgoing call, the attendant presses the ATT LINE (attendant line) key which places a ground on the ALK lead in the console. This ground is extended to the attendant line and control circuit to cause the following events.

a. Hold status signals must be generated and extended to other circuits which the attendant may have seized.

When the ATT LINE key is pressed, latch U9 pin 9 is set to a low if previously high, and latch U9 pin 4 is reset to a high if previously low. U9 pin 9 is extended to U4 pin 1 and the HOT (auto hold trunks) lead is switched to a low via U4 and U53. This lead is extended to all trunks and changes any one seized to an auto hold at a given time. Auto hold means: the trunk cannot be released; it can be connected to another station; and its transmission gates are inhibited. When the trunk is put on auto hold status, it returns a winking condition on the TA lead and a steady condition on the TB lead to the console for visual status indication to the associated trunk key.

Hold signals are generated to attendant trunks 1 and 2 if they happen to be seized. When the ATT LINE key is pressed, and if an attendant trunk 1 is seized, latch U18 pin 6 will be set to a low via U7 pin 4, U23 pin 3, and U18 pin 11. U12 pin 4 and the HICL-1 (hold incoming line 1) lead will be switched to a low and is extended to the attendant link circuit which changes its status-out to hold. If attendant trunk 2 has been seized instead of trunk 1, latch U29 pin 4 would have been set to a low via U7 pin 4, U23 pin 8, U24 pin 3, and a HICL-2 signal would be generated to place attendant line 2 on full hold status.

b. As a result of the ATT LINE key being pressed, latch U33 pin 13 is set low via U39 pin 2, U46 pin 8, and Q38; the DCP lead is switched to ground and operates the DCP relay in the console. This relay operation switches the attendant's push-button dial into the DC marking mode.

c. The ALL (attendant line lamp) lead is switched to a steady ground via latch U33 pin 13, U47 pin 3, 6, and Q36. This signal

is extended to the attendant console and lights the attendant line lamp.

If attendant trunk 1 had been previously seized, the ATL-1 (attendant lamp 1) lead would switch at a wink rate and give a visual hold status to the ATT TK 1 key via U12 pin 4, U52 pin 8, U39 pin 6, U55 pin 12, U52 pin 11, and Q34. If attendant trunk 2 had been seized, the ATL-2 lead would switch at a wink rate and give a visual hold status to the ATT TK 2 key via U34 pin 12, U43 pin 6, pin 8, U44 pin 12, U51 pin 11, and Q37.

d. The AR relay in the line circuit operates via U7 pin 4, U33 pin 13, U39 pin 2, U46 pin 8, U46 pin 12, U12 pin 12, U36 pin 12, U20 pin 3, U43 pin 12, and Q40. This relay operation provides a loop on the tip and ring. The reed contacts mounted on battery feed coil L1 make and, via U38 pin 3, an OHO signal is generated in the originating line scan.

e. The OGL (outgoing line) lead switches to a low via U7 pin 4, U33 pin 13, U39 pin 2, and U34 pin 2. It is extended to the attendant register which changes its status to dial tone enable. This status seizes the processor; the attendant's number, tens 11 and units 9 (119), is written into the write scan of the register as the originator. The attendant's line is now scanned by the OLST11 and OLSU9 leads. OHO is gated out during every line scan to indicate the off-hook status.

At this point, the register is seized and dial tone is being received. The attendant has several alternatives as described in the following paragraphs.

a. The attendant's line may be put on manual hold by pressing the (manual) HOLD key on the attendant's console. This marks a ground out on the HLD lead which is extended to the attendant line and control circuit to set latch U33 pin 9 to a low via U39 pin 8, U17 pin 10, U25 pin 4, and U25 pin 2. Pin 9 of latch U33 is extended to U38 pin 10 and the HOGL lead switches to a low via U34 pin 4. This signal is extended to the attendant register and changes its status-out to hold. The attendant's originating line scan is inhibited by an IDO signal from the processor due to this status. Release of the register is disabled by the HOGL signal in the register. The DCP relay in the console drops, due to Q38 switching off via U46 pin 11. The AR relay drops, via U46 pin 13, U12 pin12, U36 pin 12 and U20 pin 6. The ALL (attendant line lamp) lead switches at a wink rate via U47 pin 12, U47 pin 8, U47 pin 6, and Q35.

b. The attendant line is put on automatic hold whenever a trunk is seized. When the trunk key is pressed, a ground is marked out of the console on the TSC lead and extended to the attendant line circuit where it sets latch U9 pin 4 low and resets latch U9 pin 9 high if previously low. The output, pin 4, of latch U9 generates an AHO (automatic hold outgoing) signal via U10 pin 13 and U38 pin 6.

This low signal is extended to the attendant register and its status changes to hold. The attendant's line scan is inhibited by IDO from the processor. The ground on the DCP lead is removed via U46 pin 9, U34, U6, and Q38 which causes the DCP relay in the console to drop. The ALL lead switches at a wink rate via U38 pin 6, U47 pin 11, U39, U54, and Q35 to indicate the hold status.

The AR relay in the attendant line circuit remains operated due to latch U4 pin 8 switching low when the trunk was seized and inhibiting U36 pin 1. The difference between automatic hold and manual hold is that automatic hold enables the connect function while manual hold inhibits the connect function. (This is also true for attendant links and CO trunks.) The release function and the attendant line scan of the circuit on hold is inhibited for both hold and automatic hold.

c. After seizing the attendant line, the attendant may desire to call a local station number. The push-button dial in the console generates (2-out-of-7 code) DC marking to the attendant register where it is registered. When the third digit is received, the line number is stored in memory (as the terminator) in the same time slot as the attendant; when the distant station goes off-hook, the transmission path in each line circuit is simultaneously enabled.

The attendant may release by pressing the RELEASE bar on the console which generates a ground mark on the ARK lead. This is extended to the attendant line circuit and

the RLSE lead switches high via U6 pin 12. This lead is extended to the attendant register and changes its status to lockout. Both numbers (attendant and station) are removed from memory due to this status. The attendant relay, AR, is dropped as U36 pin 1 goes high via latch U4 pin 8, U4 pin 6, U13 pin 2, and U8 pin 10. When the attendant register receives the high on the RLSE lead, it enables a logic release timer; eight channel read scans later (512 microseconds), a ground pulse on the RRL lead is received by the attendant line circuit which resets latch U33 pin 13 high and OGL is switched low. The register returns to its idle state and the attendant line lamps turn off due to Q34 switching off via latch U33 pin 13, U47 pin 1, and U47 pin 6. The DCP relay in the console drops due to Q38 switching off via U34 pin 9, U46 pin 10, U39 pin 2, and latch U33 pin 13. The attendant relay, AR, drops due to U46 pin 13 switching high

2.03 Attendant Trunk 1 Seizure. If a station dials "0," a binary coded hexadecimal "C1" is generated in the processor. (See table 1.01 for a list of hexadecimal and alphanumeric equivalents.) This sets up a search for an idle attendant link; when it is found, the calling number is written into the memory in its time slot (as the originator) and the ILSZ-1 lead switches high and is extended to the attendant line circuit. This causes the ATL-1 (attendant link 1) lead to switch at a flashing rate; it is extnded to the console to give a flashing visual indication. The BUZ (buzzer) lead also switches at a 1 second rate and is extended to the console to give an audible indication of incoming calls. The ATL-1 signal is generated via U55 pin 2, U52 pin 11, and Q34 while BUZ is generated via U51 pin 10, U51 pin 3, and Q36. The attendant link changes its status to ring tone enable. The attendant seizes the incoming call by pressing the ATT TK 1 key on the console, and a ground is marked out on the ATK-1 lead. This is extended to the attendant line circuit where it sets latch U9 pin 9 and latch U19 pin 13 low. The HOT lead is switched low to set any trunk on automatic hold which may have been seized. The AR relay operates via U19 pin 13, U11 pin 6, U44 pin 3, U46 pin 1, U12 pin 12, U36, and U20. The BUZ signal is inhibited by U13 pin 13, U52 pin 10, U39 pin 6, and U51 pin 9. The attendant line lamps lead changes from flash to steady by a high on U55 pin 4 via U52 pin 10. The DCP relay in the console does not operate. The ICL lead switches high and is extended to attendant link 1 where it changes the link's status to busy. This busy status removes dial tone, seizes the processor, and writes the attendant's number (tens 11 and units 9) into its write time slot. The station and attendant line circuits are now scanned at the same time and the two parties may transmit and receive.

The incoming station call may be put on manual hold, automatic hold, released, or connected, as described in the following paragraphs.

a. When the (manual) HOLD key is pressed on the attendant's console, a ground is marked out on the HLD lead and extended to the attendant line circuit. If attendant link 1 has been seized, latch U19 pin 7 switches low via U19 pin 2, U17 pin 3, and U25 pin 4. The low on latch U19 pin 7 is extended to U18 pin 1 and the HICL-1 lead switches low via U12 pin 4 and U18 pin 3. This lead is extended to the attendant link and changes its status to hold and the attendant's line scan is inhibited by the IDT signal in the memory. The ATL-1 (attendant trunk lamp 1) lead changes from a steady condition to a wink condition via U12 pin 4, U24 pin 13, U52 pin 5, U55 pin 6, U52 pin 12, and Q34. The AR relay is dropped due to U12 pin 4 switching low and being extended through U44 pin 5, U46 pin 1, U12 pin 12, U36, and U20. Connect and release functions in the link are inhibited.

b. When a C.O. trunk key is pressed, a ground mark is extended to the attendant line circuit on the TSC lead. This sets latch U9 pin 4 low, and resets latch U9 pin 9 high if previously low. Sinch latch U19 pin 13 was set low when attendant link 1 was initially seized, U10 pin 9 was enabled through U11 pin 6. U10 pin 10 switches high due to latch U9 pin 4 going low; the AHI-1 lead is switched low via U24 pin 8, U16 pin 8, and U10 pin 8. This low is extended to attendant link 1 and changes its status to hold; the line scan is inhibited by the IDT signal in the memory. The release function in the link is inhibited and connect enabled. The AR relay is dropped due to U44 pin 4 switching and the ATK-1 lead is switching at a flashng rate due to U24 pin 12 going low.

c. After seizure, attendant link 1 is released as the attendant presses the RELEASE bar on

the console. This places a ground mark to the line circuit on the ARK lead and the RLSE lead is switched high. The trunk latch U9 pin 7 will be reset high if previously set. The RLSE lead is extended to attendant link 1 and changes its status to lockout. Due to this status, the processor clears both numbers from memory via the CLRO and CLRT leads. The RLSE signal into the link also starts a release timer; after 250 microseconds, the LRL-1 lead switches low and is extended to the attendant line circuit which resets latch U19 pin 13 high. This extinguishes the attendant trunk lamp 1 and drops the AR relay.

d. If a C.O. trunk is seized, and the attendant link 1 is put on automatic hold, the local station may be extended to the C.O. trunk by the attendant pressing the CONNECT bar on the console. A ground mark is extended to the attendant line on lead CONK, and lead CONN which switches high. This high is extended to attendant link 1 and enables the logic release timer as during the release function. A low is extended 250 microseconds later to the attendant line circuit on the LRL-1 lead and resets latch U19 pin 13 which, in turn, extinguishes the attendant trunk lamp 1 and drops the AR relay. The C.O. trunk latch U9 pin 7 and U9 pin 4 in the line circuit would be reset high.

2.04 C.O. Trunk Seizure. When a C.O. trunk key on the console is pressed, a ground mark is generated on the TSC lead and extended to the attendant line circuit where it sets latch U9 pin 7, latch U9 pin 4, and latch U4 pin 8 low. The AR relay operates via U20 pin 3, U36 pin 12, and U4 pin 8. The HT lead pulses to ground for 250 microseconds, and is extended to all trunk circuits. The TS lead from the trunk key on the console marks a ground to the associated trunk circuit and sets the attendant latch. The TS signal to the associated trunk inhibits the setting of the hold latch in the trunk. Any C.O. trunk which was previously seized by the attendant will be put on a full hold status due to HT setting the hold latch in that particular trunk. The seized trunk may be put on manual hold, automatic hold, released, or connected to a station as described in the following paragraphs.

a. When the (manual) HOLD key is pressed on the console, a ground mark from the HLD lead is extended to the attendant line circuit and the HT lead switches low for as long as the key is held down. This signal is extended to all trunks and sets the hold latch in that trunk which has the attendant latch set, thus changing its status to hold. The release and connect functions for those trunks which are on full hold status are now inhibited.

b. After the C.O. trunk is seized, it may be put on automatic hold by seizing the attendant line as previously described. This generates an HOT signal (low) to all trunks, but changes to automatic hold only that trunk which has its attendant latch set and its hold latch not set. The HT signal is not generated at this time. The trunk now remains in the following state: its connect functions are enabled; its release functions inhibited; its transmission gates are inhibited.

c. After seizing the attendant line and calling a local station, the attendant may operate the connect bar on the console (thus connecting the trunk to the station) or press the TALK CITY key to re-establish transmission to the trunk. When the TALK CITY key is pressed, a ground mark is extended to the attendant line circuit on the TCK lead to set latch U19 pin 4 low and generate a ground on the TCL lead. This signal is extended to the console and lights the TALK CITY lamp. Latch U9 pin 4 also is set low; this generates a low on the AHO lead via U9 pin 4, U10 pin 11 and U38 pin 6. The AHO signal is extended to the attendant register which changes its status to hold. The signal on the HOT lead to the trunk is inverted to a high by resetting latch U9 by a ground on pin 11. The attendant line number is in the time slot of the trunk and the attendant register but, due to the hold status of the register, the line scan is inhibited at this time by the IDO signal in the memory and enabled in the trunk's time slot. The attendant line lamp winks and the DCP relay in the console drops due to U38 pin 6 returning to a low.

d. To return to the local station from the talk city mode, the attendant presses the TALK EXT (talk extension) key on the console which marks a ground on the TEK lead. This is extended to the attendant line where it resets latch U19 pin 4 and latch U9 pin 4 high. This removes the AHO signal from the register and extinguishes the TALK CITY lamp.

Latch U19 pin 9 and latch U9 pin 9 are set low which generates a ground on the TEL lead. This lights the TALK EXT lamp on the console and generates a HOT signal which puts the trunk back on automatic hold. The attendant line lamp lights and th DCP relay in the console operates due to U38 pin 6 switching high. The attendant's line scan in the trunk's time slot is inhibited (due to the hold status of the trunk) and enabled in the register's time slot.

e. From the talk extension mode, the attendant may connect the trunk and station by pressing the CONNECT bar on the console which generates a ground on the CONK lead. This is extended to the attendant line circuit to generate a high on the CONN lead and a low on the CONN lead. Latch U19 pin 9 is reset high when pin 11 switches low via U8 pin 10 and U13 pin 8. Latch U4 pin 8 is reset via pin 4; latch U9 pin 7 is reset by a low on pin 1. Latch U9 pin 9 is reset high (due to a ground on pin 12) and returns the HOT lead high.

The CONN lead is extended to the attendant register where it changes its status to connect. The CONN lead is extended to the trunk and changes its status to write station number. The connect status from the register seizes the processor, and a search for a trunk with write station number status is made. When it is found, the station number is put in the trunk's time slot as the terminator. When the register receives the CONN signal, a logic release timer is enabled, and 250 milliseconds later, a low is generated on the RRL lead and extended to the attendant line circuit. This signal resets latch U33 pin 13 which switches the OGL lead high and drops the register. The DCP relay in the console and the attendant relay AR drop due to U46 pin 8 switching high via U39 pin 2 and latch U33 pin 13. The attendant line lamp extinguishes due to U47 pin 1 switching high and Q35 turning off.

2.05 Paging. The attendant may seize all paging circuits in the system simultaneously by pressing the PAGE key on the console. This extends a ground to the attendant line circuit on the PK lead; a low is extended to each paging circuit on the PAG lead which seizes each circuit. The attendant relay AR is operated via U1 pin 8, U35 pin 3, U35 pin 6, U36 pin 12, and U20 pin 3. The AHO lead switches low and changes the attendant register to hold status if it was seized; if either attendant link was seized, the AHI-1 or AHI-2 lead is switched low putting the line on hold.

2.06 Trunk Reservation. When the locking TS RES ON (trunk reservation)key is pressed on the console, a ground is marked out to the attendant line circuit on the TRK lead. This generates a low on the TRES lead which is extended to all trunks. This signal places on reservation only trunks which have been strapped for incoming service only.

2.07 Conference. The attendant may put stations in conference by seizing the attendant line, dialing the station number, and then pressing the CONF (conference) key on the console. This marks a ground on the CK lead and extends it to the attendant line circuit where it generates a low on the CONF lead. This low is extended to the attendant register where it changes its status to conference. This status seizes the processor which searches for an idle conference link; when the link is found, the station number is written into its time slot as the terminator. The attendant register is reset to dial tone and the next station number may be dialed and put in conference by pressing the conference key.

C. O. TRUNK
(410153)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The C. O. trunk is available for the TD-100 EPABX; it is a standard two-way trunk, accessible directly from a station or via the console on outgoing calls. It requires call completion by the attendant's console on incoming calls during normal operation. The C. O. trunk has strapping options to permit a maximum of six trunk groups to be arranged with loop start, ground start, or CDH interface operation. Each trunk has timed recall, automatic recall, camp-on busy, and consultation hold, and may be strapped for incoming service only.

The timed recall feature routes an incoming call to the attendant's console if the called station does not answer within 30 seconds. The automatic recall feature routes all calls to the console if the EPABX releases first and the central office does not release the line for a period greater than two or eight seconds (applies only to the ground start trunk) depending on strapping. Each trunk circuit has a busy switch which may be used to busy-out the circuit. A light-emitting diode (LED) provides a visual indication of the trunk's status; busy, in service, or manually made busy. Each printed circuit board (PCB) contains one trunk circuit.

2.00 DETAILED DESCRIPTION

2.01 General. The status and identity of the idle trunk is determined by the group to which it belongs. The status and identity of the different groups are as follows:

Trunk group 1 - 6F
Trunk group 2 - AF
Trunk group 3 - 2F
Trunk group 4 - 6D
Trunk group 5 - AD
Trunk group 6 - 2D

These status and identity signals are in binary coded hexadecimal form. Table 1.00 lists hexadecimal and alphanumeric equivalents. Table 1.01 is an explanation of the trunk and associated abbreviations.

Three types of starts are available for all trunks in each group: ground start, loop start, and CDH interface. The necessary strapping information is found in OB-000-003, TD-100 Feature Strapping.

2.02 Incoming Call. Each start method causes the trunk to react differently to incoming calls.

a. For ground start trunks, the application of a ground on the tip from the central office is detected by transistor Q11 through the strap on pins 20-19 after a delay of 25 milliseconds. This changes the status-out of the trunk from idle to incoming, "EF," via a strap on pins 29-30. This prevents the trunk from being seized by the processor for an outgoing call. On application of the ringing voltage from

TABLE 1.00 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

the central office, relay LC (winding 4-6) operates. The monostable U8-9 is triggered through strap on pins 3-4, and contacts 2 and and 5 of the LC relay. The attendant is alerted through a buzzer which is turned on through gate U68-2 and a flashing TA lamp through gates U13-6 and U17-8.

b. For loop start trunks, the central office applies a ringing voltage on the tip and ring which operates relay LC (winding 4-6). After relay LC operates, the sequence followed is the same as that of ground start. Straps on pins 17 to 18 and pins 15 to 16 are used to prevent trunk collision between the PBX user and the central office. Reversed battery from the central office operates relay TG and changes the status-out of the trunks from idle to incomig call, "EF," via the strap on pins 29 - 30.

c. For CDH start trunks, closure of contacts CBS1 and CBS2 in the interconnect equipment causes the status-out of the trunk to change from idle to incoming, "EF," via the strap from 33 to 29. The monostable, U8, is operated through the closure of contacts C1 and C2 in the interconnect and the strap on pin 2 to 3 of the trunk. The remaining sequence of operation of the trunk is the same as that for ground start trunks.

2.03 Answering an Incoming Call. The incoming call can be answered by the attendant, by the assigned night answer station, or by an unassigned night answer station depending on the system strapping and on whether the console switch is set for night or day service.

a. The attendant may answer the incoming call by pressing the TA button of the respective trunk on the console. The presence of a ground on the TS lead (pin 2A) sets the attendant latch U77-8 to a low. The attendant latch, U77, changes the status-out of the trunk to write attendant number ("26," "66," or "A6") via U38-3, U38-8, and U76-10 which goes low. After the processor has written the attendant number in the trunk's time slot, it applies an SI-1 and an SI-3 signal. The SI-1 signal removes the write attendant number status and enables the voice path, Q3 through Q6 through U43-2, during SCW (scan channel write). The SI-3 signal operates the L relay which releases the LC relay and the ground detector circuit from the T lead (for loop start only). The status-out of the trunk is changed from write attendant number to trunk busy, "EF." The TA and TB lamps light.

TABLE 1.01 Trunk Abbreviations

ABBREVIATION	MEANING
AIN	Artificial intrude
BT	Busy tone
BVZ	Buzzer
CONF	Conference
CONN	Connect
CPO	Camp-on
CSA	Called subscriber answered
HOT	Hold trunk (automatic)
HT	Hold trunk
I-1, I-2, I-4	Identity
LWT	Lamp wink (trunk)
MOH	Music on hold
NT	Night
R	Ring
RLSE	Release
RXEN	Receive enable
RXO	Receive originate
SCR	Scan channel read
SCW	Scan channel write
SI-1 thru SI-12	Status-in
SO-1 thru SO-4	Status-out
SPR	Status pulse record
T	Tip
TA	Trunk button lamp
TB	Trunk lamp
TRES	Trunk reservation
TS	Trunk switch
TXO	Transmit originator

b. With the console switch on night and an incoming call is progress, the status-out of the trunk is "EF." When the access code is dialed from any station, the processor sends SI-1 and SI-3 signals, and the station number on the trunk's time slot. This changes the status-out of the trunk from incoming call, "EF," to trunk busy "E7," which operates the L relay and closes the loop toward central office.

c. For assigned night answer, the preassigned station number should have already been written in the trunks' time slots for the first 10 positions. On an incoming call, the trunk status is "EF" and is changed to "E3" (apply ring tone) by an SI-1 signal from the processor. When the station answers, the trunk receives a SI-3 signal that operates the L relay and closes the loop toward the central office. If the assigned station is busy, the trunk receives SI-1, SI-8, and SI-11 signals that put the trunk on camp-on busy status via gates U75-9 (low) and U26-13 (low).

2.04 Outgoing Calls. Outgoing calls may be originated by the station or the attendant from the console. The trunks may be ground start, loop start, or CDH start.

For a station to originate a trunk call, the station user dials the access code and the processor looks for the generated identity. On finding an idle trunk, SI-1 and SI-3 signals are applied to the trunk which changes the status-out of the trunk to busy, "E7."

a. Ground start trunks. On receiving an SI-1 signal, the GS relay operates via U15-12 (low) and transmits a ground on the ring lead. When a ground is detected on the tip, transistor Q11 turns on after approximately 30 milliseconds, and after an additional delay of 100 milliseconds due to R68 and C48, the latch U12-8 is set low, which drops the GS relay and operates relay L via U55-1 (low) and relay P. The coil of relay LA monitors the loop closure to the central office.

b. Loop start trunk. On receiving SI-1 and SI-3 signals, the outgoing latch U12-8 (low) operates relay L and relay P. The loop closure is detected by coil LA.

c. CDH trunk. The SI-1 and SI-3 signals operate the L and P relays. The loop closure is transmitted to the central office on leads CS and CG. The return loop is detected by a closure on CBS1 and CBS2.

For calls originated from the attendant's console, the attendant seizes an idle trunk by pressing the appropriate TA key. This sets the attendant latch, U77-8 (low), and the status-out of the trunk is changed to write attendant number ("26," "66," or "A6"). The processor sends SI-1 and SI-3 signals which change the status-out of the trunk to busy, "E7." The rest of the operation is similar to that of a station, except that the dial pulse counter is inhibited.

For CDH trunks, dial pulses received on the SI-3 lead are transmitted on the CS and CG leads. On the loop start and ground start configuration, the dial pulses are transmitted on the tip and ring. Relay C is operated for about 100 milliseconds during dial pulsing and (mercury wetted) relay P follows the dial pulses. The dial pulse timer,U56, is set after every dial pulse. The interdigital time allowed by counter U56 is eight seconds.

On ground start and loop start trunks, the reverse battery is detected by coil LC (1-3) and the appropriate strapping. After a delay of about 25 milliseconds, monostable U8-1 is triggered. The output at U8-4, after 50 milliseconds, changes the status-out of the trunk to "FC" via U19-1 (high) and U39-8 (low). A low also appears on the CSA (called subscriber answered) lead during SCW of the trunk. If the station is not restricted, the processor sends back an SI-9 signal that resets the CSA latch, U25-7 (low) and changes the status-out to "E7."

For CDH trunks, the sequence of operation is the same as above, except that the reversed battery is detected by a ground on CRV1 and the appropriate strapping (pins 5-1.)

2.05 Extending a Trunk to a Station. A C. O. trunk may be extended to a local station in the normal manner. The trunk goes on automatic hold when the attendant seizes the attendant line. The status-out of the trunk is now "ED" (U35-10, U6-8, and U57-12 are high and U74-1 is low). The voice path between the attendant and the trunk is inhibited by a low on U19-4.

If the station dialed is free and the attendant presses the connect bar, a ground will appear on the $\overline{\text{CONN}}$ lead and the status-out is changed from "ED" to "E5" via U10-8 high and U43-6, U74-2 low. In response, the processor will send an SI-11 signal that resets the attendant off-hook latches (U77-8 to high) and changes the status-out from "E5" to "E3" (apply ring tone). In addition, the processor clears the attendant number and writes the station number in the terminating number store of the memory. Now the trunk party receives ring-back tone and the dialed station is scanned during the trunk's time slot and is ringing. The 30-second time-out counter, consisting of U45 and U52, is enabled due to a low at U45-2 and U52-2. If the station answers within 30 seconds, the processor sends back an SI-3 signal that sets the off-hook latch, U8-12 low, and changes the status-out from "E3" to "E7." If the station does not answer within 30 seconds, the TK (trunk) signal recalls the attendant. The latch, U26, is set due to a high on U52-8, that changes the status outputs from "E3" to "E1" (clear station number). The attendant is alerted by the flashing lamps TA and TB, while U26-9 and U74-4 go low.

If the trunk is extended to a busy station, the trunk goes on camp-on busy. A ground appears on the CPO (camp-on) lead from the attendant register. Latch U26 is set due to a high on U27-8 while U26-13 goes high. The trunk party receives music on hold (MOH) if equipped, and the logic states of U36-9 and U35-13 are low. Transistor Q4 is off and Q5 is on. The 30-second time-out counter (U45 and U52) and the eight-second counter (U45) are enabled by a low on pin 2 of the respective chips. These counters change the output status codes to the processors and apply a burst of tone to the dialed station. The status-out alternates from "E5" to "E3" for .5 seconds to "ED" for 7.5 seconds continuously for each cycle. During status "E3," the processor checks the

status of the dialed station and the trunk. Based on the strapping of the trunk, a single burst of busy tone (strap 27 to 28), a multiple burst of busy tone (strap 16 to 28), or no burst (no straps) is transmitted to the station with U28-10 going high, U28-13 going low, Q9 off and Q10 on. If the dialed station is still busy after 30 seconds, the trunk recalls the attendant. If the station becomes free within 30 seconds, then during status "E3," the processor sends back an SI-4 signal that resets the camp-on latch (U26-13 low) and the counters are reset by a low on U76-10, U79-4, and U79-12. The status-out remains "E3" and the trunk party receives ring-back tone. When the station answers, the trunk receives an SI-3 signal, the off-hook latch (U15/7 low) is set, and the status-out changes from "E3" to "E7."

2.06 Putting a Trunk on Hold. When the attendant is connected to the trunk, the status-out is "E7." The attendant can put the trunk on hold by depressing the manual hold key or on automatic hold by accessing another trunk or the attendant line. A ground appears on the HT (hold trunk) lead and sets the HT latch, U77-12, to high. This changes the status-out from "E7" to "ED" (U6-6), puts the trunk party on MOH (U77-12 high) and inhibits all inputs from the console (RLSE, CONN, BUSY VER, etc.) for the trunk which is on hold; the appropriate TA lamp winks.

2.07 Putting a Trunk in Conference. The trunk may be put into the conference circuit by the attendant. A ground present on the conference lead generates a conference request code "E9" (U74-3 low). The processor sends back SI-10 and SI-11 signals to the trunk; the SI-11 signal resets the attendant latch and the SI-10 signal changes the status-out from "E9" to "E7" (U23-4 and U78-8 low).

2.08 Trunk During Transfer. A call from a trunk to a station may be transferred to another station as explained in the station user's guide. When the hookswitch is operated from the station, the on-hook (200 milliseconds to 1.6 second) condition is detected by the processor, lead SI-3 goes high and counters U66 and U67 are enabled. A low appears at U66-2 and U67-2. After 200 milliseconds, latch U33 is set (U66-8 high and U33-13 low). If an off-hook is detected (SI-3 low) before 1.6 seconds, a consultation hold request is generated, which changes the status out to "EA," and U65-6 stays low. The processor sends back a SI-6 signal and connects the station to a register if one is available. The station receives transfer dial tone and the trunk status has changed from "EA" to "EC" (U35-11 low). After the station user has dialed the new station number, the processor will write the originating and terminating numbers at the transfer link's time slot in the memory, provided a link is available and the station is free. Detection of a new hookswitch flash (now in transfer link) results in the processor removing the SI-6 signal and sending an SI-7 signal to the trunk. The status-out of the trunk changes from "EC" to "EE" and the trunk and two stations are connected through the add-on link.

When one on the stations goes on-hook, the processor removes the SI-7 signal from the trunk and sends SI-3 and SI-11 signals. The new station number is written on the terminating side of the memory in the trunk's time slot. The status-out changes from "EE" to "E7." The SI-11 signal resets U33 and the SI-3 signal sets the off-hook latch (U31-7 low). If, during transfer, a register, a transfer link, or an add-on link were not available, the processor would send an SI-8 signal instead of the SI-6 signal.

This is also true when the dialed station is busy. The SI-8 signal resets U33, sets the busy-tone latch (U25-9 low) and enables the four-second timer (U29-3 low). The status-out changes from "EC" to "E7" and the station receives busy tone for four seconds. After four seconds, the busy-tone latch is reset and the busy tone is removed (U25-9 and U29-8 are high). If a station in consultation hold dials zero, the processor sends an SI-12 signal to the trunk that sets the station recall latch (U25-4 low). The status-out changes from "E7" to "E3" and the station receives ring-back tone (U25-13 and U74-13 are low); the attendant is alerted by the buzzer and flashing lamps. When the attendant answers, the attendant latch and attendant answer latch are both set (U77-8 and U33-7 high) and the station recall latch is set (U25-4 high). The status-out changes from "E3" to "E7" and a voice path between the station and the attendant is established (on the trunk's time slot) via the AIN (artificial intrude) lead while the trunk voice path is inhibited (trunk's time slot) by U19-6 and U43-12 high.

When the station goes on-hook, the station release counter (U66 and U67) is enabled, and after 200 milliseconds, the clear station number latch (U31) is set through U31-9 high and U31-4 low. The status-out "F1" is transmitted to the processor (U74-4 low). The processor then sends an SI-11 signal which resets the attendant answer latch (U33-7

low). This removes the station number and writes the attendant number in the terminating number store of the memory, on the link's time slot. The status-out changes from "F1" to "E7" and a voice path is established between the trunk and the attendant.

2.09 Attendant Recall. If the station connected to a trunk goes on-hook (ONH), the station release counter (U66 and U67) is enabled and, after 1.6 seconds, latch U31 is set. Clear station number code "E1" is transmitted to the processor (U67-8, U31-10, U31-9, and U51-8 high and U74-4 low). In the case of a ground start trunk, the eight-second counter (U34) is enabled and relay T6 is operated; after eight seconds, the attendant recall latch, U26, is set (U27-6 and U26-4 high). The TA and TB lamps flash on the attendant's console and the buzzer is on. When the attendant answers, the attendant latch, U77-8, is set and the eight-second timer, U34, is reset. With the attendant latch on, the new status of the trunk is "E6." The processor sends back an SI-11 signal which resets latch U26. If, at any time, a central office release is detected, the processor removes the seize lead signal SI-1 which changes the status of the trunk to idle "FF."

2.10 Trunk Release. The trunk may be released, either from the central office or from the local station. When the central office goes on-hook, the break in the loop is detected by relay LA which enables the C. O. release timer. A break in the loop between 100 milliseconds and 600 milliseconds (depending on the strapping) changes the status-out of the trunk to "E4" (C. O. release) and removes the SI-1 (seize) signal from the trunk. The status-out of the trunk now becomes idle.

When the local station user goes on-hook the OHT (SI-3) signal is removed. After a time greater than 1.6 seconds, the status-out changes to "E1," the L relay releases; if the trunk is loop start or CDH the status-out is changed to "E4" and then to idle. For ground start trunks, the L relay releases, breaking the loop, and in case the central office does not release, the TGE relay operates which inhibits the C. O. release timer from releasing the trunk. The trunk, under these conditions, is set-up to recall the attendant after either 2 or 8 seconds. If a central office release is detected during this time, the TGE relay releases, enables the C. O. release timer and changes the status-out of the trunk to "E4" and then to idle.

ASSIGNED NIGHT ANSWER
(410155)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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2.00 DETAILED DESCRIPTION 1
General 1

FIGURE

1.00 Assigned Night Answer Block Diagram 2

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with an assigned night answer circuit. The assigned night answer circuit (ANA) is used to associate a station with each of the trunks, 1 through 10, when the TD-100 EPABX is on night answer. The station assigned to each trunk is strapped, by tens and units in the strapping field.

2.00 DETAILED DESCRIPTION

2.01 General. Figure 1.00 is a block diagram of the ANA circuit. The following description may be applied to the block diagram.

The circuitry to the left of the strapping field can be considered as the input and is, in fact, the read-enable of each trunk, 1 through 10. On the right of the strapping field, the circuitry provides the function of converting the strapped tens and units numbers into BCD (binary coded decimals) to be sent to the memory.

Assume station 24 is strapped to trunk 1; whenever trunk 1 is scanned, a signal appears on its read-enable which is connected via the strapping field to the 2 input of the tens encoder and the 4 input of the units encoder. If the TD-100 is arranged for ANA, the night switch (on the attendant's console) has been operated, and there is an incoming call on that trunk, then a signal appears on lead NIC (night incoming call). This signal enables the BCD information, representing station 24, to go out on the TO leads to the memory, thus causing the system to associate station 24 with trunk 1.

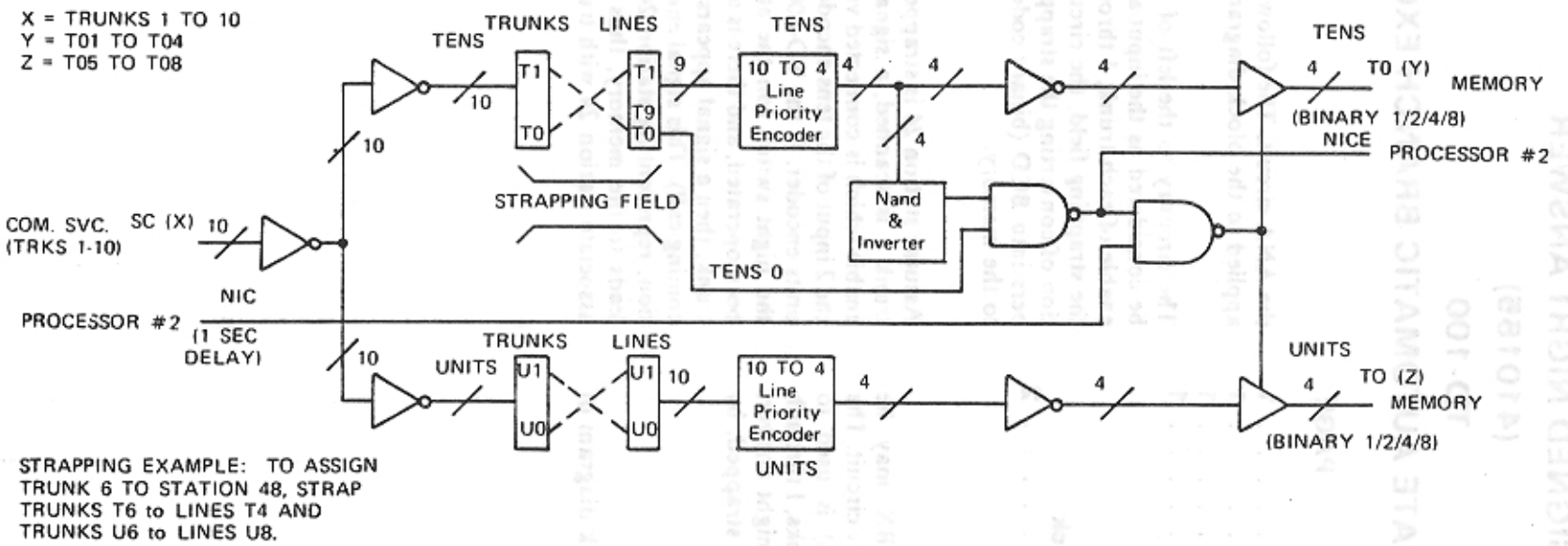

FIGURE 1.00 Assigned Night Answer Block Diagram

CONFERENCE NETWORK
(410157)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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2.00 DETAILED DESCRIPTION 1
General 1

FIGURES

1.00 Conference Network Waveforms . . 2

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with a conference network circuit to enable up to a maximum of four local stations and the balance in C. O. trunks to participate in a conference call. The conference network printed circuit board (P.C.B.) contains six identical circuits which provide the necessary speech paths for conference operation.

2.00 DETAILED DESCRIPTION

2.01 General. A station user wishing to originate a conference call dials the conference access code and the TD-100 common control circuitry transfers the originator's and terminator's numbers into one of the conference links. The terminator in this case is considered to be the conference network and each conferee to enter the network is assigned a terminator number. The first conferee is assigned terminator number 115; the second, 114; the third, 113; and so on, until the sixth is assigned terminator number 110.

When one station user has originated a conference call, and has been assigned terminator number 115, the processor generates a CNE (conference enable) signal, which is a one microsecond low pulse generated every 64 microseconds. This pulse generates a high level at U710-5 and 13 which is inverted and applied at U708-12. As U707-12 and 11 go low for one microsecond, U703-8 goes high and enables the low on U708-12 to appear at the OHT (off-hook terminator) output.

Note that U707-13, by going high, enables the RXEN (receive enable) signal to appear at U709-13 which goes low for .5 microsecond. The high levels at U704-8 and 6 enable the RXT (receive terminator) and TXT (transmit terminator) field effect transistors (FET's), respectively.

When the second station user accesses the conference network, it is assigned terminator number 114, which is designated to a conference link at time slot 14.

During this time slot, U705-2 and 3 go low and the same signals are generated as for the first conferee except that the first conferee (terminator number 115) enables the 600 series FET's and the second conferee (terminator number 114) enables the 100 series FET's.

As more conferees are added to the call, additional gates are sequentially enabled; U705-11 and 12, U707-2 and 3, U707-5 and 6, and U707-8 and 9. Each goes low for one microsecond every 64 microseconds, each in a different time slot. Figure 1.00 shows the conference network waveforms.

The transmitted voice signals from the line circuits appear on the RXT leads and through Q701 (emitter follower) are applied at the inputs of the FET's. Each FET will turn on as it is enabled and a charge will be stored in the corresponding capacitor, C101 through C601. Each conferee, by speaking, charges these sample and hold capacitors once every 64 microseconds. All voice samples appear at the input of an operational amplifier (op-amp), U701-2. This op-amp operates as a mixer; the voice samples of all conferees, except the one to whom the circuit has been assigned, are applied at the input (pin 6) of U101 through U601. When any one of the FET's Q102 through Q602, is enabled, the voice signals appear at the TXT (transmit terminate) output. Then, through the common services highway amplifier, they are applied to the line and trunk circuits.

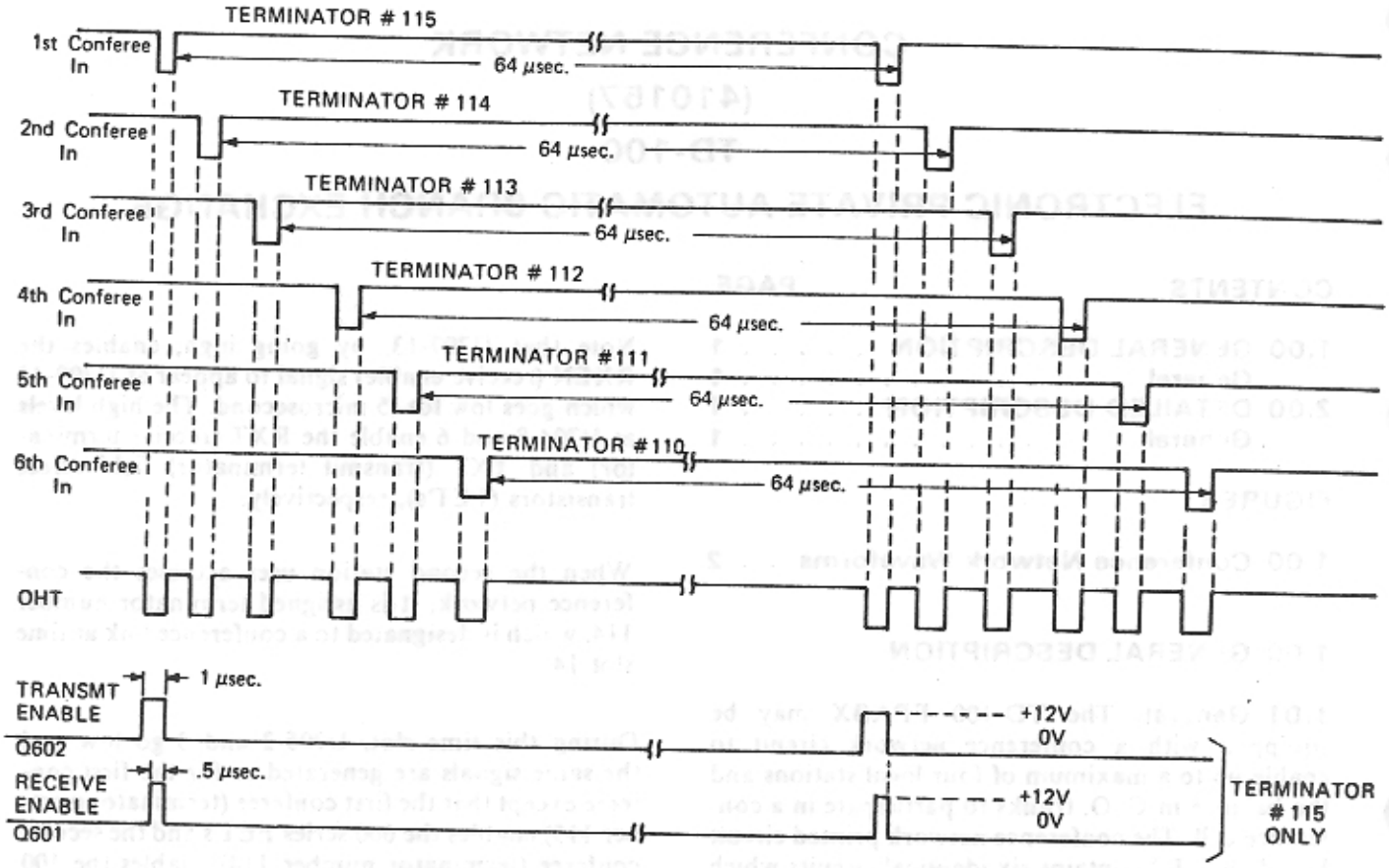

FIGURE 1.00 Conference Network Waveforms

Initiation of a conference call by a trunk party is enabled by U710, a retriggerable multivibrator. When the trunk party requests conference service from the attendant, the attendant admits the trunk party to the conference circuit by pressing the CONFERENCE button on the console. A local station must be admitted to the conference call within 30 or 60 seconds (depending on strapping), otherwise the trunk will drop. Trunks in the conference circuit will also be dropped 30 or 60 seconds after the last local station in the conference call has gone on-hook.

NOTE: For trunk release after 30 seconds, strap U705-9 to U710-13; for trunk release after 60 seconds, strap U705-9 to U710-5. Consult OB-000-003, Feature Strapping TD-100 EPABX.

POWER FAILURE TRANSFER
(410158)
(TD-100)
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 Component Numbering 3

1.00 GENERAL DESCRIPTION

1.01 General. The power failure transfer unit is used in conjunction with the TD-100 EPABX. It connects 10 trunk lines to nine predetermined station lines and the attendant's console when a local power failure, major alarm, attendant's transfer, or maintenance transfer prevents the TD-100 from completing calls in the normal manner.

When a local power failure occurs, the transfer is automatic. When the power is restored, established calls remain connected until the call is terminated, then the transfer circuit for that trunk restores. The power failure transfer circuits can be enabled when a power failure has not occurred by operating the TRANSFER switch on the rear of the console or the power transfer switch on the alarm panel board.

Each station assigned to the power failure transfer circuitry must be fitted with a grounding button if ground start trunks in the central office are used. If Tel-Touch is provided in the EPABX and the central office is not equipped to receive Tel-Touch tones, the stations assigned to the trunks must be rotary dial telephones.

2.00 DETAILED DESCRIPTION

2.01 General. The power failure transfer circuit board (PCB) consists of 10 separate circuits: nine are used to connect trunk lines to station lines and the tenth connects a trunk line to the attendant's console. Predetermined stations and trunks are cross-connected for power failure transfer operation on the main distribution frame.

A simplified schematic of the power failure transfer unit is shown in figure 1.00. All relays are shown in the released (power off) condition. A light emitting diode (LED) is lit when the power is on and extinguished when the power is off.

2.02 Normal Operation. Under normal operating conditions (power on), transistor Q1 is conducting (-48V, R1, R23 ALM LEAD OPEN) and provides a ground path through the B relays to -48V battery. This causes the B relays to operate, placing the B relay contacts in the opposite condition to that shown in figure 1.00. In this condition, the assigned central office trunk lines are connected to the EPABX trunk circuits via the now closed contacts 2-3 and 5-6 of the B relays.

Similarly, the assigned station instruments are connected to the EPABX line circuits via the now closed B relay contacts of 11-12 and 8-9. The attendant's console is connected to circuit 10 of the power failure transfer PCB.

2.03 Power Failure Operation. The power failure circuit is activated by the loss of the -48V supply to the B relays. It may also be activated by a major alarm condition or manual transfer (grounding the ALARM lead to turn off transistor Q1 and release the B relay). This causes the B relay contacts to transfer.

In this condition, the C.O. trunks are connected, via the coils of the A relays, to the station instruments. When a call originates from the C.O., ringing

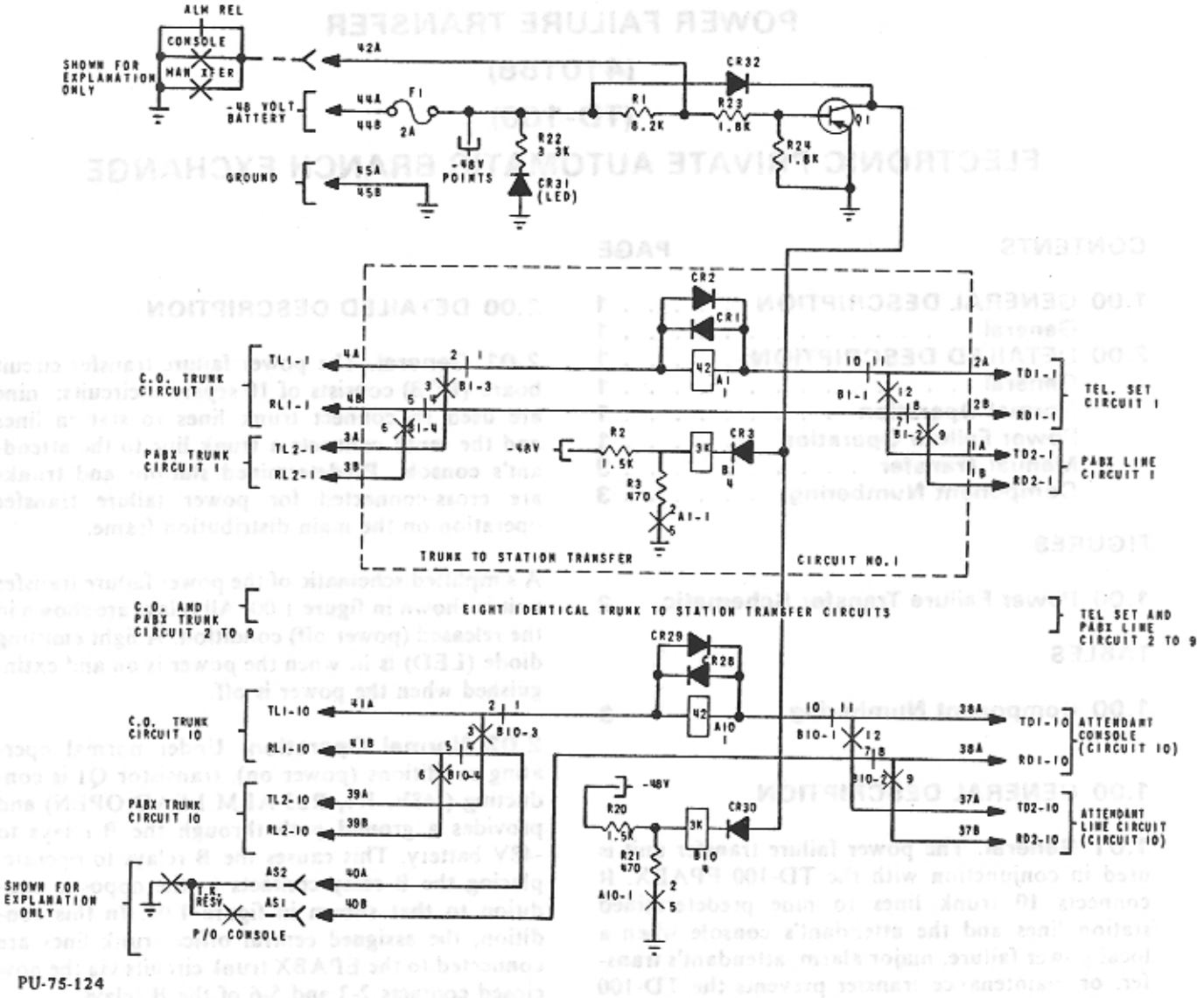

FIGURE 1.00 Power Failure Transfer Schematic

voltage is applied directly to the station instrument. When the station instrument goes off-hook, the ringing voltage is tripped and relay A operates via the loop circuit. Operation of the A relay prevents the B relay from operating should power be restored. The station instrument going on-hook allows the A relay to release and allows the B relay to operate when power is restored.

To originate a call from a station instrument during power failure, the station user goes off-hook and presses the ground (start) button (for ground start trunks only, since loop start station instruments do not have the start button). The ground seizes the C.O. via the RD1 (ring) lead, the closed contacts 7-8 and 4-5 of the B relay (closed due to power failure), the RL1 lead and the R lead. The C.O. equipment returns battery to the TL1 lead to operate the A relay via the loop provided through the station instrument. With the A relay operated, the B relay cannot operate and restore the normal path if power should be restored before the call is completed.

During a power failure, a C.O. to console call is made in a similar manner as a C.O. to station call.

Ringing voltage from the C.O. is applied across pins TL1 and RL1 of C.O. trunk circuit 10 and, through the now closed contacts of relay B10, is applied to a bridged ringer in the attendant's console. The attendant answers the call by operating the trunk reservation ON button. The ringing is tripped, and battery applied from the C.O. operates the A relay. This prevents the call from being released if the power is restored during the call.

A console to C.O. call is set up during a power failure by the attendant pressing the trunk reservation ON button and operating the CONNECT bar. This places a ground on the circuit to seize the C.O. equipment which, in turn, causes the C.O. to return battery to operate the A relay.

2.04 Manual Transfer. The power failure transfer unit can be forced to transfer by placing a ground on the alarm input lead. This causes transistor Q1 to turn off, thereby removing the ground from all B relays and causing them to release.

> NOTE: Operating the manual transfer switch will cause loss of all calls in progress between station or console circuits and the central office.

2.05 Component Numbering. The schematic diagram (figure 1.00) shows the component numbers for only the first trunk-to-station circuit. Component numbering for circuits one through 10 is shown in table 1.00.

TABLE 1.00 Component Numbering

COMPONENT	CIRCUIT NUMBER									
	1	2	3	4	5	6	7	8	9	10
Relay	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Relay	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Diode	CR1	CR4	CR7	CR10	CR13	CR16	CR19	CR22	CR25	CR28
Diode	CR2	CR5	CR8	CR11	CR14	CR17	CR20	CR23	CR26	CR29
Diode	CR3	CR6	CR9	CR12	CR15	CR18	CR21	CR24	CR27	CR30
Resistor	R2	R4	R6	R8	R10	R12	R14	R16	R18	R20
Resistor	R3	R5	R7	R9	R11	R13	R15	R17	R19	R21

COMMON SERVICES
(410159)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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General 1

1.00 GENERAL DESCRIPTION

1.01 General. The Common Services Circuit in the TD-100 EPABX provides all the necessary channel timing blocks, different tones, and the highway amplifier necessary for voice freqeuncy transmission in the system. This circuitry is contained on one plug-in printed circuit board (PCB).

2.00 DETAILED DESCRIPTION

2.01 General. A 16-MHz crystal oscillator is used to generate the various common services timing signals. The T1, T2, T3, and T4 clock pulses (5V) are obtained from U16. The 64 channels are generated through U12, U19, and U8. The 10 millisecond, 50 millisecond, 1 second, lamp flash (LF), lamp wink (LW), and lamp wink trunk (LWT) signals are obtained using decade counters U15, U11, U7, and binary counter U3. The dial tone, ring-back tone, busy tone, and reorder tone are generated using the standard wein-bridge oscillator configuration in conjunction with the amplifiers U1, U5, U9, and U13, respectively. U28 and U29 are used to generate the channel number count (CNC) signal on receiving a scan channel number (SCN) command from the processor.

The primary function of the highway amplifier is to sum up the different signals on the speech bus. The highway amplifier has a low output impedance to improve the drive capacity and provide a gain of approximately one. Primary control of the amplifier is through the $\overline{SZ}$ or $\overline{TN}$ signals. A high pulse on the $\overline{SZ}$ and $\overline{TN}$ leads turns transistor Q8 or Q39 off, respectively, which inhibits the shunt transistors Q10 and Q9. This allows the signal levels on the TXO (transmit originator) and TXT (transmit terminator) leads to rise the required level of 12.6V. At this time, signals present on these leads are transferred to RXT (receiver terminator) and RXO (receive originator) through the amplifiers consisting of Q21, Q22, Q30, Q26, Q25, Q29, and Q19, Q20, Q28, Q24, Q23, and Q27, respectively. Note that the output of Q14 (tones) and Q16 (add on-enable, intrude enable) are presented at the common input points R157, R98, R99, and R105, since they need these signals to be transmitted to both the originator and terminator.

Q3, Q4, and Q5 are controlled by processor 2, through the ring tone enable, dial tone enable, and busy tone enable signals. Test points TP1 through TP5 are provided to check the different multifrequency signals (dial tone, ring-back tone, and busy tone).

COMMON SERVICES
(410T5B)
TD 100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

CLASS OF SERVICE/VACANT NUMBER INTERCEPT
(410160 001, 002, 003)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 COS/VNI System Interface 2

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1.00 COS/VNI Terms 2
1.01 Class of Service Chaining Example 4

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX is equipped with a class of service printed circuit board (PCB). This PCB is located in position seven of the channel subrack.

Classes of service are assigned in the TD-100 on deny, allow, or restrict bases with classes of service 1 through 6-deny; classes of service 7 through 14-allow; and class of service 15-toll restriction. The classes of service are flexible and are determined by the customer requirements. The strappings are made on the class of service and vacant number intercept board. Consult OB-000-003, Feature Strapping TD-100, for full strapping information.

A vacant number intercept feature, which is part of the class of service and vacant number intercept board, allows all unassigned station numbers to be strapped so that calls to these numbers receive reorder tone or are routed to the console attendant.

2.00 DETAILED DESCRIPTION

2.01 General. The following paragraphs deal with each feature of the COS (class of service) PCB individually. Table 1.00 is a list of terms and lead designations associated with this PCB. Figure 1.00 is a system interface drawing showing the relationship of the COS PCB with other TD-100 subsystems.

2.02 Vacant Number Intercept. When an originating station dials another station number, a test for enabling the vacant number intercept is performed. The terminating number, read from the TOC leads, is selected via U49 and U50 during the high state (500 microseconds) of the T4 lead. The tens digit on leads TOC1-through TOC4 is decoded from its BCD format to a decimal output in the 4-line to 16-line decoder U51. These outputs are gated with the units from leads TOC5 through TOC8 to select stations 00-99 via the BCD-to-decimal decoders U28 through U37.

Station numbers that are unassigned are strapped together and then to the terminal designated INCPT (intercept). The resultant low logic level on this lead, when an unassigned number has been dialed, is clocked into (D-type) flip-flop U5 on the positive edge of T4 after being inverted in U3. The Q output changes from logic high to give a low output on the COS/VNI lead. This low state is maintained until the end of the 1 microsecond channel scan when it is clocked into processor 2 to either place the calling station on unassigned lockout (ULO) or route the call to the attendant.

In the next channel scan period, if the called station is not strapped for intercept, the INCPT lead will be high and will be clocked into the (D-type) flip-flip U5 on the positive edge of T4. The COS/VNI lead will then return to its normal high state.

2.03 Deny Class of Service. An originating sta-

TABLE 1.00 COS/VNI Terms

ABBREVIATION	MEANING
BRD	Battery reversal deny (when toll restriction is performed in CO)
COS/VNI	Class of service/vacant number intercept
OO-1 – OO-4	Originator out, tens digit
OO-5 – OO-8	Originator out, units digit
RC	Restricted code
RH	Register hold
TO-1 – TO-4	Terminator out (from register), tens digit
TO-9 – TO-12	Terminator out (from register), hundreds digit
TOC-1 – TOC-4	Terminator out (from memory), tens digit
TOC-5 – TOC-8	Terminator out (from memory), units digit
T4	Clock pulse

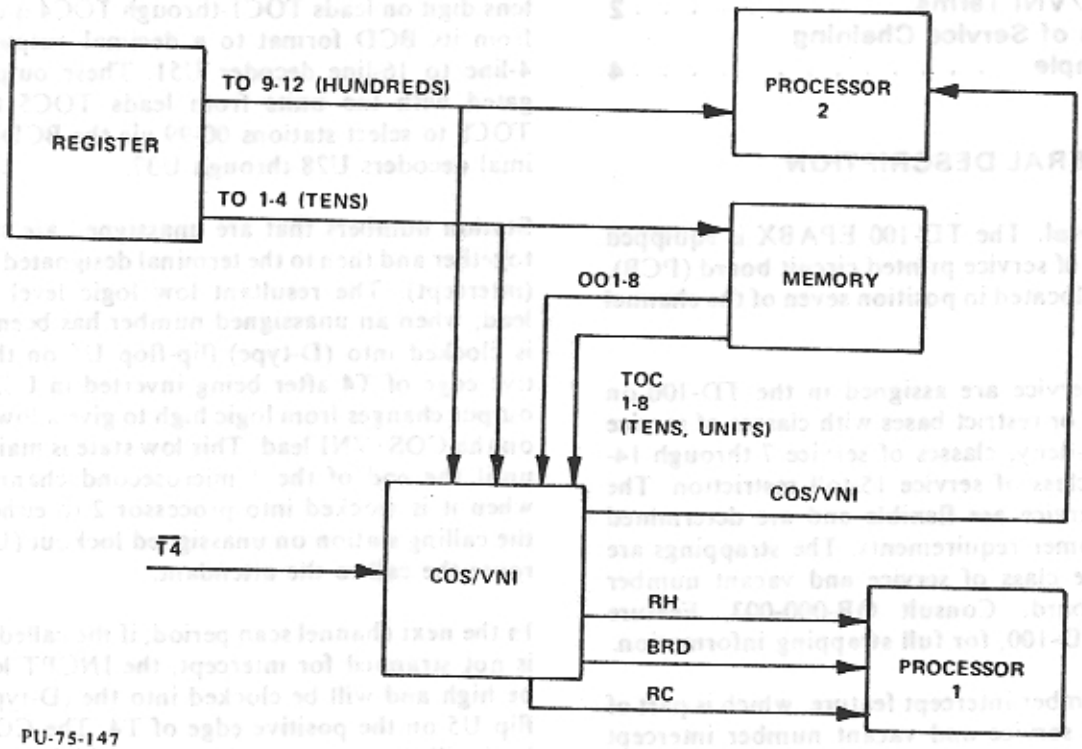

FIGURE 1.00 COS/VNI System Interface

tion number or tie-trunk number with its tens and units in a BCD format on the 001 through 008 leads, is selected by U49 and U50 when the T4 clock is in a low state during the latter half on the 1 microsecond channel scan. As in the case of VNI (vacant number intercept), the BCD numbers are decoded to stations 00-99 and tie-trunks 1-10. At the same time, the hundreds and tens digits of the number dialed (terminating digits) are decoded from a BCD format in U1 and U2; the decimal output is connected to the H (hundreds) 0-9 and T (tens) 0-9 strapping points.

For example, if stations 00, 01, 02, and 11 are banned from dialing trunk group 93, strapping is required as follows:

a. Station 00 is strapped to 01, 01 to 02, 02 to 11, 11 to an RP terminal, and that RP terminal to COS1 terminal A.

b. Hundreds 9 (H9) is strapped to COS H-1.

c. Tens 3 (T3) is strapped to COS T-1.

When station 02 dials 93, U20 pin 9 goes low and U13 pin 6 goes low. With the low on COS H-1 and COS T-1, gate U12 is enabled and the output (pin 6) goes high. The output of U6 (pin 8) changes from low to high, U4-1 goes low, U3-11 goes high, and U4-4 goes low. This low on U4-4 is extended to the COS/VNI lead and is clocked into Processor 2 to place the call on unassigned lockout (ULO) or route it to the attendant.

Terminals COS H-1 to H-6 and T-1 to T-6 are assigned to deny classes of service. Should the trunk access code be a single digit (hundreds only), the associated COS T-terminal is strapped to ground.

Terminals COS 1A, B, C, and D are for connection of distinct chains of station numbers that require common classes of service. These chains can also be connected to other COS terminals and assigned to other decimal codes. This chaining of class of service assignments is demonstrated by the example in table 1.01.

2.04 Allow Class of Service. To minimize cross connections, it may be advantageous to strap stations to access services allowed, thus denying this service to all others not strapped.

Assume station 55 is allowed to page, and the access code to page is 51. Station 55 is connected via an unused RP terminal through a pull-up resistor to terminal COS 7A. The hundreds digit of the code (5) is strapped from H-5 to terminal COS H-7 and the tens digit of the access code (1) is strapped to terminal COS T-7. Should any non-allowed station dial 51, the low from decimal decoder U1 strapped to COS 7 changes the output of U11-8 to high. The output of the exclusive OR gates U8-8, U10-11, U10-8, U8-6, U8-11, U8-3, U10-3, and U10-6 all change to a logic high. U9-8 goes low and U19-4 high; U4-1 goes low, U13-11 high, and U4-4 low. This low is clocked into processor 2 to lock out (ULO) the calling station or route the call to the console attendant.

If, however, station 55 originated the page request, U23-8 would change to a logic high and U16 to a low to enable U15 (pins 2, 1, 13); U15 pins 2 and 1 are low from the digit 5 dialed. U15-12 changes to a high, which changes the output of U8-8 to low. U9-8 goes high, U19-4 low, U41-1 high, U3-4 low, and U4-4 high.

A high on the COS/VNI lead allows the page to be made. Distinct chains of stations may be assigned multiple allow and deny classes of service as required.

> NOTE: Second (4101606-002) and later generation PCB's provide for two-digit allow codes as opposed to single digit codes on earlier generation boards. Terminals COS T-7 through COS T-14 are then strapped to the tens access digits. The output of U52 (newly added) is gated with the output of U11 to enable the exclusive OR gates U8 and U10.

2.05 Toll Restriction. To prohibit a station user dialing a 1 or a 0 on the first or second digit to the central office (after the CO has been seized) points RN1, 2, 3, and 4 are strapped to H-0, H-1, T-0, and T-1, respectively. The station number(s) to be restricted are strapped to terminals COS 15 (A-D); strap R-S is inserted.

Terminals COS H-15 and COS T-15 are strapped to terminal H-9, the CO trunk access digit. When a 9 is dialed, gate U18 pins 3, 4, and 5 are enabled to send a low on the RH (register hold) lead. The register is reset and held to decode the first two digits

TABLE 1.01 Class of Service Chaining Example

STATION HUNT	TRUNK GROUP DENY	COS ASSIGNMENT (H-1 to 6, T-1 to 6)	COS ABCD CONNECTION
1	91	H-1, T-1	COS 1A to
	92	H-2, T-2	COS 2A to
	93	H-3, T-3	COS 3A
2	92		COS 2B to
	93		COS 3B to
	94	H-4, T-4	COS 4A
3	93		COS 3C to
	94		COS 4B to
	95	H-5, T-5	COS 5A
4	94		COS 4C to
	95		COS 5B to
	96	H-6, T-6	COS 6A
5	91		COS 1B to
	93		COS 3D to
	95		COS 5C
6	92		COS 2C to
	94		COS 4D to
	96		COS 6B
7	91		COS 1C to
	92		COS 2D to
	95		COS 5D to
	96		COS 6C

transmitted to the CO. Should the calling station user dial a 0 or a 1 following CO access, the output of U27-8 goes high. The station number strapped to terminal COS 15 is low, U27-6 goes high, U19-12 low, and U4-13 high. This enables gate U3, whose output, pin 3, goes low. This low is clocked into the processor to lock out the calling station and release the register and the seized CO trunk.

When the toll restrictor PCB (4102286) is provided, straps RN1, 2, 3, and 4 are not required but strap R-S is necessary. As in the 0/1 restrictions, the RH lead is enabled to reset and hold the register to monitor the outgoing digits.

Fifth (4101606-005) generation PCB's provide additional features. Terminal T-15 has been expanded to eight inputs for toll restriction of up to eight station groups. A night/day restriction feature is also made possible.

Four groups of stations may be assigned to no toll restriction during the day and to toll restriction during night service. This is accomplished by strapping terminal N to S (on the toll restrictor PCB) and the desired station groups to terminals G, I, K, and L (on the COS PCB). During day operation, U53 (pins 12 and 3) is inhibited and calls are not toll restricted. During night operation, U53 is enabled whenever the station attempts a toll call. This output is gated with the trunk group dialed to produce the desired toll restriction.

Conversely, four groups of stations may be toll restricted during day operation and allowed during night operation by strapping N to S (on the restrictor PCB) and the station groups to terminals E, F, J, and H (on the COS PCB). During night operation, the low on the NS lead inhibits U53 (pins 8, 9, and 10) to allow unrestricted toll calls.

Consult Section OB-000-003, Feature Strapping TD-100, for full strapping information.

2.06 Battery Reversal. When toll restriction is indicated by CO reversal of the trunk tip and ring leads (battery reversal), the originating number is enabled from the memory, decoded and (being strapped to terminal COS 15) gate U27-6 changed to a logic high. Strap R-S is omitted in this application.

The logic high is clocked into flip-flop U5 pin 2 and the Q output changes to a low. This low is clocked into processor 1 to place the calling station on unassigned lock out (ULO) and release the CO trunk.

MEMORY
(410161)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.01 Memory Waveform Chart 6

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1.00 Memory Terms 3
1.01 Channel Allocation Chart 4

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX is equipped with a memory circuit composed of a line scanner, a 60-bit shift register circulating storage, and decoding circuits as shown in the block diagram in figure 1.00. All circuitry is mounted on a single plug-in printed circuit board (PCB).

The line scanner is comprised of the units and tens counter. Together, they are capable of counting to 110 (100 lines and 10 tie lines). The units counter is capable of counting from 0 to 9. The tens counter is capable of counting from 0 to 10.

The line scanner is enabled once every 64 microseconds and the number output is presented to the originating storage circuit, decoded, and marked to the processor. The processor then scans the line for an off-hook indication. If the line is on-hook, the processor takes no action during channel 0. If the line indicates an off-hook condition, the processor marks the CW (call waiting) lead which inhibits the counter in the line scanner and the SN (store number) lead to cause the originating number to be placed into the temporary (circulating) storage; the processor then looks for an idle register. (Table 1.00 is a list of terms associated with the memory circuit and their meanings.) On finding an idle register channel, the processor marks the WN3 (write number 3) and WN4 (write number 4) leads in the memory causing the originator's number to be removed from the temporary storage and to be marked out to the processor. At the same time, the originating number is marked out to the 60-bit shift register in the memory and is marked to the processor on the next and subsequent scans of the register. As soon as the originator completes dialing the number of another station (terminator), the terminator number is marked into the terminator's temporary (circulating) storage and the processor starts checking for an idle link channel. When the processor finds an idle link, it signals the link and marks the WN1 (write number 1) through WN4 (write number 4) with the correct logic levels to cause both the originator's and terminator's line address to be placed in the link's channel in the 60-bit shift register. Both of these addresses will circulate through the 60-bit shift registers and, every 64 microseconds, will be decoded and marked out to the processor and back to the input of the 60-bit shift register. This process will continue as long as both stations are off-hook.

When both stations go on-hook, the processor clears the channel assigned to the link. With the associated channel clear, the link becomes available and can be accessed by other calls.

2.00 DETAILED DESCRIPTION

2.01 General. The following is a detailed description of memory operation. It is aided by table 1.01, a channel allocation chart, and figure 1.01, a memory waveform chart.

2.02 Line Scan. On channel 62, the SCR62 (scan

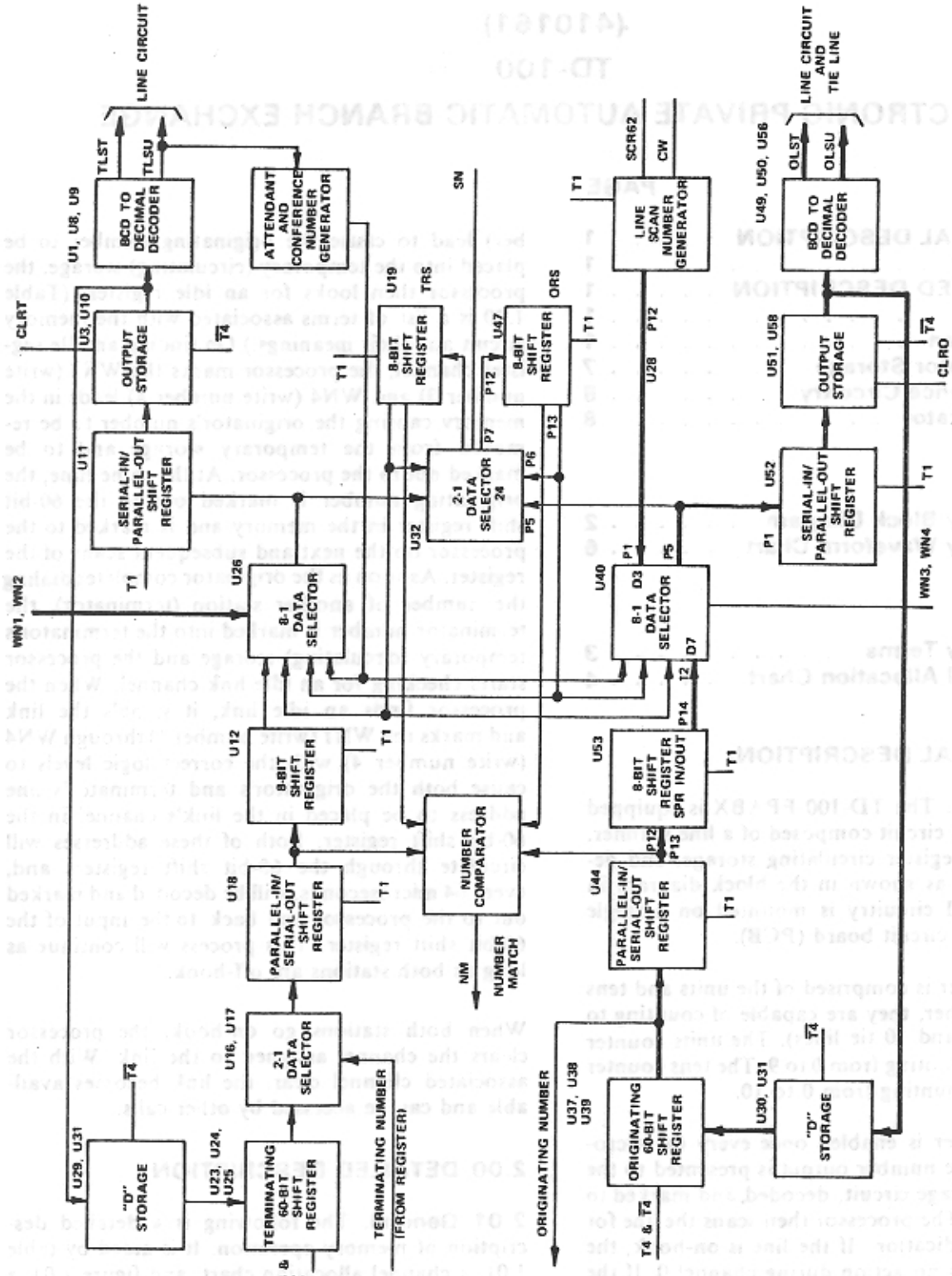

FIGURE 1.00 Memory Block Diagram

PU-75-131

TABLE 1.00 Memory Terms

ABBREVIATION	MEANING
BRX	Bar receive
CL	Conference lamp
CLRO	Clear originator
CLRT	Clear terminator
CW	Call waiting
ETXT	Enable terminator transmit
IB	Inhibit busy
IDO	Inhibit decoder originator
IDT	Inhibit decoder terminator
IE	Intrude enable
IED	Intrude enable delay
IES	Intrude enable start
ITE	Inhibit intrude enable
LW	Lamp wink
NE	Number enable
NM	Number match
OLST 0-11	Originator line scan tens (0 through 11)
OLSU 0-9	Originator line scan units (0 through 9)
OO 1-8	Originator out (1 through 8)
PL	(Not used at this time)
POR	Power-on reset
RXEN	Receive enable
RXENT	Receive enable trunks
SCR62	Scan channel read (62)
SH	Station hunt
SN	Store number
SPR	Status pulse record
SZ	Seize
SZD	Seize delayed
T1-4	Timing pulse (1 through 4)
TLST 0-11	Terminator's line scan tens (0 through 11)
TLSU 0-9	Terminator's line scan units (0 through 9)
TN	Terminate number
T/O	Terminate/originate
TO 1-8	Terminate out (1 through 8)
TOC 1-8	Terminate out, class of service (1 through 8)
TRO	Terminate register output
TRUC	Busy verification by attendant
WAN	Write attendant number
WN 1-4	Write number (1 through 4)

TABLE 1.01 Channel Allocation Chart

CHANNEL	FUNCTION	
	READ	WRITE
0	Option 1	Line Scan
1	Trunk 6	
2	Transfer Link 1	Add 0 Link
3	Option 2	Option 1
4	Trunk 7	Trunk 6
5	Transfer Link 2	Transfer Link 1
6	Option 3	Option 2
7	Trunk 8	Trunk 7
8	Transfer Link 3	Transfer Link 2
9	Option 4 Increment Line Scan	Option 3
10	Trunk 9	Trunk 8
11	Conference Link 1	Transfer Link 3
12	Option 5	Option 4
13	Trunk 10	Trunk 9
14	Conference Link 2	Conference Link 1
15	Register 1	Option 5
16	Trunk 11	Trunk 10
17	Conference Link 3	Conference Link 2
18	Register 2	Register 1
19	Trunk 12	Trunk 11
20	Conference Link 4	Conference Link 3
21	Register 3	Register 2
22	Trunk 13	Trunk 12
23	Attendant Link 1	Conference Link 4
24	Register 4	Register 3
25	Trunk 14	Trunk 13
26	Attendant Link 2	Attendant Link 1
27	Local Link 1	Register 4
28	Trunk 15	Trunk 14
29	Attendant Register	Attendant Link 2
30	Local Link 2	Local Link 1
31	Trunk 16	Trunk 15
32	Spare	Attendant Register
33	Local Link 3	Local Link 2
34	Trunk 17	Trunk 16
35	Spare	Spare
36	Local Link 4	Local Link 3
37	Trunk 18	Trunk 17
38	Spare	Spare
39	Local Link 5	Local Link 4
40	Trunk 19	Trunk 18
41	Spare	Spare
42	Local Link 6	Local Link 5
43	Trunk 20	Trunk 19
44	Spare	Spare

TABLE 1.01 Channel Allocation Chart (Cont.)

CHANNEL	FUNCTION	
	READ	WRITE
45	Local Link 7	Local Link 6
46	Trunk 21	Trunk 20
47	Local Link 12	Spare
48	Local Link 8	Local Link 7
49	Trunk 22	Trunk 21
50	Trunk 1	Local Link 12
51	Local Link 9	Local Link 8
52	Trunk 23	Trunk 22
53	Trunk 2	Trunk 1
54	Local Link 10	Local Link 9
55	Trunk 24	Trunk 23
56	Trunk 3	Trunk 2
57	Local Link 11	Local Link 10
58	Trunk 5	Trunk 24
59	Trunk 4	Trunk 3
60		Local Link 11
61		Trunk 5
62		Trunk 4
63	Add-on Link	

channel read 62) lead is marked with a logic low for the one (1) microsecond channel scan. The low on SCR 62 is felt on pin 2 of the (D-type) FF U59 and pin 3 of the (D-type) FF U30. On the next positive going pulse of the 1 microsecond clock (T4) lead, the logic low on the SCR 62 lead is felt on pin 2 of U30 and in turn is felt on pin 12 of U59. At approximately 62.5 microseconds before the end of channel 62, the clock 1 lead (pin 3) of U59 goes high which causes the low on pin 2 to be felt on pin 5. The low on pin 5 is felt on pin 9 of multiplexer U40, while pins 11 and 10 (WN3 and WN4) are marked with a high from the processor. With pin 5 low and pins 10 and 11 high, pin 1 is enabled so that T1 (8 MHz) will clock the line number out of the 8-bit shift register U48 and into pin 1 of U40.

The processor marks the SN lead (store number) with a low which enables the input on pin 5 of data selector/multiplexer U32 to be felt on the output, pin 7. Pin 7 of U32 drives pin 12 of the 8-bit shift register U47, and U47 is clocked by T1 so that, at the end of channel 63, the line number from the line scanner will be stored in U47 (the originating store register).

The output of U40 also goes to pin 1 of the serial-in-parallel-out shift register U52, which is clocked by T1. At th end of channel 63, the WN3, WN4, and SN leads from the processor go back to a logic low.

At the beginning of channel 0, the T4 clock on pin 9 of U51 and U58 causes the inputs from U52 to be marked out to the processor via binary coded decimal (BCD) to decimal decoders U50, U49, and U56. Also during channel 0, T1 on pin 9 of U47 clocks the number stored during channel 63 out on pin 13 into U32 on pin 6 (a high on the SN lead enables pin 6). This goes out of U32, pin 7, and back into U47, pin 12. The number will continue to circulate in this fashion once every microsecond until the number is cleared. The processor checks the line and, if the line is not requesting service, no action is taken.

At the end of channel 0, the processor marks the CLRO (clear originator) lead with a low clearing the line number from the circulating memory. If the line is requesting a register, the processor marks the CW lead with a low to inhibit the line scanner, and starts looking for an idle register. Also at the end of

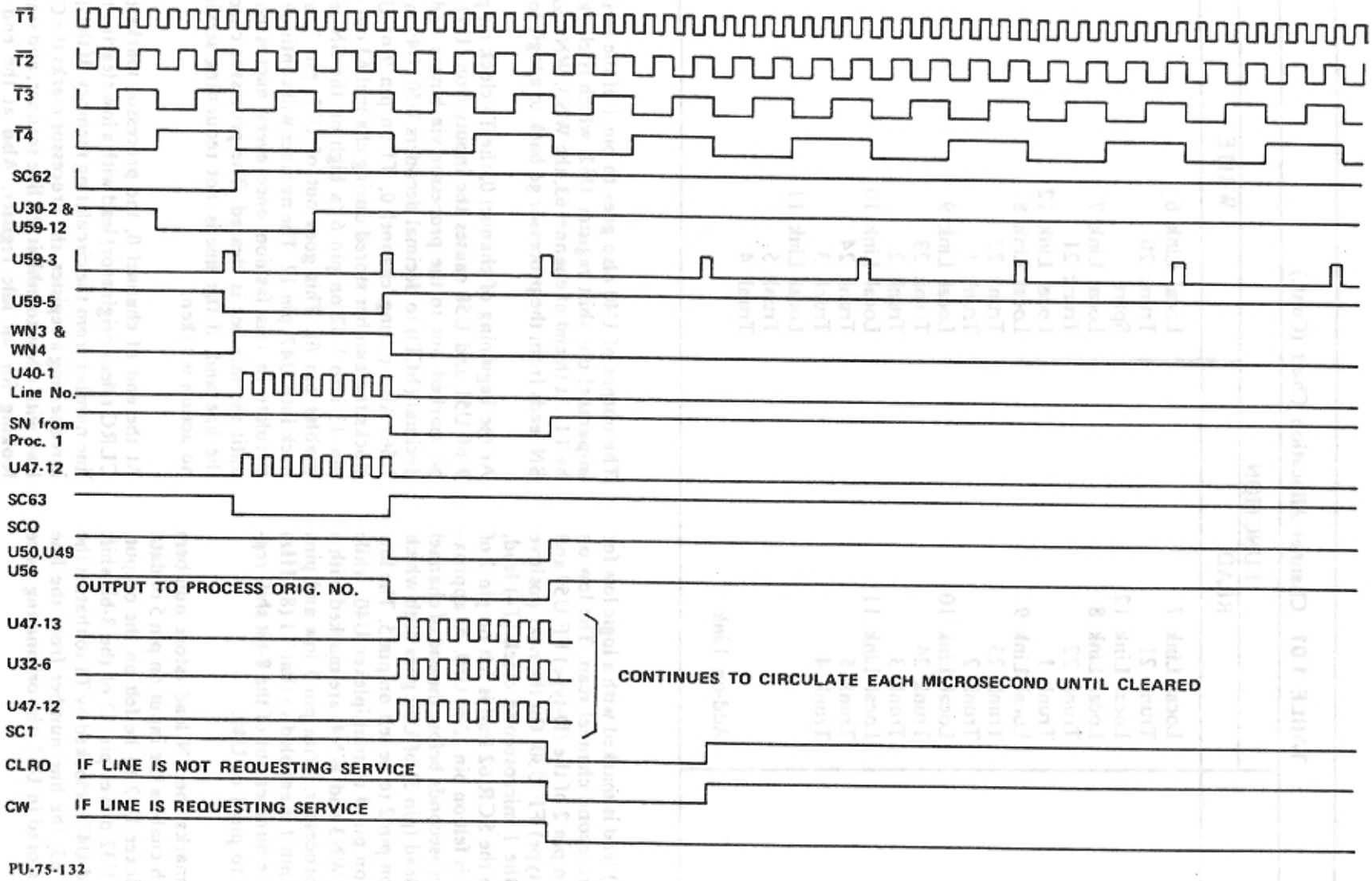

FIGURE 1.01 Memory Waveform Chart

channel 0, the processor marks CLRO with a low to remove the information from the channel time slots.

On finding an idle register (see table 1.01) at channel 15, the processor waits until channel 17 and then marks the WN3 and WN4 leads with a low which is felt on pins 10 and 11 of U40. A logic low on pins 10 and 11 and a high on pin 9 enables pin 15 of U40 causing the output of U47 (pin 13) to be passed through U40 and out on pin 5 into pin 1 of U52.

At the beginning of channel 18 (the register write scan), T4 is on pin 1 of U51; U58 clocks the line number out to the processor via U50, U49, and U56. The line number also goes from the output of U51 and U58 to the inputs of U30 and U31.

At the beginning of channel 19, T4 (on pin 9 of U30 and U31) clocks the line number through to the outputs of U30 and U31. The number will be circulated through the memory and will reappear at the output of U51 and U58 on the next write scan of the register (channel 18).

2.03 Terminator Storage. At the completion of dialing, the BCD equivalent of the dialed number is fed into the memory via leads TO1 through TO8 during the read channel of the register (channel 15). The BCD equivalent of the dialed number is felt on the inputs of data selector/multiplexer U16 and U17. The input leads TO5 through TO8, are also felt on the inputs of NAND gate U22 which causes the output (pin 6) to go to high (at least 1 of the inputs of U22 will be low). The output (pin 6) of U22 is felt on pins 9 and 10 of NAND gate U22. Pins 12 and 13 of U22 are high from the SH lead (static state), causing the output on pin 8 to go low which is felt on pin 1 of NAND gate U42 and the output of U42 (pin 3) goes high. The high on pin 3 is inverted by U77 causing pin 1 of multiplexers U16 and U17 to go low.

The low on pin 1 of U16 and U17 enables input pins 3, 5, 11, and 14 and inhibits input pins 3, 6, 10, and 13. This causes the inputs on the TO1 through TO8 leads to be felt on the output pins 4, 7, 9, and 12.

At the end of the register read channel (channel 15), pin 15 of parallel-in-serial-out shift register U18 goes from low to high (as U65 causes the outputs from U16 and U17 to be clocked into U18). At the end of channel 15, the origiator's number is clocked into U44 from U45 and U46.

During channel 16, T1 (8 MHz) clocks the terminator's number out of U18 and into U12. T1 also clocks the originator's number out of U44 and into U53.

During channel 17, the inverted terminator and originator numbers are clocked by T1 out of U12 and U53. The outputs of U12 and U53 pass through data selector/multiplexer (WN1/WN4 of logic 1), and are clocked into serial-in-parallel-out shift register U11 and U52 during channel 17.

At the beginning of channel 18 (the write scan of the register), T4 marks the terminator's number through U10 and U3 to the processor, and to U29 and U31. T4 also marks U51 and U58 at the beginning of channel 18 which presents the originator's number to the processor and to U30 and U31. The processor checks the terminator's line (during the register write scan) and marks the line status into the register.

On the next read scan of the register (61 microseconds later), the processor reads the status that it marked into the register and, if the terminator's line is idle on the second scan after the read scan of the register, the processor marks the SN lead with a logic low.

The low on the SN lead is felt on pin 1 of U32 which enables the A inputs (pins 2 and 5). With the A inputs of U32 enabled at one microsecond before the write channel of the register, the terminator's number goes to both U11 and to U19 and the originator's number goes to both U52 and to U47. At the beginning of the next microsecond, the SN lead goes to logic 1 enabling the "B" inputs of U32 which enables the terminator and the originator numbers to circulate through U19 and U47, respectively.

During the write channel of the register, the processor marks the CLRO and the CLRT leads to clear the register channel and then starts looking for an idle local link.

Local link #1 is located in read channel number 27 and write channel number 30 (see table 1.01) and will be used to simplify the explanation.

At channel 27, the processor determines that the assigned link is idle. Two microseconds later, at channel 29, the processor marks the WN leads as follows: WN1 is high, WN2 is low, WN3 is low, and

WN4 is low. This combination causes the terminator and originator numbers to be fed through U26 and U40 into U11 and U52, respectively.

At the beginning of channel 30, the T4 clock signal marks the number out to the processor and to the input of the 60-bit shift registers. The number will continue to circulate through memory and will be marked out to the processor on channel 30 until the call is released and the memory cleared by the processor.

2.04 Conference Circuitry. The conference circuit is comprised of U41, U33, U27, U6, U13, U20, U5, U4, U34, U28, U21, and transistor Q2. A maximum of six parties can be in conference; of these up to four may be local stations and the balance, trunks.

When a station goes into conference, the station number is stored in the originator side and the conference number, 110 to 115, into the terminator side. In an attendant-set conference, the attendant presses the CONF button causing the processor to apply a write access number condition on the WN1 to WN4 leads; the highest priority conference number (115), which is determined by (priority encoder) U33, goes through the parallel-to-serial converter U41 to multiplexers U40 and U26.

The originator's station and conference numbers are transferred to the conference link channel and decoded as originator and terminator outputs of the conference circuit channel. The highest priority conference number is stored in the terminator's register temporary storage U19, and in the conference link time slot (terminator side), upon receiving the instruction from the processor.

At the scan channel read of the conference link time slot, the terminator outputs will be decoded; U9 pin 9 and U1 pin 6 will go low for one microsecond and the output of U4 (pin 6) will become high. The output of the (J-K) flip-flop U6 (pin 12) will go high and remain there until the "0" channel when it is reset by the line scanner clock. The high level is passed out on the output of the (D-type) flip-flop U27 just before the reset signal and remains there for the next 64 microseconds. As long as the station is in conference, this output of U27 will be high and at the output of U33, the next conference number (inverted) will appear.

When a second party accesses the conference, the above steps will be repeated with the exception that 114 will be decoded out of the terminator's side and U9 pin 9 and U1 pin 5 will become low for one microsecond; U5 pin 4 will become high. This high level will produce a high on pin 3 of U6 and on the next microsecond, the high level will be transferred to the next output of U27. Then, the output of U33 will be the inverted next output of U27; the outputs of U33 will therefore be the inverted next lower priority conference number.

> NOTE: The tens digit is always set to 11 by grounding pins 10, 11, 14, and letting pin 12 remain open on gate U41.

The outputs of the (hex D-type) flip-flop U27 are normally low. When one of these become high, CL goes low and the attendant's conference lamp lights. If the conference circuitry is full, all outputs of U27 and inputs of U34 are high. This enables the lamp wink signal on U34 pin 1 to pass through and wink the attendant's CONF lamp thus indicating that the conference network is full.

2.05 Comparator. The comparator is a serial bit-by-bit comparator which compares either the originator's or terminator's time slot contents to the number being stored in U47 and U19, respectively. The comparator consists of U42, U60, U4, U62, and U69. This circuit compares the two numbers bit-by-bit (1 bit in 1 microsecond) and if they compare favorably, at the end of the microsecond marks out a logic low on the lead NM (number match) for 125 microseconds.

PROCESSOR 1
(410162-003)

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1.00 GENERAL DESCRIPTION

1.01 General. Processor 1 is one of the four common control boards in the TD-100 EPABX; its use is essential for system operation. Processor 1 is the major decision-making circuit; in conjunction with 2, it changes the "Status In" of all the channel circuits and provides specific commands to common services, memory, and other TD-100 subsystems. In order to achieve these objectives, specific programs are stored in two Programmable Read Only Memories (PROM's). Refer to the program list, drawing number 4900297, for additional PROM information. Table 1.00 lists some of the abbreviations used in this document, and their meaning.

As shown in the processor 1 block diagram (figure 1.00), two input state sources exist. The first is the I & SO leads from the channel circuits and the second source is processor 2. Input states can be either requests for service or states passing from the I and SO inputs to the outputs with no change. A request for service requires that the code appearing at the address inputs of P1 generate a code at the output such that its L.S.B. (Least Significant Bit) is zero.

Processor 1 can be seized either from the I & SO or the A to F leads, contingent on the state of the A lead. Depending on the type of request for service, the processor can be seized either for SEARCH purposes (find a circuit, transfer from one circuit to another, etc.) or NO SEARCH purposes (write attendant number, etc.) The processor timing can be divided into three discrete intervals; "Set-up Time," where all the necessary information to all other boards is stored at B4, B5, and B6, "Search Time," where the processor examines all channels one by one, and 'Reset Time," where the processor resets the circuit which requested services and then resets itself.Each of these intervals (see figure 1.01) requires a maximum of 64 microseconds; since processor 1 completely executes one request at a time and ignores all others, the maximum seizure time is 3 times 64, or 192 microseconds.

1.02 Basic Operation. Assume that the processor is idle and a code A (see table 1.01) requesting services appears at the I & SO leads.

> NOTE:The codes referred to in this example and in table 1.01 are sample codes only and do not have logical meanings. They are not hexadecimal numbers.

TABLE 1.00 Processor Terms

ABBREVIATION	MEANING
ATT#	Attendant Number
BRD	Battery Reversal Deny
CNC	Channel Number Compare
RC	Restricted Code
RH	Register Hold
SN	Store Number
SCN	Store Channel Number
TL	Tie Line
TT	Terminator Tens
TWNS	Terminate and Write New Status
TW#	Terminate and Write Number
TXFR	Local Link Found, Transfer
WAN	Write Attendant Number
WNS	Write New Status
WSS	Write Search Status
W#	Write Number

After a delay of one microsecond and through the one out of three times eight multiplexer (B3), this code A appears at the address leads of P1. The output of P1, Code B, goes through multiplexer B9, and after one microsecond appears at the inputs of B11, P2, and P1. Note that code B must contain a "zero" at the L.S.B. (Least Significant Bit) to produce an output at B7. This will switch multiplexer B3 over, so that the output of B10 is selected and appears at the input of P1.

Code B generates an output, code C, at P1, an output, code D, at P2 and a WSS (Write Search Status) pulse which clocks the latches at B4 and stores code C. One microsecond later, multiplexer B9 is switched so that the output of P2 is selected. Code D generates an output, code E, at P2, an output, code F, at P1 and a WNS (Write New Status) pulse which clocks the latches at B6 and code F is stored. Code E generates an output, code G, at P2, an output, code H, at P1 and a W# pulse which clocks the latches at B5 and H is stored.

Notice that the sequence of WSS (Write Search Status), WNS (Write New Status), and W# (Write Number) pulses is not necessarily binary as the one mentioned above. After one microsecond, code G generates an output, code K, at P2 and code "FF" at the output of P1. Code K at the input of P2 generates a code K at its output, and thus the circuit locks itself into a continuous cycle.

There are also cases (see table 1.02) where code G will generate the end of the program ("FF" at the output of P2). These operations are all completed during the "SET UP" cycle.

During the "SEARCH" cycle the processor is enabled to compare the code C stored at the B4 latches against the identity and status of all channels. If the I & SO of a channel matches C, a comparison signal is generated which enables the output of B6 to appear at the output of B8, thus changing the contents of that channel. Note that the comparison signal is also clocking B5, and enables WN1 (Write Number 1) to WN4 signals to the memory board.

At the end of the "SEARCH" cycle, 128 microseconds after the processor was seized, a signal, CS=2, is generated which unlocks the processor. A new WNS pulse is generated and a new code, M for example, is stored at the B6 latches. The nature of this code M depends on whether a transfer has or has not occurred. On the next step, a TWNS (Terminate and Write New Status) signal is generated and the program comes to an end. At the end of the

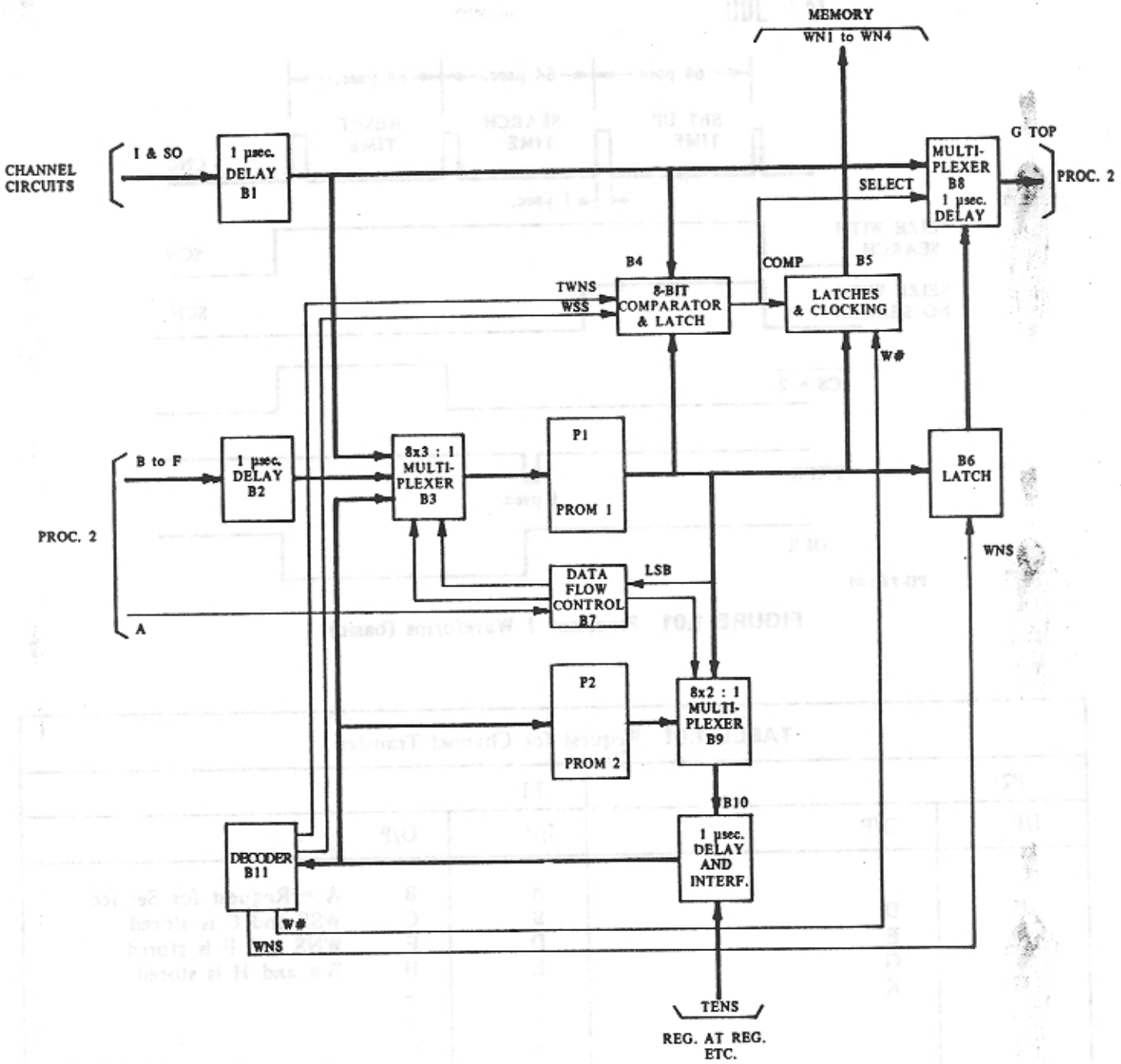

FIGURE 1.00 Processor 1 Block Diagram

RESET cycle multiplexer B8 is switched over and the output of B6 is selected. Thus, information M is entered to the channel from which the request for service came, and may release its circuit or provide other signals to it.

This sequence of events may be seen in the sequence tables. Table 1.01 is applicable to cases where a request for transfer from one channel to another is made. Table 1.02 is a request for service from a non-channel circuit and table 1.03 is a non-search request for service.

The codes programmed in the PROMS are in hexadecimal form and their alphanumeric equivalents are given in table 1.04.

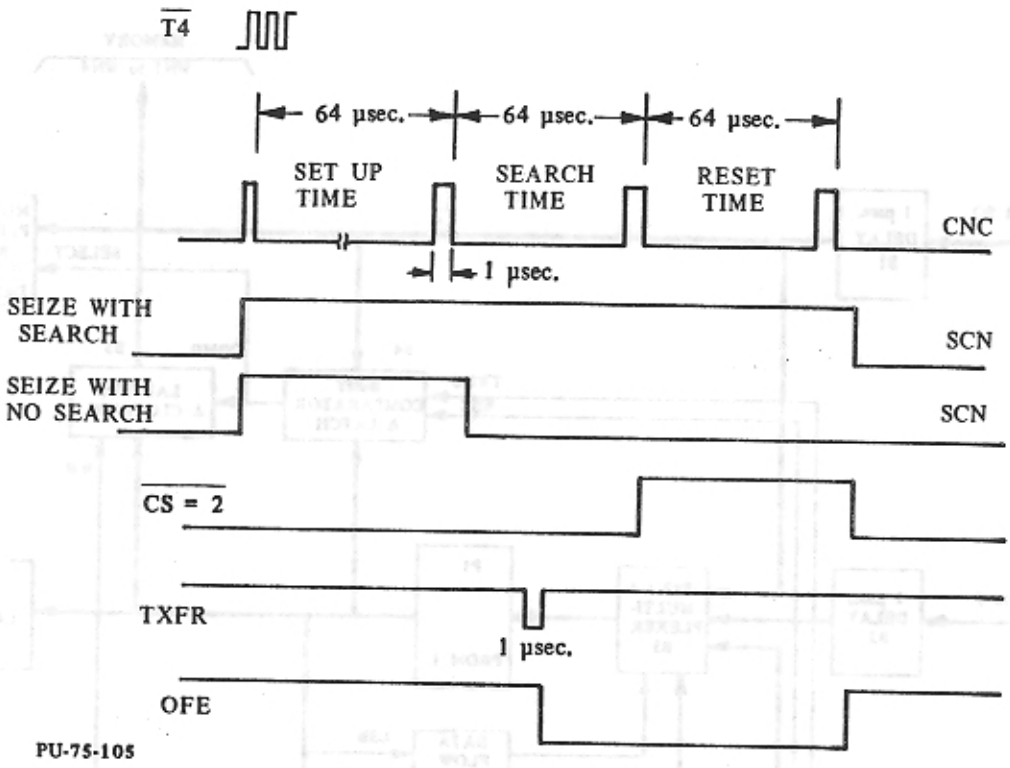

FIGURE 1.01 Processor 1 Waveforms (basic)

TABLE 1.01 Request for Channel Transfer

P2			P1		
I/P	O/P		I/P	O/P	
B	D		A	B	A = Request for Service
D	E		B	C	WSS and C is stored
E	G		D	F	WNS and F is stored
G	K		E	H	W# and H is stored
			–	–	
			–	–	
			–	–	
			–	–	M stands for either Q or V
			–	–	
			–	–	
			–	–	
K	K		–	–	
L	N		–	–	CS = 2
N	P	TRANSFER	N	Q	WNS and Q is stored
P	S	TWNS			TWNS sets condition at B4
T = N-1	U	TRANSFER	T	V	WNS and V is stored
U	S	TWNS			TWNS sets condition at B4
S	END				

TABLE 1.02 Request for Service from Non-channel Circuit

P2		P1		
I/P	O/P	I/P	O/P	
B D E G	D E G END	A B D E	B C F H	A = request for service WSS and C is stored WNS and F is stored W# and H is stored

TABLE 1.03 Non-search Request for Service

P2		P1		
I/P	O/P	I/P	O/P	
B C	C END	A A	B B	A = request for service W# and D is stored

TABLE 1.04 Hexadecimal and Alphanumeric Equivalents

Bits				Alphanumeric Equivalent
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

2.00 DETAILED DESCRIPTION

2.01 General. To aid the understanding of this complex circuit in relation to the overall system, a detailed explanation will be given. These examples will detail specific events in relation to the processor programming.

One of the most important operations is the initiation and completion of a local call, which exercises most of the circuitry of processor 1.

When an originating station goes off-hook, its number is stored in the memory and processor 2 generates a code which initiates operation of processor 1. Processor 1 searches for a free register and, when it finds one, stores the station's number in the register's time slot. The called number is dialed and stored in the register's time slot; the register changes status out and seizes processor 1, which now searches to find a free link and transfer the contents of the register's time slot into the link's time slot. As soon as the called station goes off-hook, conversation can take place. The above operations of processor 1 can be divided into two phases; search for a register and search for a link. Each of these phases will be explained in detail with the aid of the programming sequence tables and drawing 4101627-003.

When processor 1 is idle, U62-6, U24-9, and U54-2 are low, thus generating low levels at the address leads 2 and 14 of the input multiplexers U4, U12, U50, and U58. This address selects the I and SO; i.e. the outputs of U10 and U55. When input A goes high, the address leads of the input multiplexers U4, U12, U50, and U58 change to "0" at pin 14 and "1" at pin 2 and the outputs of U59 are selected. When the processor is seized, the address becomes "1" at pin 14 and "0" at pin 2 and the inputs of U29 are selected.

2.02 Search for a Register. When an originating station goes off-hook, processor 2 generates the following code at the A to F input leads of processor 1; A=0, B=0, C=0, D=1, E=0, and F=1. One microsecond later, the address leads of the input multiplexer (U4, U12, U50, and U58) become low at pin 14 and high at pin 2, which selects the outputs of U59. A binary code C5 is generated at the address leads of U28; the output of U28 becomes "OC" and appears at the outputs of the buffers U20 and U42. The outputs of U20 can be related to the channel identity with the M.S.B. (most significant bit) at pin 6 and the L.S.B. (least significant bit) at pin 3; the outputs of U42 can be related to the channel status out with the M.S.B. at pin 11 and the L.S.B. at pin 3. Since "C" contains a zero in the L.S.B., U62-6 goes high and, after it is clocked by LP, U54-3 becomes low, thus locking a high at U62-6. Note that U54-2 goes high, thus changing the address of the input multiplexers so that the inputs of U29 are selected while SN (Store Number) and SCN (Store Channel Number) signals are generated. This relationship is shown in figure 1.02.

CNC (Channel Number Compare) is also shown in figure 1.02, and is generated in Common Services due to SCN (Store Channel Number). CNC is applied at U62-1, but it is enabled when U62-2 goes high one microsecond after its first pulse appears. This means that the first pulse is inhibited from clocking U7. At this same time, U45-10 is low and the outputs of U20 and U42 are selected and appear at the outputs of U21 and U43. As soon as the first nagative going edge of T4 appears after U62-6 becomes high OC is clocked at the address leads of U28 and U29; U45-10 becomes high and multiplexers U21 and U43 select the outputs of U29. The outputs of U21 and U43 are clocked to the inputs of U28 and U29 through U13, U59, U24 and U37, and thereafter U29 takes over the control of the processor.

A code which is generated at the output of U29 is clocked to its input to generate a new code at the output which will again be clocked to the input, and so on, until an "FF" output is generated, which signals the end of the program. The duration of each code at the input or output is one microsecond.

The following statements should be made about the operation of U29 and the devices peripheral to it.

A high-going pulse at U52-6 is called WNS, at U52-12 W#, at U52-8 WSS, at U6-10 TWNS, and at U6-13 ATT#. Each of these pulses is generated due to specific codes at the input and output of U29.

With the outputs of U21 other than C, D, E, F, and under the condition that the processor is seized, U38-13 is high.

If the codes "7C," "7D," "7E," and "7F" are applied at the input of U29 and the processor is seized, U5-8 becomes low. An ATT# (Attendant Number) signal is generated (U6-13) if the input of U29 is code "7D"

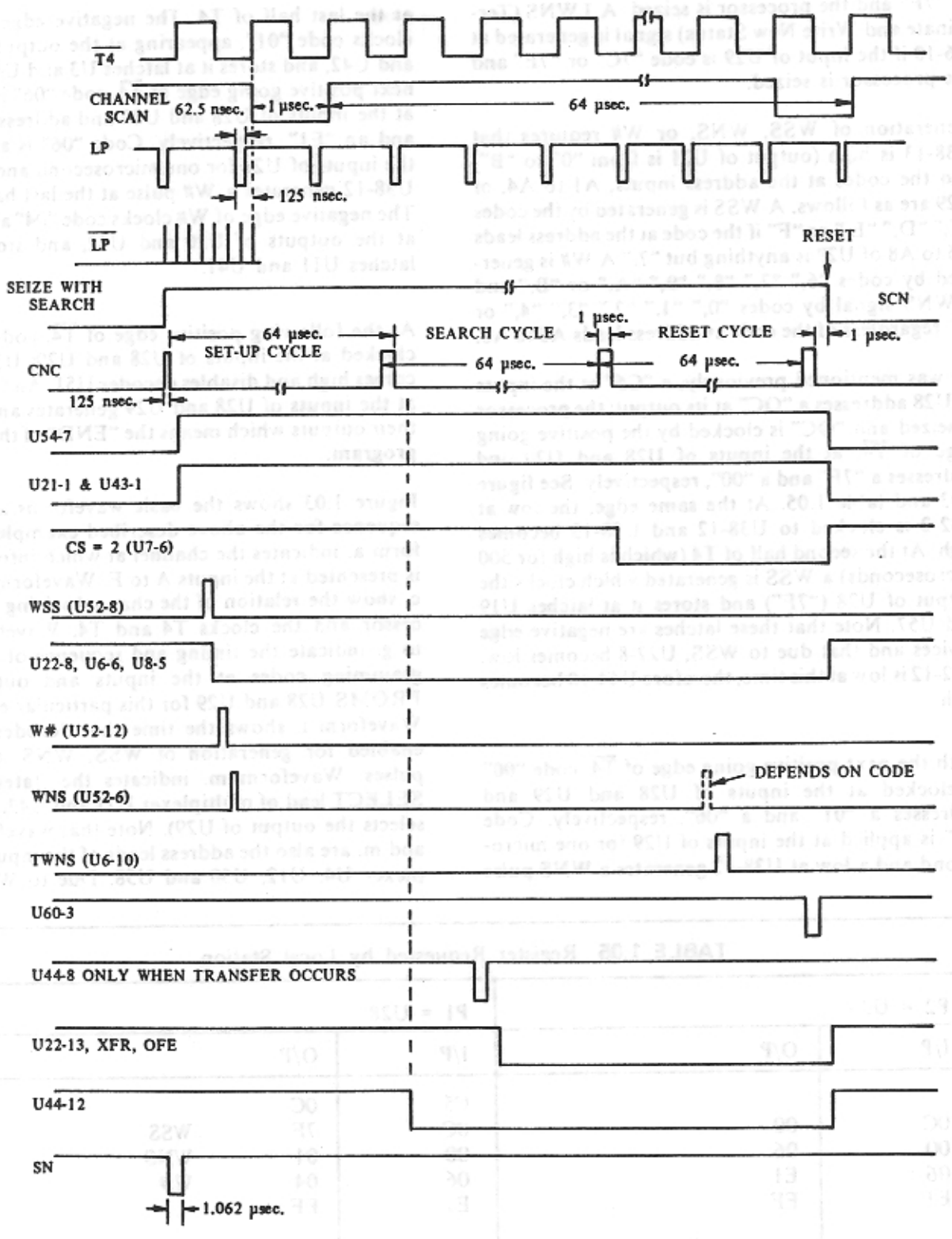

FIGURE 1.02 Processor 1 Waveforms (detailed)

or "7F" and the processor is seized. A TWNS (Terminate and Write New Status) signal is generated at U6-10 if the input of U29 is code "7C" or "7E" and the processor is seized.

Generation of WSS, WNS, or W# requires that U38-13 is high (output of U21 is from "0" to "B") and the codes at the address inputs, A1 to A4, of U29 are as follows. A WSS is generated by the codes "C," "D," "E," or "F" if the code at the address leads A5 to A8 of U29 is anything but "7." A W# is generated by codes "6," "7," "8," "9," "A," or "B," and a WNS signal by codes "0," "1," "2," "3," "4," or "5" regardless of the code at address leads A5 to A8.

As was mentioned previously, a "C5" at the inputs of U28 addresses a "OC" at its output; the processor is seized and "OC" is clocked by the positive going edge of $\overline{T4}$, at the inputs of U28 and U29 and addresses a "7F" and a "00", respectively. See figure 1.03 and table 1.05. At the same edge, the low at U32-2 is clocked to U38-12 and U38-13 becomes high. At the second half of T4 (which is high for 500 microseconds) a WSS is generated which clocks the output of U28 ("7F") and stores it at latches U19 and U57. Note that these latches are negative edge devices and that due to WSS, U22-8 becomes low. U22-12 is low at this time, therefore U44-10 becomes high.

With the next positive going edge of $\overline{T4}$, code "00" is clocked at the inputs of U28 and U29 and addresses a "01" and a "06", respectively. Code "00" is applied at the inputs of U29 for one microsecond and a low at U38-12 generates a WNS pulse at the last half of T4. The negative edge of WNS clocks code "01", appearing at the outputs of U20 and U42, and stores it at latches U3 and U49. At the next positive going edge of $\overline{T4}$, code "06" is clocked at the inputs of U28 and U29 and addresses a "04" and an "E1", respectively. Code "06" is applied at the inputs of U29 for one microsecond and a low at U38-12 generates a W# pulse at the last half of T4. The negative edge of W# clocks code "04" appearing at the outputs of U20 and U42, and stores it at latches U11 and U41.

At the following positive edge of $\overline{T4}$, code "E1" is clocked at the inputs of U28 and U29; U38-12 becomes high and disables decoder U51. An "E1" code at the inputs of U28 and U29 generates an "FF" at their outputs which means the "END" of this part of program.

Figure 1.03 shows the basic waveforms and code sequence for the above described example. Waveform a. indicates the channel at which information is presented at the inputs A to F. Waveforms b. and c. show the relation of the channel seizing the processor and the clocks T4 and $\overline{T4}$. Waveforms d. to g. indicate the timing and sequence of the programming codes at the inputs and outputs of PROMS U28 and U29 for this particular example. Waveform i. shows the time that decoder U51 is enabled for generation of WSS, WNS, and W# pulses. Waveform m. indicates the states of the SELECT lead of multiplexer U21 and U43. (A high selects the output of U29). Note that waveforms h. and m. are also the address leads of the input multiplexer U4, U12, U50 and U58. Due to W# being

TABLE 1.05 Register Requested by Local Station

P2 = U29		P1 = U28		
I/P	O/P	I/P	O/P	
0C	00	C5	0C	
00	06	0C	7F	WSS
06	E1	00	01	WNS
E1	FF	06	04	W#
		E1	FF	

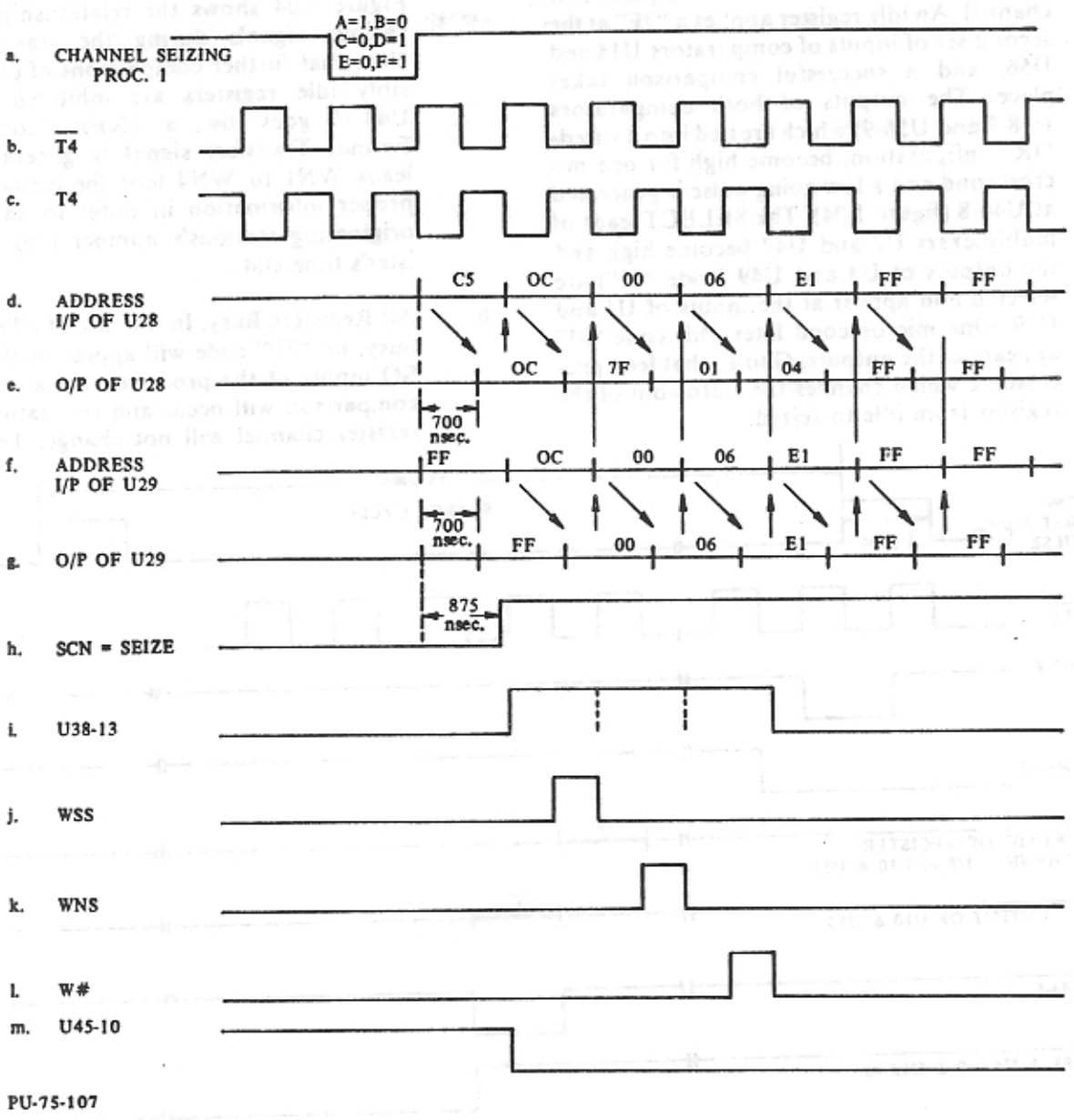

FIGURE 1.03 "Find A Register" Code Sequence and Waveforms (Set Up Cycle)

"04," U44-2 becomes high while U44-13 is at a low level, thus disabling this four input NAND gate. These conditions do not change until the first one microsecond pulse of CNC appears 64.125 microseconds after the processor was seized. This pulse clocks U7 and U7-2 becomes high while U7-3 goes low. One microsecond later (delay due to U45) U44-13 becomes high and U44-9 is enabled.

Note that the identity of a register is "7," and status-out "F" denotes an idle circuit. At this point in the call sequence, comparators U18 and U56 have a "7F" code latched at their input. Two different cases may occur; one or more registers are idle, or all registers are busy.

a. One or More Registers Idle. The identity and status-out of each channel in the system appears at the outputs of U10 and U55 one

microsecond after the read of the particular channel. An idle register applies a "7F" at the second set of inputs of comparators U18 and U56, and a successful comparison takes place. The outputs of both comparators U18-9 and U56-9) which are tied into a wired-OR configuration, become high for one microsecond and a low going pulse is generated at U44-8 (figure 1.04). The SELECT leads of multiplexers U2 and U47 become high and the outputs of U3 and U49 (code "01") are selected and appear at the inputs of U1 and U39. One microsecond later, this code "01" appears at the outputs, G to P, that feed processor 2 which changes the status-out of the register from idle to seized.

Figure 1.04 shows the relationships of the various signals during the search cycle. Note that further comparisons of other possibly idle registers are inhibited because U44-10 goes low, a TXFR (Local Link Found, Transfer) signal is generated and leads WN1 to WN4 feed the memory with proper information in order to switch the originating stations's number into the register's time slot.

b. All Registers Busy. In the case of all registers busy, no "7F" code will appear at the I and SO inputs of the processor. As a result, no comparison will occur and the status of the register channel will not change. Thus, the

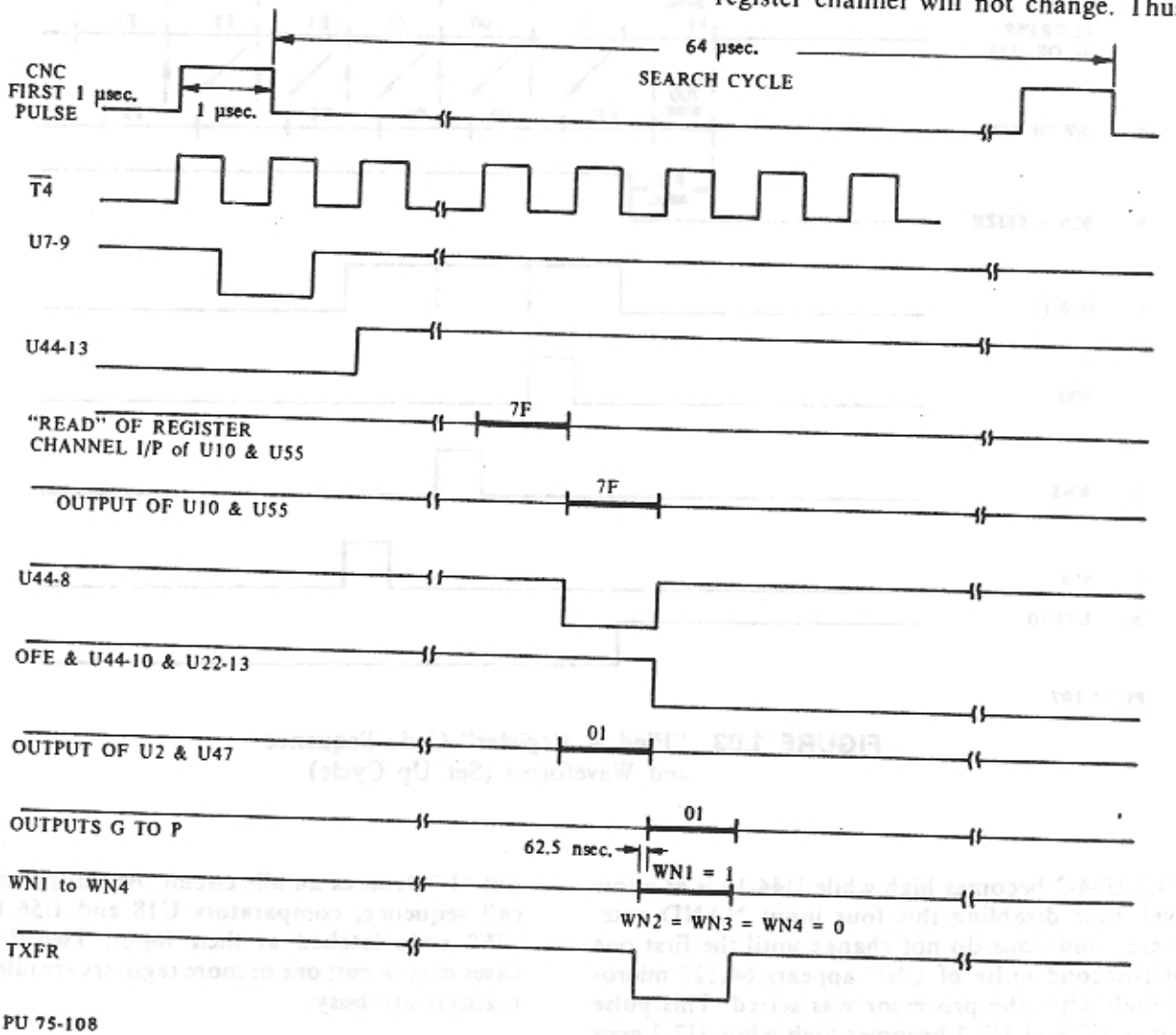

FIGURE 1.04 "Search for Idle Register" Waveforms
(Search Cycle, with at least one register idle)

processor does not assume any action in this cycle.

The last cycle of processor 1 is the reset cycle. In this cycle, the processor generates an output such that the channel which requested service (seized the processor) becomes idle. Note that at the end of this cycle the processor resets itself.

If a register is found code "04" at the output of processor 1, processor 2 generates dial tone enable and resets CW in processor 2. If a register is not found, no tones are applied to the station and processor 1 will be seized and again search for an idle register. This process will be repeated as many times as necessary until an idle register is found, regardless of whether the originating station has remained off-hook.

After the called station's number has been dialed, the register identity and status-out change to "73", and processor 1 is seized and searches for an idle link. The function of processor 1 is described below:

2.03 Search For a Local Link. The function of the processor can be divided into three phases: set-up cycle, search cycle, and reset cycle. Each cycle is described with the aid of table 1.06 and figures 1.05 and 1.06.

In table 1.06, inputs and outputs of U28 and U29 are shown for the case where a transfer from a register to a local link is requested. Note the sequence of codes for each cycle.

a. Set-up cycle. As soon as the third digit is dialed, the register's identity and status-out becomes "73". This code is applied to the inputs of U10 and U55 and appears at their outputs one microsecond later. Since the request for service is not due to an access code, U32-4 remains low; the address leads (2 and 14) of the input multiplexers U4, U12, U50 and U58 are at low levels, thus the outputs of U10 and U55 are selected and applied at the address inputs of U28. This code addresses an "OE" at the outputs of U28, and since "E" contains a zero at the L.S.B., the processor is seized, an SCN is generated, and the address of the input multiplexers changes so that the inputs of U29 are selected. (Refer to paragraph 2.02 for more details.)

The sequence of the codes is shown in figure 1.05. These codes generate: WSS which clocks code "BF" into latches U19 and U57, WNS that clocks "04" into latches U11 and U41, and W# which clocks "04" into latches U3 and U49. In figure 1.05, the levels of U38-13 are shown. Note the difference from the previous example. As soon as the W# code is stored, an "F9" is clocked at the inputs of U29, which then addresses and "F9" at the outputs of U29. The program is then self-locked until the end of the search cycle.

b. Search cycle. During this cycle, the contents of all the channels are compared to code "BF" which is stored at latches U19 and U57. In the case where a successful comparison occurs, U44-8 goes low and multiplexers U2 and U47 select the outputs of latches U3 and U49 where the WNS code "04" is stored. One microsecond later, this code appears at the G to P outputs of the processor; WN1 to WN4 information is applied to memory, further comparison is disabled (U44-10 becomes low) and an XFR (transfer) signal is generated.

In the case where successful comparison does not occur, all the previously set levels remain the same. At the end of this cycle, the second CNC pulse generates low levels at U7-6, U15-pins 13, 14, and 15, and U31-13.

c. Reset cycle. During the reset cycle, the channel from which the request for service came and the processor itself are reset to idle.

Since an "F9" is continuously generated at the outputs of U21 and U43, multiplexer U15 is enabled (pin 7 becomes low) and pin 15 of U15 is selected. The output of this multiplexer, U15-6, becomes high; U31-6 is also high, thus U36-3 becomes low and U24-6 changes to high. This level is delayed by one microsecond (U37) and an inversion is applied at the input of U29, which changes the L.S.B. from a one to a zero and consequently changes the "F9" to "F8". An "F8" at the inputs of U28 and U29 addresses a "1A" and a "03" at their respective outputs.

TABLE 1.06 Transfer from Register to Local Link

P2 = U29			P1 = U28		
I/P	O/P		I/P	O/P	
			73	OE	
OE	D1		OE	BF	WSS
D1	01		D1	AC	
01	07		01	04	WNS Set-Up Cycle
07	F9		07	04	W#
F9	F9		F9	FF	
					Search Cycle
F8	F3		F8	1A	
F3	03	$\overline{\text{XFR}}$	F3	4E	
03	7E		03	05	WNS RESET Cycle
F2	05	XFR	F2	FF	
05	7E		05	09	WNS
7E	FF	TWNS	7E	4A	
FF	FF		FF	FF	END

From this point the sequence of codes depends on whether an idle local link was found (XFR) or was not found ($\overline{\text{XFR}}$).

In the case that a transfer (XFR) occurred (see figure 1.06) a low level is applied at U15-1, 2, and 3, and since at the outputs of U21 and U43 an "F3" code is generated, U15-6 becomes high and consequently U36-3 is low. Notice that U24-5 is low due to "F3," thus U24-6 becomes low changing the "F3" into "F2". An "F2" at the inputs of U28 and U29 generates an "FF" and a "05" at the outputs of U28 and U29, respectively. A "05" at the inputs of U28 and U29 generates a "09" and a "7E" at their respective outputs. Since the output of U29 is "05," a new WNS pulse is generated which clocks "09" into latches U3 and U49. At the next microsecond, "7E" is clocked at the inputs of U28 and U29, U5-8 becomes low, and a pulse is generated at U6-10 (TWNS) which causes U14-9 to become low at the next negative going edge of T4. At the same time, the input of U29 becomes "FF" and the program ENDS.

At the end of this cycle, CNC goes high thus applying a high at U60-2 which, combined with the high at U60-1, generates a high at U60-11. Multiplexers U2 and U47 now select the outputs of U3 and U49 and, one microsecond later, a "09" appears at outputs G to P which resets the register to idle. Note that one-half microsecond later the end of the reset cycle, U7-11 goes low and one-half microsecond later, U8-11 goes low and resets the processor.

In the case where a link is found (TXFR), U15-1, 2 and 3 remain high thus "F3" at the outputs of U21 and U43 is clocked at the inputs of U28 and U29 addresses a "4E" and a "03", respectively. A "03" at the inuts of U28 and U29 addresses "05" and "7E", respectively. Note that a "03" at the input of U29 generates a WNS pulse which clocks "05" into U3 and U49. At the next microsecond, "7E" at the input of U29 generates a TWNS and an "FF" at the outputs of U21 and U43 which denotes the end of the program. The remainder of the function are the same as in the case of a transfer.

At this point, the purpose and functions of U15, U31, U30 and the related circuitry should be mentioned. Depending on the code at the outputs of U21 and U43 and the levels at the outputs of U30, the L.S.B. of the input code to U29 changes from a "one" to a "zero" or remains a "one". This enables the processor to change the program sequence in response to specific input signals such as RH, TT, RC, TL, and BRD. Note that U15 is enabled (pin 7 = low) whenever the output of U21 is "2", "3", "6", "7", "A", "B", "E", or "F", while U31 is disabled. U31 is enabled whenever the output of U21 is "0", "1", "4", "5", "8", "9", "C", or "D", while U15 is disabled.

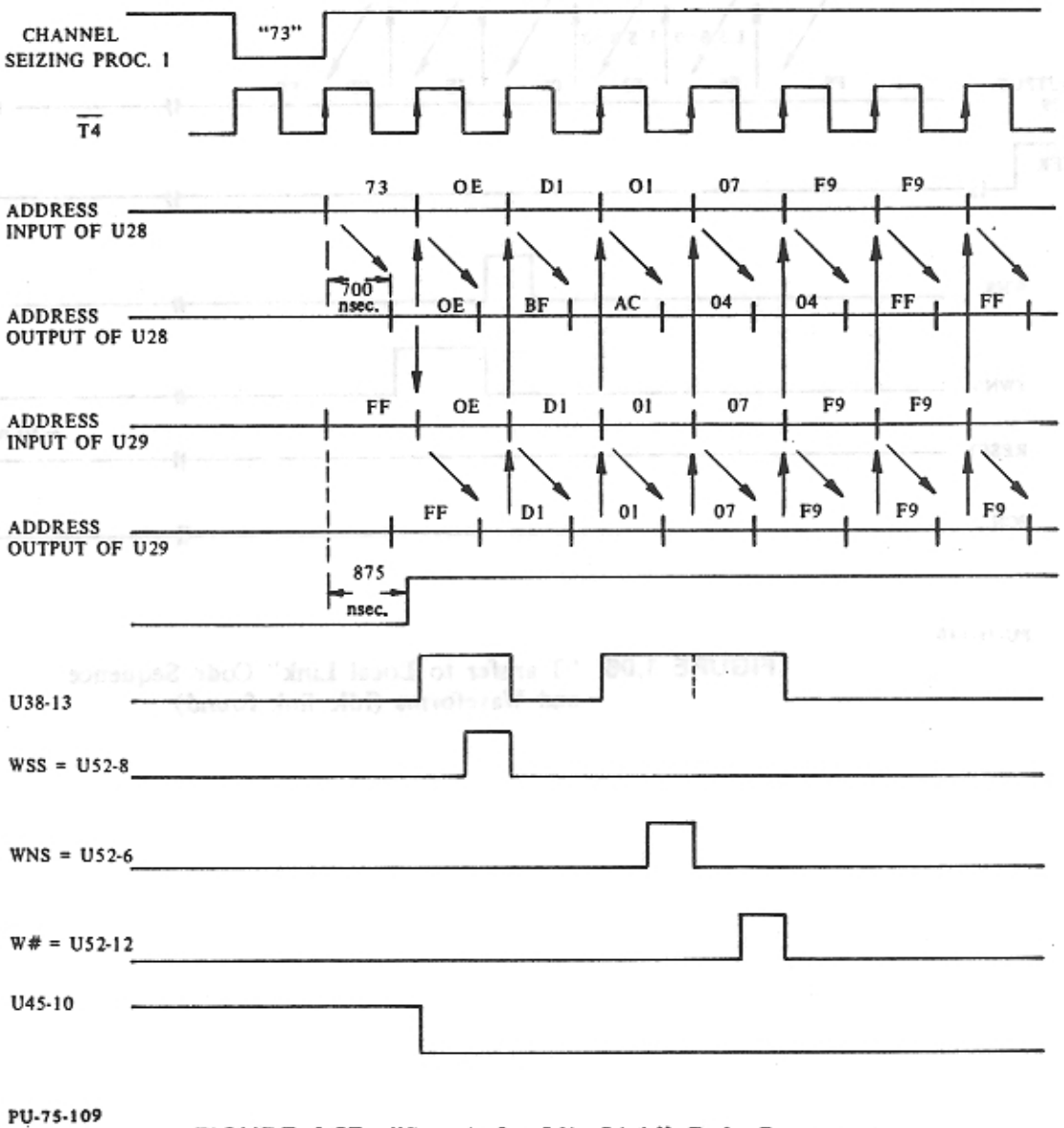

FIGURE 1.05 "Search for Idle Link" Code Sequence and Waveforms (Set Up Cycle)

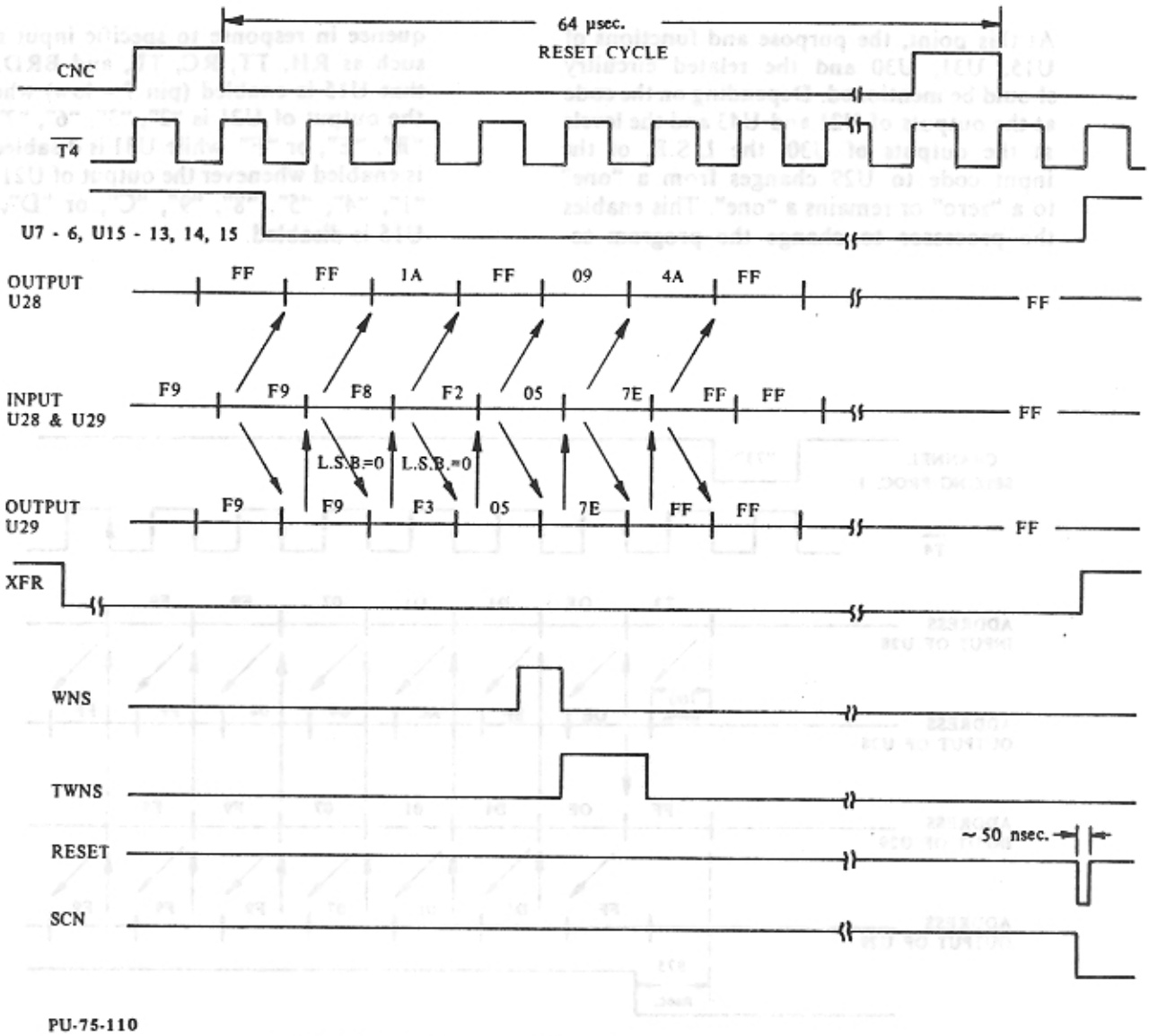

FIGURE 1.06 "Transfer to Local Link" Code Sequence and Waveforms (Idle link found)

PROCESSOR 2
(410163)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. One of the primary control boards of the TD-100 EPABX is processor 2. Processor 2 may be considered as a large decoder, where a specific combination of input signals generates one or more predetermined output signals. Operating primarily in conjunction with processor 1, processor 2 also accepts inputs from all channel circuits; SO-1 through SO-4, I-1 through I-4, TO-1 through TO-4, TO-9 through TO-12, and signals from some other circuits. Its outputs are connected onto the output bus, thus providing most of the necessary control signals of the system. Figure 1.00 is a simplified block diagram of processor 2.

2.00 DETAILED DESCRIPTION

2.01 General. When a call originator goes off-hook, an OHO (off-hook originator) signal is generated at the zero time slot. (Figure 1.01 is a timing chart of processor 2 functions.) This OHO signal combined with an SCO (scan channel zero) signal generates a logic high at U18-2 which is clocked to the Q output. The $\overline{Q}$ output, U18-6, goes low and provides a set condition for this flip-flop. This state will remain until a low is applied at the clear input of the flip-flop, U18-1. Table 1.00 lists some of the processor 2 abbreviations and their meanings.

The CW (call waiting) signal from U18-6, combined with an SC61 (scan channel 61) signal from common services, provides a low at U68-2 which generates a hexadecimal "C5" at the outputs B to F of U68. This "C5" is fed to processor 1 which recognizes it as a request to find a register. Table 1.01 is a list of hexadecimal and alphanumeric equivalents.

At the end of the register search cycle, processor 1 applies signals at the inputs (G to P) of processor 2 which address specific information stored in the programmable read only memories (PROMS) U1, U2, and U3. If a register has been found, the originating line circuit is transferred to the register's time slot, the DTE (dial tone enable), and SI-1 leads go low once every 64 microseconds. Lead $\overline{SZ}$ (seize) goes high and a low signal is applied at U18-1 to reset the CW signal. If a register had not been found, the address to the PROMS would have been such that U18-1 would go low to reset CW, and BTE (busy tone enable) would be enabled to return busy tone to the originator.

> NOTE: Contents of the PROMS is available from the Program List, drawing number 4900297.

2.02 Incoming Trunk Calls. On all incoming trunk calls, a delay of 1 to 2 seconds is provided to reduce false indications of incoming trunk calls. When a trunk call indication is received, the trunk's I and SO is "EF," which is detected by U61. The output, U61-8, is applied to U38-1 and U38-15. If this trunk indication is still present after 1 to 2 sec-

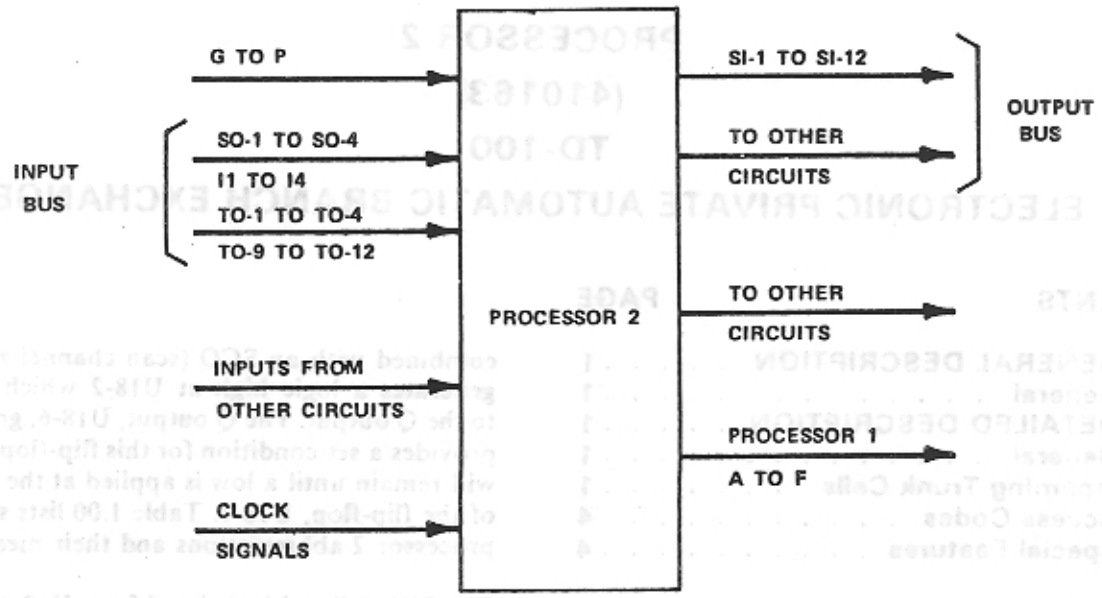

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FIGURE 1.00 Processor 2 Simplified Block Diagram

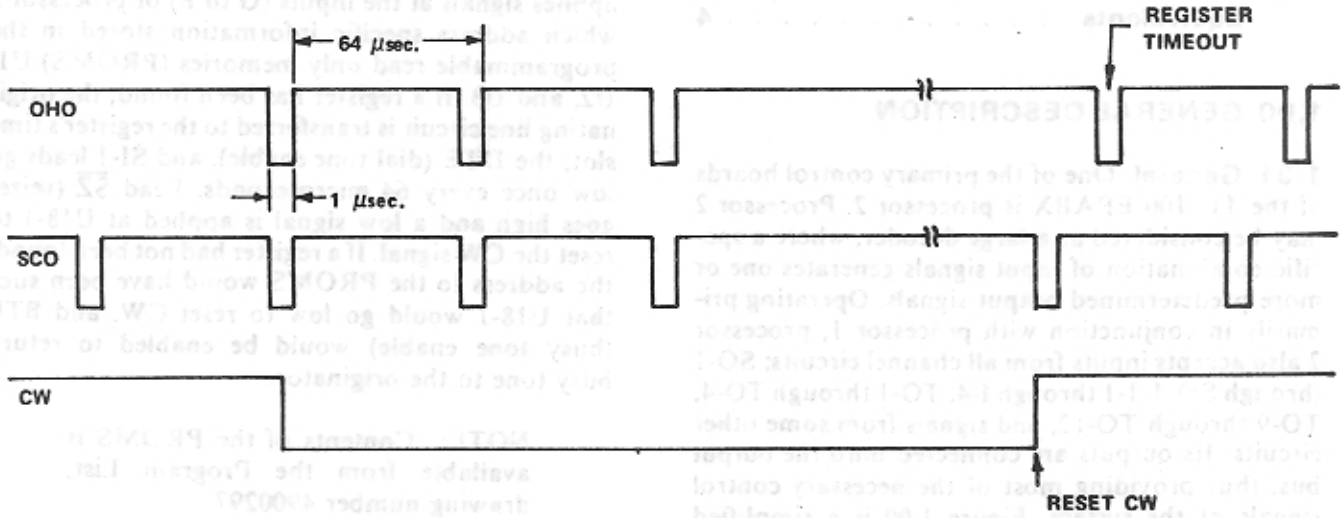

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FIGURE 1.01 Processor 2 Timing Chart (Showing generation and clearing of CW signal during register search)

TABLE 1.00 Processor 2 Terms

ABBREVIATION	MEANING
AOE	Add-on enable
BLO	Busy lock-out
BTE	Busy tone enable
CLRO	Clear originator
CLRT	Clear terminator
CNE	Conference network enable
COB	Camp-on busy
CW	Call waiting
DTE	Dial tone enable
ETXT	Enable term/transmit highway
I-1 thru I-4	Identity 1 thru 4
IB	Inhibit
IDT	Inhibit decoder terminator
IDO	Inhibit decoder originator
IE	Intrude enable
IED	Intrude enable delayed
LP	Last pulse
LWT	Lamp wink (trunk)
OHO	Off-hook originator
POR	Power-on reset
RTE	Ring tone enable
SC (0, 61, etc.)	Scan channel
SI-1 thru SI-12	Status-in 1 thru 12
SIN	Status in now
SO-1 thru SO-4	Status out 1, 2, and 4
SOD	Status out delayed
$\overline{SZ}$	Seize
TO-1 thru TO-12	Terminate out 1 thru 12
TRAC	Trunk access
TRO	Terminate register out
ULO	Unassigned lock-out
UNAE	Unassigned night answer enable
VNI	Vacant number intercept

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

onds, U53-3 and U53-5 go low once every 64 microseconds at that trunk's time slot. The primary source of this delay is U38, U37, and U34.

If the processor is strapped for night answer, U54-4 (for UNA) or U54-2 (for ANA) will go low when an incoming call occurs. A 3 microsecond delay is provided by U46, U52, and U63 to signals being generated by other circuits. The circuits include class of service, trunks, register, etc., (but not processor 1).

2.03 Access Codes. Access codes arrive at the processor 2 PCBs in binary form and are decoded to decimal form by U34 and U41. Each access code (hundreds and tens) must be strapped to the proper NOR gate (U23, U19, U21, U55, U57, or U58) in order to produce the correct code on leads B to F. Each NOR gate corresponds to a specific service function such as conference access, trunk access, tie line access, etc. These NOR gates and their functions are not interchangeable.

Each time an access code is sensed, one of the inputs of U68, U67, U8, or U10 (eight line to three line priority encoders) will go low. U65-1 and U66-6 will go high generating a high at lead A to processor 1 which indicates a service request. Note that in some cases, such as toll restriction or when the attendant dials an access code, lead A is prevented from going high by a low at either U65-5 or U65-4 in the same time slot during which U65-1 goes high. When a station is toll restricted and dials a toll access code, U65-5 and lead SO-3 go low at the register's time slot while U66-8 is low, thus causing a forced busy condition, FB.

2.04 Special Features. The SI leads form the output bus and the proper levels of this bus are detected by SIN (status in now). If one of the SI leads is shorted, either U27-8 or U44-6 will go high at the zero time slot. The SIN lead goes low and an alarm is generated.

When the night answer switch on the attendant's console is set to "NIGHT," either UNA (unassigned night answer) or ANA (assigned night answer) will be enabled. In the event of an incoming trunk call, when UNA is enabled, U64-8 goes high providing a low at UNAE (unassigned night answer enable) to turn on the UNA bell or buzzer. A TRO (terminate register out) signal combined with an IB (inhibit) signal from the memory and an FB (forced busy) signal from the line circuits generates a signal on lead SI-8. If FB is not present, a signal is generated on lead SI-4.

LOOP DIAL TIE TRUNK
(410164)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with two-way dial tie trunks strapped for battery and ground or loop signaling. These trunks may be accessed directly from a station or via the attendant's console; a strapping option is provided to allow all incoming calls to be routed to the attendant.

Each tie trunk has strapping options to permit a maximum of six trunk groups to be arranged for battery and ground or loop signaling. Each trunk circuit is equipped with add-on, conference, and consultation hold features, and a busy switch. An LED (light emitting diode) is provided to show whether the trunk is busy, in service, or manually made busy. Each PCB (printed circuit board) contains one trunk circuit and may be strapped for immediate start, wink start, or delay start operation.

Each TD-100 tie trunk must be assigned to a group for seizure by the processor. The SO (status-out) and I (identity) of an idle tie trunk is determined by the group to which it belongs. Table 1.00 shows the idle status-out for each trunk group.

1.02 Trunk Start. Each two-way dial trunk may be strapped for immediate start, delay start, or wink start. Immediate start is required if the distant PABX is non-senderized; local PABX pulsing is started immediately on receipt of second dial tone.

In delay start operation during idle conditions, the loop is open at the distant PABX; at the local EPABX, battery is on the ring side of the line and ground is on the tip side. The distant PABX closes the loop to seize the line. Within 300 milliseconds, the local EPABX returns an off-hook signal (battery reversal) which stops the distant PABX from outpulsing digits. When the local EPABX has a register attached and is therefore ready to receive digits, it will send an on-hook signal (normal battery polarity). If this occurs before sender time-out, the distant PABX sender outpulses the required digits to the local PABX.

Wink start operation is similar to delay start except that upon seizure, the local EPABX sends a wink signal (off-hook pulse of approximately 200 milliseconds duration) to alert the distant PABX to begin sending.

1.03 Trunk Strapping. Numerous features and options are available from the tie trunk and

TABLE 1.00 Trunk Group Idle Status	
TRUNK GROUP	IDLE STATUS
1	E2
2	F2
3	F5
4	6F
5	AF
6	2F

are explained in this publication. Strapping necessary for these features and options is fully described in section OB-000-003, Feature Strapping, TD-100 EPABX.

2.00 DETAILED DESCRIPTION

2.01 Incoming Call - Day Operation. On an incoming call with the NIGHT switch off, a loop is closed across the tie-trunk tip and ring leads which operates relay L. This causes U43 pin 5 to go low bringing U43 pin 8 low, enabling counters U28, U34 and U45. After 200 milliseconds, the incoming latch operates and U56 pin 9 goes high. The status-out of the tie trunk is a binary coded hexadecimal "FF". Table 1.01 is a list of hexadecimal and alphanumeric equivalents; table 1.02 shows some terms pertinent to tie trunk operation and their meanings. Table 1.03 shows the identity and status-out of the tie trunk under various conditions.

If all incoming calls are routed to the attendant, the attendant is alerted by the console buzzer and a flashing TA lamp. At this time, U44 pin 5 is high and U44 pin 6 is low and the tie trunk status changes to "EF". When the attendant answers, a ground is placed on the TS lead and U41 pin 9 is marked high. The TA and TB lamp light and U72 pin 10 (write attendant number) is low. The processor sends SI1, SI3 and SI11 signals and writes the attendant's number in the terminating register store of the tie trunk's time slot.

At this time, U44 pin 5 is low and U44 pin 8 goes low to inhibit counters U28, U34, and U45. The tie trunk status changes to "E7." As the off-hook latch operates, U19 pin 8 goes high, and U26 pin 12 low and U5 pin 8 high causing Q30 to turn on and operate the RB relay.

2.02 Incoming Call - Night Operation. On an incoming call with the NIGHT switch on, latch U44 pin 5 goes high and the status-out of the trunk becomes "EF." The processor sends SI1, SI3, and SI11 signals and writes the answering station's number in the terminating register store of the tie trunk's time slot. The remainder of the operation is identical to that described for day operation, above.

2.03 Incoming Call - Without Attendant. Within 200 milliseconds of receipt of an incoming call, the status-out of the tie-trunk changes from "FF" to "EO". The OHO lead, U25 pin 8 goes low and the processor writes the tie trunk's number in the originating number store of the tie trunk's time slot and then sends an SI10 signal. U61 pin 5 goes high indicating the tie trunk's request for a register or that a register is attached.

If a register does not become available within 4.7 seconds, U44 pin 5 goes high and a lockout condition is applied to the line by marking U29 pin 11 and U43 pin 3 low. Strapping options are provided to route the call to the attendant if a register is not attached within 4.7 seconds.

The request for a register is removed and the status-out of the tie trunk becomes "FF" with U11 pin 8 high and U36 pin 6 low. The tie trunk remains busy and the TA lamp is lit. When the distant PABX releases, the BLO latch is reset. U27 pin 13 goes low causing the RB relay to release and the tie trunk becomes idle.

2.04 Incoming Call - Trunk Start. The tie trunk may be strapped for immediate start, delay start, or wink start. Each type of start operation has slightly different effects on the circuit operation.

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

On incoming calls to immediate start tie trunks, U31 pin 2 is high and U32 pin 6 is low. The RXO transmission path is enabled through FET (field-effect transistor) Q15 by U32 pin 10 generating RXEN, OLST, and OLSU signals (low). When a register has been connected, the processor sends back an SI6 signal changing the status-out of the tie trunk to "EC" and sending dial tone to the distant PABX. U78 pin 12 goes low making U44 pin 8 low, U43 pin 8 high and resetting counters U28, U34, and U45.

For delay start operation, U56 pin 9 is high and the RB relay is operated via U78 pin 8 (low) and U12 pin 6 (low) to generated ONH (on-hook) and DD (delay dial) signals. When a register is attached, the processor sends and SI6 signal. After 200 milliseconds, U80 pin 13 goes high and the RB relay is released.

With wink start, when the processor sends an SI6 signal, U79 pin 12 goes low; U12 pin 6 goes low and the RB relay operates. Pin 1 of counters U28, U34, and U45 goes high via U65 pin 1. After 200 milliseconds, U80 pin 6 goes low and U79 pin 12 goes high to cause the release of the RB relay. U79 pin 6 is also low which sets U44 pin 8 low and inhibits counters U28, U34, and U45.

2.05 Incoming Call to Station. On an incoming call, after the digits of the local station are dialed, the TD-100 circuitry determines whether the dialed station is busy or idle. If the dialed station is busy, a BLO (busy lockout) signal is generated. U35 pin 11 is low and U29 pin 11 goes low. The status-out of the tie trunk changes to "FF" and busy tone is transmitted to the distant PABX.

If the called station is idle, the processor sends an SI4 signal; U61 pin 5 goes low and the status-out of the tie trunk becomes "E3" (apply ringback tone). The voice path, RXO and TXO, is enabled during the write scan of tie trunk via U26 pin 6 and U32 pin 2. The called station number is written on the terminating side of the tie trunk's time slot. When the called station goes off-hook, the processor sends an SI3 signal. The off-hook latch, U19 pin 9, is high and U26 pin 12 is low causing the RB relay to operate.

2.06 Incoming Call to Attendant. If calling line dials "O" for access to the TD-100 attendant, the processor writes the number of the tie trunk in the originating number store of the attendant link's time slot. An RTE (ring tone enable) signal is generated which sets latch U81 pin 5 high. The

TABLE 1.02 Tie Trunk Terms

ABBREVIATION	MEANING
AIN	Artificial intrude
BLO	Busy lockout
BT	Busy tone
BUZ	Buzzer
CONF	Conference
$\overline{\text{CONN}}$	Connect (inverted)
CPO	Camp-on
CSA	Called subscriber answered
HOT	Hold trunk (automatic)
HT	Hold trunk (manual)
I1, I2, I4	Identity 1, 2, and 4
LWT	Lamp wink trunk
OLS	Originator line scan
OHO	Off-hook originator
OHT	Off-hook terminator
$\overline{\text{RLSE}}$	Release (inverted)
RTE	Ring tone enable
RXEN	Receive enable
RXO	Receive originator
RXT	Receive terminator
SCR	Scan channel read
SCW	Scan channel write
SI1	Seize
SI3	Off-hook terminator
SI4	Tested line is not busy
SI5	Intrude
SI6	Consultation hold
SI7	Add-on
SI8	Busy
SI9	Called subscriber answered - reset
SI10	Conference
SI11	New station number
SI12	Attendant recall
SO1-SO4	Status-out 1-4
SPR	Status pulse record
TA	Trunk A (lamp)
TB	Trunk B (lamp)
TLS	Terminator line scan
TS	Trunk seize
TXO	Transmit originator
TXT	Transmit terminator
1S	1 second
12MS	12 milliseconds
50MS	50 milliseconds

TABLE 1.03 Tie Trunk Circuit Conditions

CIRCUIT CONDITION	HEXADECIMAL CODE	IDENTITY 8 I1	4 I2	2 I3	1 I4	STATUS OUT 8 SO1	4 SO2	2 SO3	1 SO4
Trunk Busy	E7	1	1	1	0	0	1	1	1
Intrude	EB	1	1	1	0	1	0	1	1
Apply Ringtone	E3	1	1	1	0	0	0	1	1
Inhibit Decode Terminator	ED	1	1	1	0	1	1	0	1
Write Station Number	E5	1	1	1	0	0	1	0	1
Conference	E9	1	1	1	0	1	0	0	1
Clear Station Number	E1	1	1	1	0	0	0	0	1
Add-On	EE	1	1	1	0	1	1	1	0
Write Attendant Number	26, 66, A6	X	X	1	0	0	1	1	0
Consultation Hold Request	EA	1	1	1	0	1	0	1	0
Consultation Hold	EC	1	1	1	0	1	1	0	0
C.O. Release	E4	1	1	1	0	0	1	0	0
"E0"	E0	1	1	1	0	0	0	0	0
"E2"	E2	1	1	1	0	0	0	1	0
"F8"	F8	1	1	1	1	1	0	0	0

TXO and RXO voice paths are enabled via U32 pin 5 and the OLST and OLSU leads; and tie trunk functions as a line circuit. When the attendant answers, an SI3 signal is generated via U46 pin 3 which causes U81 pin 8 and U5 pin 2 to go low and operate the RB relay.

2.07 Incoming Call to Trunk (or Tie Trunk). An incoming tie trunk party may dial an access code for a trunk or another tie trunk. In this case, the tie trunk acts as a line circuit and is scanned on the terminating side of the trunk's (or tie trunk's) time slot. U22 pin 13 is made high by U30 pin 2 and U15 pin 3. The status-out of the tie trunk is "FF," and the TA lamp is lit. The TXT and RXT voice paths are enabled via Q4 and Q14 during the TLS signal and dial pulses are transmitted via the OHT signal. The L relay follows the dial pulses via U43 pin 5, U31 pin 13 and U29 pin 9. The RB relay operates when the CSA (called subscriber answered) lead goes low. This is because U19 pin 6 is high, U12 pin 8 goes low and U5 pin 8 goes high to turn on Q30 which operates the RB relay.

2.08 Outgoing Call - Attendant Origination. The attendant may originate an outgoing tie trunk call by depressing an idle tie trunk key. This causes the TS (trunk seize) lead to go low; U41 pin 9 goes high and a WAN signal will be generated as U72 pin 10 goes low. The processor sends SI1 and SI3 signals which operate the LST relay. A voice path is now established between the attendant, who receives dial tone, and the tie trunk. Dial pulses on lead SI3 are transmitted via the P_1 and P_2 relays. When the distant PABX answers, the battery reversal is detected through the LC relay, supervision is transmitted on the CSA lead, and the answer latch operates.

When the distant PABX releases, the LC relay will drop and the central office release timer U2 will be enabled. After 100 to 600 milliseconds, depending on the strapping of the timer, U54 pin 11 goes low; the processor removes the SI1 signal and the tie trunk becomes idle.

If the attendant presses the RELEASE bar before the distant PABX answers, U8 pin 8 goes low and U72 pin 4 goes low. The LST relay and the L relay release; the RLSE relay operates and enables the COR timer. U73 pin 2 goes low and the processor removes the SI1 signal to return the tie trunk to idle.

If the attendant presses the RELEASE bar after the distant PABX has answered, U51 pin 8 goes low. U8 pin 10 goes low and a clear station number signal is generated at U72 pin 4. The RLSE relay operates as U8 pin 8 goes low; the TB relay will remain operated as long as the distant PABX is off-hook thus preventing a CO release. When the distant PABX releases, the TB relay is released, the COR timer is enables, and U73 pin 2 goes low. The processor removes the SI1 signal and the tie trunk returns to idle.

2.09 Outgoing Call - Attendant Transfer. After originating a call as described in paragraph 2.08, the attendant may transfer the tie trunk to a TD-100 station. When the attendant presses the attendant line key, the tie trunk is put on automatic hold (HOT); its status-out is "ED" (INHIBIT).

After dialing the station number, the attendant presses the CONNECT bar; the WST# (write station number) lead at U72 pin 2 will go low. The processor sends SI1 and SI11 signals; the attendant's latch U41 is reset and the status-out of the tie trunk changes to "E3" (apply ring tone). When the station answers, and SI3 signal (off-hook terminator) is received and the status-out of the tie turn changes to "E7" (tie trunk busy).

If the distant PABX releases first, the LC relay will drop as described in paragraph 2.08. If the TD-100 station goes on-hook first, counters U3 and U4 are enabled; after approximately 1.6 seconds, the RLSE relay operates. U8 pin 8 and U72 pin 4 go low, and when the distant PABX releases, the TB relay releases and the COR timer is enabled. After 100 to 600 milliseconds (depending on strapping) U73 pin 2 goes low and the processor removes the SI1 signal allowing the tie trunk to return to idle.

2.10 Outgoing Call - Station Origination. When a TD-100 station goes off-hook and dials a tie trunk access code, the processor seizes an idle tie trunk by sending SI1 and SI3 signals. The LST relay operates, the station receives second dial tone and the call proceeds as described in paragraph 2.08.

2.11 Outgoing Call - Station Transfer. A station user momentarily depresses the hookswitch to initiate a tie trunk transfer. This momentary depression, or flash, enables counters U3 and U4. A consultation hold request is generated with U14 pin 6 and U73 pin 12 low. The processor sends an SI6 signal and the tie trunk status changes from "EA" (consultation hold request) to "EC" (consultation hold). The station user may now dial a station number that is free or busy, or may dial "O" for connection to the attendant.

If the dialed station is busy, the processor sends an SI8 signal. Latch U77 pin 12 will be set high which enables counters U3 and U4 by marking U77 pin 8 low. After 4 seconds, latch U77 will be reset changing the status-out of the tie trunk from "EC" to "E7." Busy tone is transmitted to the originating station as Q10 is off and Q11 is on.

When the dialed, or terminating, station is free and goes off-hook to answer, and the transfer originator flashes the hookswitch a second time, the terminating station will be placed in a transfer link. The tie trunk receives an SI7 signal which changes its status-out to "EE" (add-on). A three-way conversation is enabled between the two stations and the tie trunk. When one station goes on-hook, the other station number is placed on the terminating side of the tie trunk's time slot and the tie trunk's status-out changes to "E7."

If the station dials "O" (for attendant assistance), the processor sends and SI12 signal to the tie trunk. U62 pin 6 goes low and the tie trunk's status-out changes to "E3" (apply ring tone). The attendant is alerted by the buzzer and flashing TA and TB lamps. When the attendant answers, U41 pin 9 and U62 pin 9 go high and U62 pin 8 goes low. The attendant is connected to the station via the AIN lead. When the station goes on-hook, U72 pin 4 goes low and the tie trunk's status-out becomes "F1." The processor sends SI1, SI3 and SI11 signals and U62 pin 8 goes high. The attendant's number is written on the terminating side of the tie trunk's time slot and the voice path is enabled between the tie trunk and the attendant.

2.12 Outgoing Call - To Tie Trunk. An incoming trunk party may request and gain access to a tie trunk. The attendant accesses the tie trunk by pressing the attendant line key and dialing the tie trunk access code. The TA and TB lamps associated with the selected tie trunk light. The TA lamp associated with the incoming trunk winks

(on automatic hold) and the attendant receives dial tone from the distant PABX.

The processor applies SI1, SI3 and SI9 signals to the tie trunk and writes the tie trunk's number on the terminating side of the (incoming) trunk's time slot. The attendant then dials the distant PABX number; the dial pulses enter the line circuit via the SI3 lead and are transmitted via the P relays and C relay in the same manner as from a station. (See paragraph 2.08) SI1 and SI3 signals from the processor operate the LST relay and the SI9 signal marks U61 pin 9 high. With the exception of U61 pin 9, all conditions are identical to any outgoing call.

When the attendant presses the CONNECT bar (with U61 pin 9 high), the status-out of the tie trunk changes to "F8," and the tie trunk acts as a line cirucit. Monostable U22 pin 13 goes high via U24 pin 1, putting the tie trunk into a tandem mode of operation. The status out is "FF" and the TA lamp is lit.

The RXT and TXT FET's are operated to establish a voice path between the trunk and the tie trunk. The tie trunk transmits its off-hook condition to the trunk via the OHT lead. In all outgoing calls, pin 3 of counters U45, U34 and U28 are enabled and then reset after each dial pulse. This enables the tie trunk to disregard erroneous release signals from the distant PABX during dialing. The tie trunk may be strapped to disregard release signals of 8 seconds, 16 seconds, or 32 seconds.

2.13 Tie Trunk on Hold. When the attendant is connected to the tie trunk, its status-out is "E7." The attendant may put the tie trunk on manual hold by depressing the HOLD key, and may put the tie trunk on automatic hold by selecting another trunk or line. In either case, the status-out of the tie trunk becomes "ED."

When a tie trunk is on automatic hold, its corresponding TA lamp winks and its TB lamp lights. When the manual HOLD key is depressed, U38 pin 9 is low, U41 pin 6 is low, U54 pin 8 is high, and U72 pin 1 is low. The TA lamp winks and the TB lamp is extinguished; the CONNECT and RELEASE bars and the function control keys (CONF, PAGE, CODE, etc.) are inhibited with respect to the tie trunk (s) on manual hold.

2.14 Tie Trunk In Conference. A tie trunk may be put into the conference cirucit by the attendant. In this case U63 pin 11 goes low, U72 pin 3 goes low, and the status-out of the tie trunk becomes "E9." The processor sends an SI10 signal and the attendant's latch is reset via U75 pin 1 high and U76 pin 8 high. The tie trunks status-out changes to "E7" via U50 pin 6 low, U76 pin 6 high, and U72 pin 11 low.

STATION HUNTING
(410165)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with a maximum of two station hunting printed circuit boards (PCB's). The station hunting feature enables a call to be routed to an idle station line in a prearranged hunt group when the dialed station line is busy. The master-slave principle is used; one selected line is the master and the other station lines within the hunt group are slaves.

Each station hunting PCB may be strapped to provide:

a. A maximum of eight individual hunt groups with a master and three hunt station lines.

b. A single hunt group with a master and 24 hunt station lines.

c. Any combination within a and b.

ITT Publication OB-000-003 provides complete station hunt strapping information.

2.00 DETAILED DESCRIPTION

2.01 General. The main input to the station hunting circuit is the number input block where the station numbers are assigned to the hunt groups (strapping field A). The hunt groups block contains eight groups of four stations each, and the outputs of the groups terminate in strapping field B. The other side of strapping field B is the number output block where the strapped numbers are converted into binary coded decimals (BCD) for transmission to the memory.

2.02 Operation. Consider this example; group 1 is strapped such that station line 31 is the master, 32 and 33 are slaves, and 34 is last.

When station line 31 is dialed, the input of hunt group 1 master circuit is enabled via the strapping field in the number block, and the latch in group 1 is set. If station line 31 is free, then a signal on lead SI-4, generated by the processor, will trigger the monostable multivibrator in the hunting control logic block and its output will reset the latch in hunt group 1.

If station line 31 is busy, no signal will be sent on lead SI-4 and the group 1 latch will remain set. This output is connected (in strapping field B) to station line 32, and this number is stored in the number output block. The station hunting circuit signals on the SH (station hunting) lead and the IB (inhibit) leads to the processor that a station hunt is in progress. The number now stored in the number output block, 32, must be transmitted to the memory in the read time slot of the register concerned. This is accomplished by the NE (number enable) lead which enables the number output in this time slot.

This new number, 32, is now clocked through the memory; the line circuit is scanned to determine if it is free or busy. Simultaneously, the number appears at the first slave input of group 1 via the number input block. If this number is free, the group 1 latch is reset, and if it is busy, the next number, 33, is generated. If all stations in a group are busy, when the last station in the group, 34, is scanned the group latch is reset and the hunting sequence is terminated.

2.03 Special Features. The TD-100 station hunting circuit has additional features. A hunt group is enabled only the first time a master station line is scanned. This condition is signaled by a ground on the TRO (terminate register out) lead in the hunting control logic block.

Strapping point N1 to point N2 in the hunting control logic block inhibits hunting when the system is switched for night answer. This control block also ensures that all group latches are reset when the PCB is first plugged-in, or the power first applied.

REGISTER
(410166-002, 410166-003)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. Each TD-100 EPABX is provided with four registers. Each register has as its function the acceptance of dialed information from the originating circuit.

Registers accept dial pulses and, with the addition of an optional TEL-TOUCH® receiver, will accept multifrequency (MF) signals. The register will accept and translate up to three digits to a binary code for presentation to the processor. Also transmitted is the register's identity and status; that is whether it is idle, busy or seized. Each register is equipped with a time-out feature that causes the calling line to be placed on lock-out and the register to release if the first digit is not received within 8 or 16 seconds after the register is seized.

NOTE: TD410166-003 times out in 16 seconds; TD410166-002 and earlier generations time out in 8 seconds.

Each register printed circuit board (PCB) is equipped with a busy switch to remove the unit from service, a light emitting diode (LED) indicator to show whether the register is idle, busy or seized, and a power-on LED indicator. Table 1.00 gives some register abbreviations and their explanations.

2.00 DETAILED OPERATION

2.01 General. Operation of the registers may be divided into five basic functions for consideration; seizure, receipt of dial signals, trunk call transfer, consultation hold, toll restriction and register release. The following paragraphs describe each section. Figure 1.00 is a simplified block diagram of a TD-100 register and may be consulted during each description.

2.02 Seizure. When a station goes off-hook, the processor looks at the status of each register and, if an idle register is found, the OHO (off-hook originator) instruction (logic 0) is sent from the processor to the register on the SI-2 lead. The seize instruction (logic 0) is sent on the SI-1 lead at the same time and is latched at the output of the latch circuitry. The busy LED (CR1) lights and the status-out is changed to "77." The processor applies dial tone to the originating station and if there is no digit dialed from the station within 8/16 seconds of the off-hook condition, through the counter U7, the register times out.

Through U34 and U27, the lock-out status, "75," of the register is sent to the processor which applies a lock-out condition to the station. The register re-

TABLE 1.00 Register Terms

ABBREVIATION	MEANING
I-1	Identity
RXEN	Receive enable
RXT	Receive terminate
SCR	Scan channel read (send info to processor)
SCW	Scan channel write (accept info from processor)
SI-1	Seize
SI-2	Off-hook originator
SI-4	Free
SI-5	From trunk
SI-7	Reset
SI-8	Busy
SI-9	Trunk reset
SO-1 thru SO-4	Information to processor
SPR	Status pulse record
TO-1 thru TO-4	Terminate out (tens digit)
TO-5 thru TO-8	Terminate out (units digit)
TO-9 thru TO-12	Terminate out (hundreds digit)
1S	One-second clock
1 thru 6	Information from Tel-Touch receiver

leases while the processor removes all requests to the register which returns to the idle state.

Signaling within the TD-100 is in binary coded hexadecimal form. Table 1.01 gives hexadecimal and alphanumeric equivalents.

2.03 Receipt of Dial Signals. If the register is seized and the first digit is dialed with 8/16 seconds of the off-hook condition, the dial pulses come to the register on the SI-2 leads and, through U25, U8, U6 and U23, go to U4, the digit counter. "Digit in" information is sent through U22 to U34 and through U27 to the processor as the new status, "7B," of the register. Dial tone is then removed from the originating station.

If the first digit dialed came from a Tel-Touch phone, then the digit passes through the Tel-Touch receiver to the register (two inverters of U1 and two nand gates of U12). U16, U15, and U3 comprise the interface circuitry between the Tel-Touch receiver and the register. The binary output from the Tel-Touch receiver interface is nor-gated with the outputs of the dialed digit counter, U4, to send the first digit out to the processor on leads TO-9 through TO-12.

From the Tel-Touch receiver interface, the first "digit in" information is also sent out on the status-out leads through U23, U13, U22, U34, and U27. For the second digit from a Tel-Touch or rotary dial phone, a similar operation occurs except that U22 is clocked a second time and U19 is enabled to send the digit out on the TO-1 through TO-4 leads to the processor.

Timing circuitry, consisting of U8, U6, and associated components, determines the minimum inter-digital time (approximately 100-150 milliseconds). Each time a digit comes into the register, the time-out counter, U7, is reset. The status-out to the processor is sent from U27 to keep the processor informed about the "digit in" state of the register. When the second digit is in, the processor looks to see if it is strapped for two such digits (example 91, 92, etc.), indicating a request for special service. If the processor is strapped for the first two digits, it then performs the necessary operation according to the strapping by allotting a suitable time slot to the originating circuit and passing the necessary information from the "TO" leads to be stored in the memory.

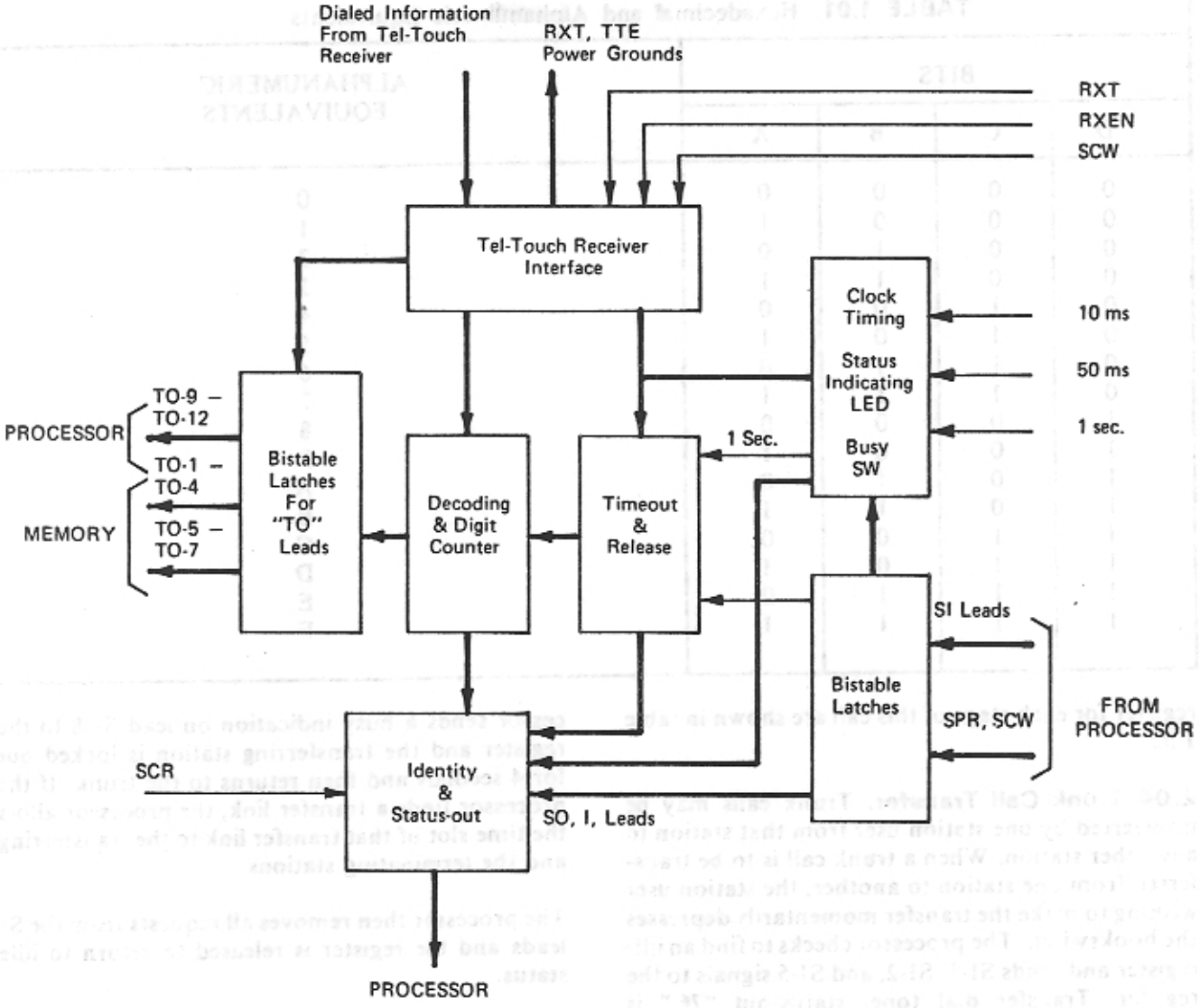

FIGURE 1.00 Register Block Diagram

If the processor does not find any strap for the first two digits indicating special service, then the processor recognizes a station number and the third digit is sent into the register in a similar manner as the first two, except that U22 is clocked again and the third digit is sent out on leads TO-5 through TO-8 to the memory through latch U20 and the surrounding circuitry. After the third digit is in, the processor checks the "free or busy" status of the terminating line circuit. If the terminating station is free, the processor sends a free indication on lead SI-4 to the register. Through U33, U17, U34, and U27, the new status of the register is sent out to the processor which allots a suitable time slot (e.g., the time slot of a free link) to the originator and terminator. After this transfer, the processor removes all input requests from the SI leads and the register returns to the idle status.

If the terminating station is idle, but the processor cannot find a free link, it removes all input requests from the SI leads and releases the register. The originating station is then locked out.

If the called station is busy, the processor sends the "busy line" information on lead SI-8 to the register, the register status changes and the originating station is locked out. The status leads of the

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

register for each stage of this call are shown in table 1.02.

2.04 Trunk Call Transfer. Trunk calls may be transferred by one station user from that station to any other station. When a trunk call is to be transferred from one station to another, the station user wishing to make the transfer momentarily depresses the hookswitch. The processor checks to find an idle register and sends SI-1, SI-2, and SI-5 signals to the register. Transfer dial tone, status-out "76," is applied to the station that put the trunk on hold.

NOTE: TD410166-002 and earlier generations have interrupted dial tone instead of transfer dial tone as in TD410166-003.

The transferring station user dials the number and the processor removes dial tone, status-out "7A," from the transferring station and puts the pulses on lead SI-2. If the dialed station is busy, the processor applies a busy indication on lead SI-8 to the register and the transferring station is locked out and returns to the trunk after 4 seconds. If the terminating station is not busy, the processor sends the free line indication on lead SI-4 and looks for a transfer link. If all transfer links are busy, the processor sends a busy indication on lead SI-8 to the register and the transferring station is locked out for 4 seconds and then returns to the trunk. If the processor finds a transfer link, the processor allots the time slot of that transfer link to the transferring and the terminating stations.

The processor then removes all requests from the SI leads and the register is released to return to idle status.

If the transferring station momentarily depresses the hookswitch, then the trunk, terminating and transferring stations are all connected through the add-on link and the transfer link is released. If one of the stations goes on-hook, the remaining station is connected to the trunk on the trunk's time slot and the add-on link is released. If the add-on link is busy when a station tries to add on, the transferring station returns to the trunk and the register releases. The status leads of the register for each stage of this call are shown in table 1.03.

2.05 Consultation Hold. Trunk calls may be put on permanent hold by the station user momentarily depressing the hookswitch and dialing the consultation hold code. On receipt of this signal, the processor sends SI-1, SI-2, and SI-5 signals to the reg-

TABLE 1.02 Register Status Leads* (when seized by station)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Idle	1	1	1	1	1	1	1	1	1	1	1
Seized from a station	0	0	1	1	1	1	1				
Dial tone to station								0	1	1	1
Station dials	0	0	1	1	1	1	1				
Digit in, dial tone removed								1	0	1	1
End of dialing, line idle	0	0	0	1	1	1	1				
Transfer to link								0	0	1	1
End of dialing, line busy	0	0	1	1	1	0	1				
Apply lock out to station								0	1	0	1
Call terminated (on hook, time out, ETC)	0	1	1	1	1	1	1				
Register released								0	0	0	1
Idle	1	1	1	1	1	1	1	1	1	1	1

* The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

TABLE 1.03 Register Status Leads* (when seized via station by a trunk)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Seized via station by a trunk	0	0	1	0	1	1	1				
Apply transfer dial tone								0	1	1	0
Station dials, trunk waiting	0	0	1	0	1	1	1				
Digit in, dial tone removed								1	0	1	0
End of dialing line idle	0	0	0	0	1	1	1				
Transfer to line								0	0	1	0
End of dialing line busy	0	0	1	0	1	0	1				
Apply lock out to station								0	1	0	0
Call terminated (on hook, time out, ETC)	0	1	1	0	1	1	1				
Register released								0	0	0	0
Idle	1	1	1	1	1	1	1	1	1	1	1

*The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

ister as in the case of a transfer. After the consultation hold code is sent into the register, the processor recognizes the code and sends an SI-7 signal to reset the register and removes the SI-5 signal. The station user can then accomplish station-to-station, station-to-trunk, or any other call as if there were no trunk waiting. The station will not return to the trunk until the re-access code to the trunk is dialed from the station.

2.06 Toll Restriction. If a trunk number is dialed from a station not toll restricted, then the requested trunk time slot is allotted to the originating line and the register is released. If an originating station is toll restricted and dials a toll trunk number, the processor checks the restriction; SI-1 and SI-2 signals sent originally to the register are followed by SI-9 and SI-5 signals. If a code disallowed by the COS toll restrictor is dialed, the processor removes all SI inputs, releases the register and sends a lockout tone to the originating station. If the dialed code was an allowed code, then the processor sends an SI-7 signal which resets the register to accept more digits and the requested trunk is seized.

The toll restrictor feature board places restrictions on digits dialed following the access code. When the next digit is dialed, it is sent to the processor on leads TO-9 through TO-12; when the processor recognizes the digit as an allowed digit, it sends an SI-7 signal to the register. The register is then reset to accept the next digit on leads TO-9 through TO-12. After every digit, an SI-7 signal is sent to reset the register and each succeeding digit is sent on the TO-9 through TO-12 leads until the trunk's slot is allotted to the originating station. The register is then released and returns to the idle state.

Ordinary COS toll restriction is dealt with by the processor differently from the toll restrictor feature board in that the SI-7 signal is only sent to the register once to reset it. The next digits are sent in exactly the same manner as an ordinary call from a station. The register would take up to three digits in to put the three digits on the TO-9 through TO-12 leads for the first, TO-1 through TO-4 leads for the second, and the TO-5 through TO-8 leads for third digit. The status leads of the register for each stage of this call are shown in table 1.04.

2.07 Register Release. If a station goes on-hook after being off-hook for less than 8/16 seconds, goes on-hook after dialing an incomplete number, or goes on-hook after dialing a complete code or number but before the register is reset, then U24 and its associated circuitry releases the register while the processor takes off all input requests from the SI leads. The register sends out a terminate status of "70," "71" or "7E" depending upon whether the register was seized by a trunk via a station, or seized by a toll restricted station. The register release could be due to an on-hook, inter-digit time-out, or register time-out.

TABLE 1.04 Register Status Leads* (when seized by toll-restricted station)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Seized by Toll Restricted Station	0	0	1	1	1	1	1				
Dial tone to station								0	1	1	1
Station dials	0	0	1	1	1	1	1				
Digit in, dial tone removed								1	0	1	1
End of code dialing, toll restriction checked	0	0	1	0	0	1	0				
Dialed circuit seized (trk) register reset								1	0	0	0
First digit in (SI-7 only for T.R. Feature BD after every digit in)	0	0	1	0	0	1	0				
Register reset (only when T.R. Feature BD in)								1	0	0	0
Final digit in (only when T.R. Feature BD in)	0	0	1	0	0	1	0				
Register reset (only when T.R. Feature BD in)								1	0	0	0
Terminate toll restriction	0	0	1	0	1	1	1				
Register released								1	1	1	0
Off hook removed	0	1	1	0	1	1	1				
Idle	1	1	1	1	1	1	1	1	1	1	1

*The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

TEL-TOUCH® RECEIVER (410167) TD-100 ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with one Tel-Touch receiver PCB (printed circuit board) per register. The Tel-Touch receiver PCB is mounted as an addition to the TD-100 register PCB and is signaled via the register. The purpose of the Tel-Touch receiver is to detect the DMF tones sent from station instruments equipped with Tel-Touch push-button dials, and to convert these tones to digital signals that are acceptable to the register for further processing.

2.00 DETAILED DESCRIPTION

2.01 General. Tel-Touch tone samples are received on the RXT (receive terminator) lead and passed via an FET (field-effect transistor) to operational amplifiers where the samples are reconstructed, filtered, and amplified. The tones are separated into high and low frequency tone groups by the high and low pass filters. The high and low tone groups, in turn, each drive one limiter of the dual limiter circuit. The output of the low tone group limiter drives four filter detectors, one each for 697, 770, 852, and 941 Hz. The high tone group output drives three filter detectors, one each for 1209, 1336, and 1447 Hz.

Each of these seven filter detectors drives the non-inverting (+) input of a voltage comparator. The seven comparators have a common inverting (-) input reference voltage provided by the power regulator of the high/low-pass filter PCB. Whenever a tone of the correct frequency is detected by the filter detector, it will cause its corresponding comparator to switch from a logic high to a logic low. The comparator output signals are amplified, inverted, and provide inputs to two dual-input NAND gates which generate coded digital dial signals on leads 1 and 4, and to the four eight-input AND/OR inverters which generate coded digital dial signals on leads 2, 3, 5, and 6. These coded digital dial signals are then passed to the register for further processing.

2.02 Input. Tel-Touch tone samples are provided to the Tel-Touch receiver via the RXT lead when FET (field-effect transistor) Q2 is conducting. Q2 is turned on when the TTE (Tel-Touch enable) lead is low. This occurs for one-half microsecond every 64 microseconds during the SCW (scan channel write) time slot.

Components R4 and C1 comprise a sample and hold network and, with operational amplifier U10 and an RC filter network, reconstruct the composite tones. These tones are passed to the inputs of the high and low pass filter.

2.03 Filters and Regulator. The circuitry for the high and low-pass filters and the power regulator is mounted on a separate PCB attached to the Tel-Touch receiver board. Composite tones are fed simultaneously into the low-pass (965 Hz) filter (pin 9), and the high-pass (1185 Hz) filter (pin 6). From this point, two separate low and high tone groups are amplified; the low tone group is output on pin 7 and the high tone group on pin 5.

The power regulator circuitry provides reference voltages, internal ground, and +Vcc, and -5V used in the analog circuitry for the reconstruction of the dialed Tel-Touch tones.

2.04 Dual Limiter. The dual limiter consists of three op/amps interconnected such that two of them amplify signals coming from the low and high pass filters. The third op/amp provides the reference voltage to the non-inverting inputs (+) of the first two. This arrangement permits the low and high tone group signals to be referenced to the same precision voltage and thus not be clipped or distorted.

2.05 Frequency Detectors. There are seven filter frequency detectors. These are each composed of four op/amps interconnected in a chain with external RC components to filter through and detect one of the Tel-Touch tone frequencies.

The filter detectors are divided into two groups; each op/amp in a group has a common input (pin 13). The low tone group consists of detectors for 697 Hz, 770 Hz, 852 Hz, and 941 Hz. The high tone group has detectors for 1209 Hz, 1336 Hz, and 1477 Hz. The output of each filter detector is at +24 volts when a tone of its frequency is not present, and at +19 volts when a tone of its frequency is present.

2.06 Digital Output and Register Interface. Integrated circuits U7 and U8 make up the seven comparator circuits necessary to convert the detector outputs to TTL-compatible logic levels (OV and +5V). The output of each filter detector drives the non-inverting input of a comparator. The inverting inputs of all comparators are connected to a common reference level of approximately +19 volts from the power regulator section (pin 3).

When a tone is detected, the non-inverting input is at +19 volts and the output of the comparator is therefore 0 volts; conversely, when the non-inverting input is at +24 volts (no tone present) the output will be at +5 volts. Because of the limited drive capability of the comparator (fan-out equals 3), seven inverter driver circuits are used, one at each comparator output.

The logic levels from the driver outputs are coded by the 2 NAND gates of U1 and the AND/OR inverters of U2, U3, U4, and U5. The codes thus generated on leads 1 through 6 are presented to the register for further processing. Table 1.00 shows the status of the tone detectors and the logic level on leads 1 through 6 for each digit sent by the Tel-Touch equipped station. Note that the register lead levels are all high for both the asterisk and pounds sign; this indicates to the register that an unacceptable digit has been dialed.

TABLE 1.00 Tel-Touch Receiver-Register Correlation

DIGIT DIALED	TEL-TOUCH TONES							LEVELS ON REGISTER LEADS					
	LOW GROUP				HIGH GROUP								
	697	770	852	941	1201	1336	1477	1	2	3	4	5	6
1	✓				✓			1	0	1	1	1	1
2	✓					✓		1	1	0	1	1	1
3	✓						✓	1	0	0	1	1	1
4		✓			✓			1	1	1	1	0	1
5		✓				✓		1	0	1	1	0	1
6		✓					✓	1	1	0	1	0	1
7			✓		✓			1	0	0	1	0	1
8			✓			✓		1	1	1	1	1	0
9			✓				✓	0	1	1	1	1	0
0				✓		✓		1	1	1	0	1	0
*				✓	✓			1	1	1	1	1	1
#				✓			✓	1	1	1	1	1	1

LINK (LOCAL AND CONFERENCE)
(410168)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. Each TD-100 EPABX may be equipped with a maximum of 12 local and conference links. The sole purpose of a local link is to monitor the status of the originating and terminating stations on station-to-station calls. The conference link has a different assigned identity (12 or 13) and is used to monitor station conference calls.

2.00 DETAILED DESCRIPTION

2.01 General. As with all channel circuits in the TD-100 system, the local link is scanned every 64 microseconds. Information is written into the link from the processor in the form of 1 microsecond pulses during the write scan; information is passed from the link to the processor during the read scan, again, as 1 microsecond pulses. The link decides, on the basis of the information received from the processor, when the terminating station has been answered and when one of the stations releases.

Information from the processor is received and stored in the status input logic block (U102). The station release timer (U104) times on-hook signals from the processor. If a station is on-hook for more than 300 milliseconds, a release signal is sent to the processor via the status output logic block (U101).

Also included in each link circuit is a busy switch used to make the circuit busy and to cause the busy (light emitting diode) to light.

ATTENDANT REGISTER AND LINK
(410169)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. Each TD-100 EPABX is equipped with one attendant register and link printed circuit board (PCB). This PCB contains two attendant link circuits and one attendant register circuit.

2.00 ATTENDANT REGISTER

2.01 General. The attendant register is used exclusively by the attendant to originate calls to extensions and to connect trunk calls to extensions. The attendant gains access to the attendant register by pressing the ATT LINE button on the console; the connect, release, hold and busy verification controls may also be used to manipulate the attendant register. The attendant register therefore acts as an interface between the console and the TD-100 common control circuitry. Figure 1.00 is a block diagram of the attendant register and table 1.00 gives register terms and their meaning.

2.02 Seizure and Dialing. The attendant seizes the circuit by pressing the ATT LINE button on the console which causes a ground to be applied to the OGL lead in the console input logic block. This signal enables the digit counter and various latches in the status input logic block, and causes the status output logic block to output a dial tone enable status during the read enable time slot. (Table 1.01 provides the status-out lead conditions and their meanings.)

The attendant now dials the required number. The digits are received on leads DL1-4 and DH1-3, decoded in the digit input logic block, counted by the digit counter block, and sent to the memory via the TO leads from the digit output logic block during the read enable time slot.

After the first digit has been received, the digit counter gives an output which changes the status from dial tone enable to digit in. This status causes the processor to remove dial tone from the attendant register.

After the third digit has been received and transmitted to the memory on the TO leads from the digit output logic block, the processor sends an SI-7 signal during the attendant register write enable time slot to reset the number on the TO leads. The signal is received in the status input logic block and resets the digit counter.

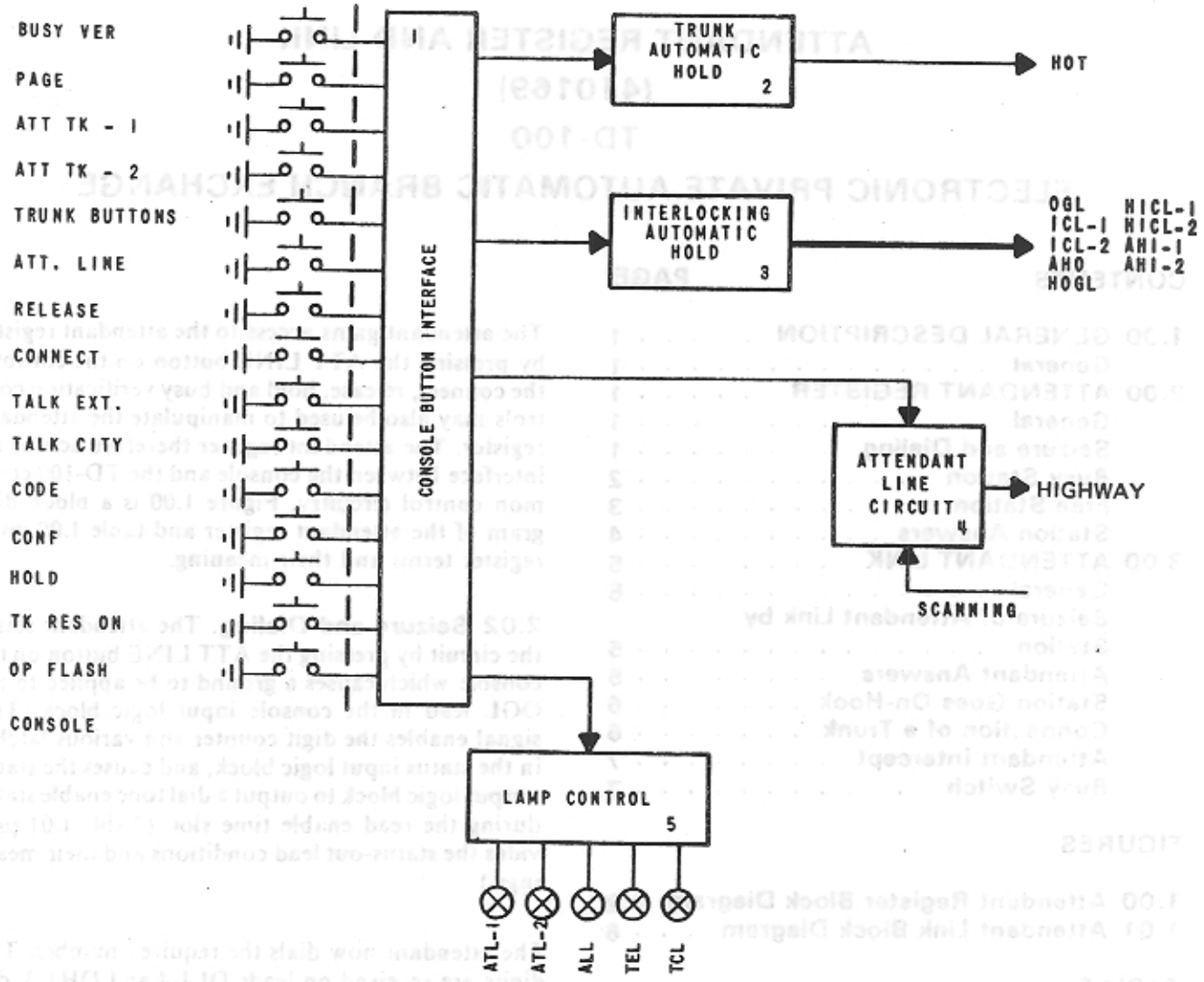

FIGURE 1.00 Attendant Register Block Diagram

2.03 Busy Station. If the called station is busy, the processor will send an SI-8 signal, which is received by the status input logic block during the write enable time slot, is stored, and causes a busy tone enable status to be sent to the processor from the status output logic block during the read enable time slot. Upon hearing the busy tone, the attendant has three options available.

a. If the call is to be connected to a trunk, the attendant can press the CONNECT button which will cause the CONN lead in the console input logic block to go high. This will result in the CPO lead going low, and a connect status being sent to the processor via the status output logic block. The logic release timer is enabled by the connect signal and will give an output after approximately 450 microseconds. This signal is used to release the associated logic in the attendant control circuit.

The connect status to the processor will cause the processor to transfer the dialed number to the appropriate trunk, and release the attendant register; the CPO signal will cause the trunk to switch into the camp-on mode.

b. The attendant can operate the BUSY VER button on the console in order to intrude onto the busy line. This will cause the TRUC lead in the console input logic block to go low, resulting in an intrude status being sent

TABLE 1.00 Attendant Register Terms

ABBREVIATION	MEANING
AHO	Automatic hold outgoing
CONF	Conference
CONN	Connect
CPO	Camp-on
DL1, DL2, DL3, DL4	Dial (longitudinal)
DH1, DH2, DH3	Dial (horizontal)
HOGL	Hold outgoing link
HOT	Hold trunk (automatic)
OGL	Outgoing link
RLSE	Release
SI-3	Status-in 3 (off-hook terminator)
SI-4	Status-in 4 (tested line is free)
SI-5	Status-in 5 (internal reset)
SI-6	Status-in 6 (conference)
SI-7	Status-in 7 (reset digit counter and number)
SI-8	Status-in 8 (tested line is busy)
TRUC	Busy verification key operated

TABLE 1.01 Attendant Register Status-Out*

FUNCTION	SO-1	SO-2	SO-3	SO-4
Seize (dial tone)	0	1	1	1
Digit in	1	0	1	1
Ring tone	0	0	1	1
Busy tone	1	1	0	1
Hold	0	1	0	1
Intrude	1	0	0	1
Conference	0	0	0	1
Connect	1	1	1	0
Lock-out	0	1	1	0

*Identity remains 9.

to the processor from the status output logic block. This status condition will remain as long as the attendant has the BUSY VER button pressed, and will cause the processor to switch the attendant onto the busy line with a warning tone superimposed on the connection. After delivering the message, the attendant can exercise the third option.

c. The attendant can release the attendant register by operating the RELEASE button on the console. This will cause the RLSE lead in the console input logic block to go high and enable the logic release timer which will give an output after approximately 450 microseconds. The output will reset the associated logic in the attendant control circuit which will remove the signal on the OGL lead and release the attendant register.

2.04 Free Station. If, after dialing a station number, that station is found to be free, the processor will send a signal on the SI-4 lead in the status input

logic block during the write enable time slot. This signal is latched and causes a ring tone enable signal to be sent to the processor during the read enable time slot via the status output logic block; the attendant hears ringback tone.

2.05 Station Answers. If the called station answers, its off-hook condition is passed to the attendant register on the SI-3 lead in the status input logic block. This signal resets the ring tone enable status and causes a digit-in status to be sent to the processor via the status output logic block. This status condition will cause the processor to remove ringback tone and enable a conversation between the attendant and the called station.

Having established a connection, the attendant has many options available.

a. The attendant can put the attendant register on automatic hold by pressing a CO trunk button or by pressing the TALK CITY button. This will cause the AHO lead in the console input logic block to go low which inhibits the release function and presents a hold status to the processor via the status output logic block. This status causes the processor to continue to scan the station but to inhibit scanning of the attendant line in this time slot, so that the station and the attendant cannot speak to each other. If the automatic hold is removed by pressing the TALK EXT button or the ATT LINE button, the AHO signal will be removed and the attendant register will restore to a digit-in status condition.

b. The attendant can put the attendant register into manual hold by pressing the HOLD button or one of the ATT TK buttons. This causes the HOGL lead in the console input logic block to go low, which inhibits both the release and connect functions and presents a hold status to the processor as in automatic hold.

When the hold is removed by pressing the ATT LINE button, the low signal on HOGL is removed and the attendant register restores to a digit-in status condition.

c. The attendant can put the called station into conference by pressing the CONF button on the console. This will cause the CONF lead in the console input logic block to go low, presenting a conference request status-out to the processor via the status output logic block.

When the processor receives this signal, it will search for a free conference link, and having found one, will seize it and write the called station number into its memory slot. The processor will then send an SI-6 signal to the attendant register during the write enable time slot.

This signal is received in the status input logic block and resets the free/busy latches, the station release timer, the digit counter and the conference request status and restores the circuit to a dial tone enable status condition.

d. After completing conversation with the called station, the attendant can release the attendant register by pressing the RELEASE button on the console. This will cause the RLSE lead in the console input logic block to go high, enabling the logic release timer and presenting a lockout status to the processor via the status output block. The lockout status causes the processor to lock out the called station and send busy tone. The logic release timer gives an output after approximately 450 microseconds which resets the associated logic in the attendant control circuit to remove the OGL signal to the attendant register and release it.

e. After completing the conversation with the attendant, the called station can release by going on-hook. This on-hook condition is signaled to the attendant register by a high signal on lead SI-3 during the write enable time slot. This signal is stored in the status input logic block and enables the station release timer, which times the on-hook period. After 150-200 milliseconds, the station release timer gives an output which presents a lockout status to the processor via the status output logic block and enables the logic release timer.

The lockout status to the processor will cause the called station to be locked out and hear busy tone, and the logic release timer, after approximately 450 microseconds, will reset the associated logic in the attendant

control circuit and release the attendant register.

f. If the attendant has called the station with the intention of connecting it to a previously seized trunk, this can be accomplished by pressing the CONNECT button on the console. This causes the CONN lead in the console input logic block to go high, presenting a connect status to the processor via the status output logic block and enabling the logic release timer. The connect status will cause the processor to transfer the called station number from the attendant register memory slot to the appropriate trunk memory slot. The logic release timer will time out in approximately 450 microseconds and the output will reset the associated logic in the attendant control circuit and release the attendant register. The connect sequence can also be performed before the called station has answered.

3.00 ATTENDANT LINK

3.01 General. The attendant link circuit is used to provide access to the TD-100 EPABX attendant from stations. Stations may also be connected to trunk circuits via the attendant link circuits. Access to the attendant links from stations is made by dialing zero.

The attendant answers calls on the attendant link by pressing the ATT TK button on the console. Figure 1.01 is a block diagram of the attendant link and table 1.02 provides some link terms and their meanings.

3.02 Seizure of Attendant Link by Station. When a station dials "0," the processor seizes a free attendant link circuit by causing the SI-1 lead in the status input logic block to go low during the write enable time slot of the attendant link. This signal will appear during the write enable slot for as long as the circuit is seized, and is stored in the status input logic block. The signal causes the attendant register to give a ring tone enable status to the processor on leads SO-1 through SO-4 via the status output logic block during the read enable time slot and causes lead ILSZ-1 in the console logic block to go high. This high signal causes the buzzer to sound on the console and the ATT TK 1 lamp to flash. (Table 1.03 provides the link status-out lead conditions and their meanings.)

The busy LED on the attendant link circuit board is also turned on by the stored SI-1 signal via the circuit busy control block. The off-hook condition of the calling station is signaled to the attendant link as a low condition on lead SI-1 in the status input logic block during the write enable time slot.

3.03 Attendant Answers. The attendant answers the call by pressing the flashing ATT TK button, which causes lead ICL-1 in the console logic block to go high and change the signals on the SO leads in the status output logic block. The new status is write attendant number and remove ring tone. The flashing ATT TK button now changes to a steady signal and the buzzer turns off due to logic in the attendant control circuit; the attendant is in connection with the calling station.

Having established a connection, the attendant has a number of different options available.

a. The attendant can put the attendant link on automatic hold by pressing the CO TK button on the console, or by pressing the TALK CITY button. This causes the ATT TK button to wink under the control of logic in the attendant control circuit and also causes lead AHI-1 in the console logic block to go low.

   This signal changes the status output to hold via the status output logic block, and inhibits the release function in the console logic block.

b. The attendant can put the attendant link on manual hold by pressing the HOLD button, the ATT LINE button, or the other ATT TK button. This causes the ATT TK button to wink under the control of logic in the attendant control circuit and also causes lead HICL-1 in the console logic block to go low. This signal changes the status output to hold via the status output logic block and inhibits the release and connect functions in the console logic block.

c. The attendant can release the attendant link by pressing the RELEASE button on the console. This puts a high signal on lead RLSE in the console logic block. If the circuit is not on hold or automatic hold, this signal will change the output status to release, and will enable the logic release timer.

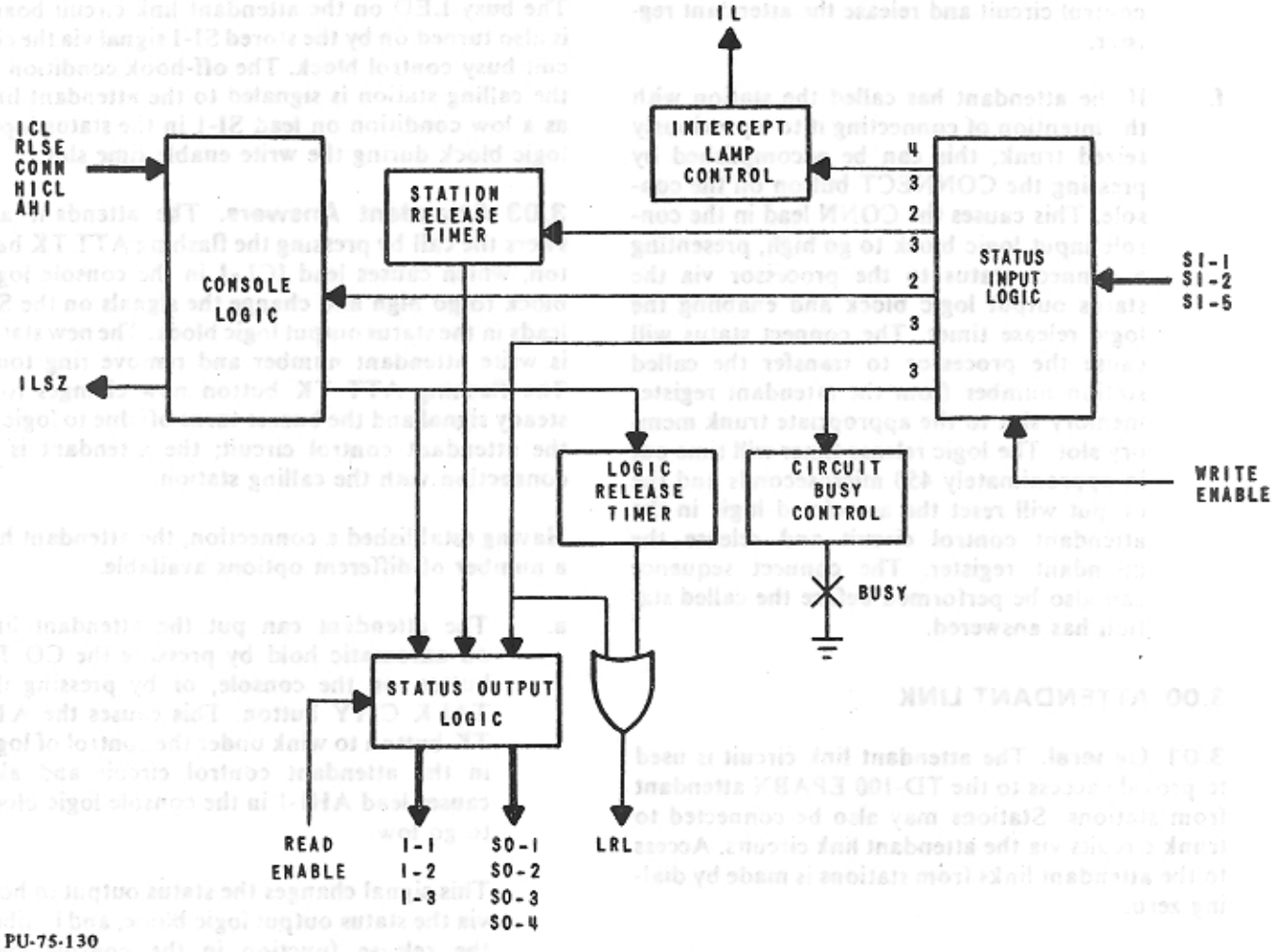

FIGURE 1.01 Attendant Link Block Diagram

The logic release timer will give an output after approximately 450 microseconds on lead LRL-1 which releases the associated logic in the attendant control circuit. The release status on leads SO1-SO4 causes the processor to lock out the calling station and cease writing SI-1 and SI-2 into the attendant link thus causing it to release. The release of the logic in the attendant control circuit removes the high signal on lead ICL-1 in the console logic block and the attendant link resets to an idle condition.

3.04 Station Goes On-Hook. The station can terminate the call by going on-hook. This will cause the processor to remove the low signal on lead SI-2 in the status input logic block. This, in turn, will enable the status release time which gives an output after approximately 300 milliseconds. The output will cause a release status on the SO leads in the status output logic block and a signal on the LRL-1 lead to reset the associated logic in the attendant control circuit. The release of the logic in the attendant control circuit removes the high signal on lead ICL-1 in the console logic block and attendant link resets to an idle condition.

3.05 Connection of a Trunk. The attendant can connect the station in the attendant link to a trunk or tie-trunk by pressing a trunk or tie-trunk button and then pressing the CONNECT button. Pressing the trunk button will put the attendant link on automatic hold as previously described. When the attendant presses the CONNECT button, the CONN lead in the console logic block goes high, enabling the logic release timer and causing the status output logic block to give a connect status to the processor on the SO leads during the read enable time slot. The logic release timer will give an output after approximately 450 microseconds on lead

TABLE 1.02 Attendant Link Terms

ABBREVIATION	MEANING
AHI-1, AHI-2	Automatic hold incoming
HICL-1, HICL-2	Hold incoming link
ICL-1, ICL-2	Incoming link
ILSZ	Incoming link seize
IL-1, IL-2	Intercept lamp
LRL-1, LRL-2	Link release
RLSE	Release
SCR-1, SCR-2	Scan channel read
SCW-1, SCW-2	Scan channel write
SI-1	Status-in 1 (seize)
SI-2	Status-in 2 (originator off-hook)
SI-5	Status-in 5 (intrude)
SPR	Status pulse record

TABLE 1.03 Attendant Link Status-Out*

FUNCTION	SO-1	SO-2	SO-3	SO-4
Idle	1	1	1	1
Ring tone	0	1	1	1
Busy	0	0	1	1
Lock-out	0	1	1	0
Connect	0	0	0	1

Identity remains 1.

LRL-1, which releases the associated logic in the attendant control circuit.

The connect status causes the processor to write the number of the station in the attendant link into the appropriate trunk, and to cease writing any station into the attendant link circuit. This, in conjunction with the reset of the attendant control circuit logic, causes the attendant link to reset to an idle condition.

The station is now connected to the trunk.

3.06 Attendant Intercept. If the TD-100 is arranged for attendant intercept and a station user dials a code to which the station is denied access, the call is directed to the attendant as an intercept call. On an intercept call, the attendant link is seized in the same way as if a station dialed "0," but during the initial write enable scan when the attendant link is seized, the processor causes lead SI-5 in the status input logic block to go low. This low signal is latched in the intercept lamp control block and turns on the intercept lamp on the console lead IL-1. The intercept lamp remains lit for as long as the attendant link is seized.

All subsequent operations are as previously described.

3.07 Busy Switch. The busy switch in the circuit busy control block is used to make the attendant link appear busy to dial "0" calls. The busy switch is enabled only when the attendant link is not seized and affects the busy condition by inhibiting the read enable signal. Operation of the busy switch also causes the busy LED to flash.

TABLE 1.02 Attendant Link Terms

ABBREVIATION	MEANING
ABI-1, ABI-2	Automatic hold incoming
HICL-1, HICL-2	Hold incoming link
ICL-1, ICL-2	Incoming dial
ILS2	Incoming link seize
IL-1, IL-2	Intercept lamp
LRI-1, LRI-2	Link release
RLSE	Release
SCR-1, SCR-2	Scan channel read
SCW-1, SCW-2	Scan channel write
SI-1	Status-in 1 (select)
SI-2	Status-in 2 (originator off-hook)
SI-3	Status-in 3 (interdig)
SPR	Status pulse record

TABLE 1.03 Attendant Link Status-Out*

FUNCTION	SO-1	SO-2	SO-3	SO-4
Idle	1	1	1	1
Ring tone	0	1	1	1
Busy	0	0	1	1
Lockout	0	1	1	0
Connect	0	0	0	1

Identify remains 1

ITT PRACTICES
Narrative Series

TRANSFER AND ADD ON LINKS
(410170)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with one transfer and add-on link printed circuit board (PCB). This PCB contains three transfer links and one add-on link. A transfer link allows a station connected to a trunk to transfer the trunk to another station; the add-on link allows a station connected to a trunk to add on another station, thus enabling a three-way conversation. Access to the add-on link is always via a transfer link.

2.00 DETAILED DESCRIPTION

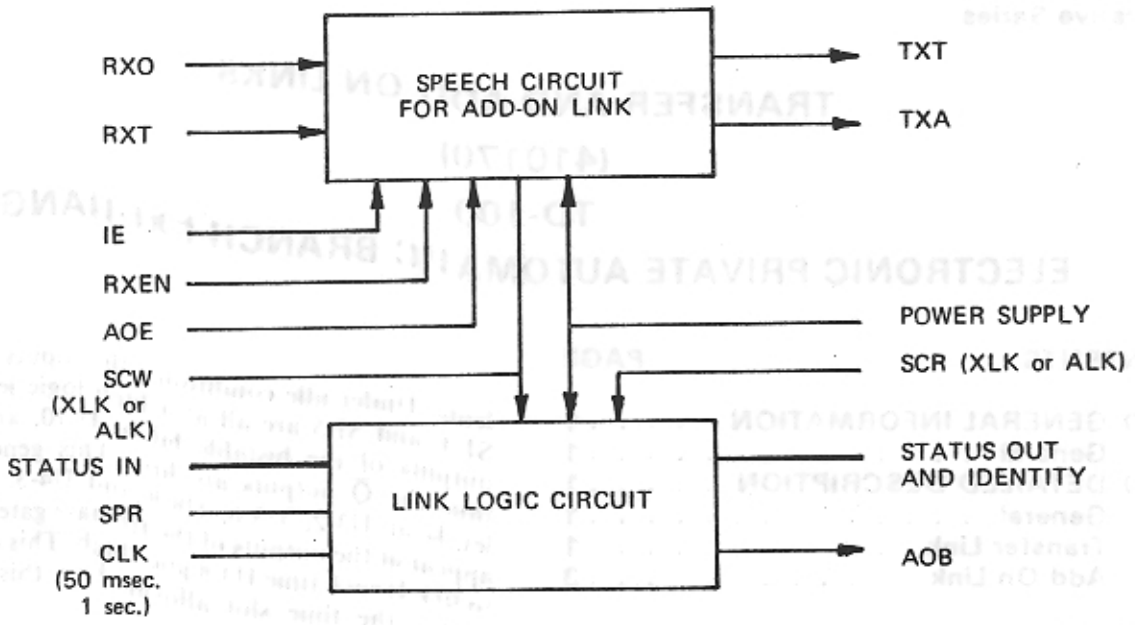
2.01 General. The following discussion treats the transfer and add-on links separately even though their functions are similar and interrelated. Figure 1.00 is a block diagram of the control logic for the links. Table 1.00 lists some of the abbreviations used in this procedure and the meaning of each.

2.02 Transfer Link. The identity and status of an idle transfer link is a hexadecimal "3F." Table 1.01 lists hexadecimal and alphanumeric equivalents. Under idle conditions the inputs SI-1, SI-2, SI-4 and SI-5 are all at a high logic level. The Q outputs of the bistable latch U1-10, are all high, thus the $\overline{Q}$ outputs are low. This generates high levels at U3-2, U3-6, U4-6 and U4-3, which will appear at the outputs of the tri-state gates U1 (SO-1 to SO-4) each time U3-8 goes high. This occurs only during the time slot allocated to this particular transfer link.

Assume that a trunk is set for a station which decides to transfer the trunk to another station. The station flashes the hookswitch and dials the number of the station to which the trunk is to be transferred. The processor finds a free idle transfer link and applies a signal on leads SI-1 and SI-2 to the idle link. This results in U10-10 and U10-15 becoming low and U10-1 and U10-11 going high. In turn, U6-6 goes low, thus [illegible] turns on, the status out becomes "37," and the called, or terminating, station rings.

If the called station does not answer, the calling station can flash the hookswitch to return to the trunk. Flashing the hookswitch causes the signal on lead SI-1 to be removed momentarily; U10-15 goes high and U10-14 low. This change starts the counters U14 and U13. After 400 milliseconds, U12-10 goes low and latches as a high at U12-11. If the hookswitch flash is longer than 1.5 seconds, U12-2 will go low and the link will release. When the duration of the hookswitch flash is between 400 and 1500 milliseconds, the signal on SI-1 appears again and counters U14 and U13 are reset to produce a low at U7-8. The status out becomes "[illegible]," the originating station is reconnected to the trunk and the transfer link becomes idle.

If the originating station goes on-hook at this point, 1600 milliseconds later the U12-2 goes low and the status out becomes "[illegible]." The trunk is now set to the terminating (or second) station and receives ring back tone while the terminating station is ringing.



PU 75-114

FIGURE 1.00 Link Block Diagram

TABLE 1.00 Link Abbreviations

ABBREVIATION	MEANING
AOB	Add-on busy
AOE	Add-on enable
I-1, I-2, I-3	Identity
RXEN	Receive enable
RXO	Receive originator
RXT	Receive terminator
SCR	Scan channel read
SCW	Scan channel write
SI-1	Seize
SI-2	Off-hook originator
SI-3	Off-hook terminator
SI-5	Intrude
SO-1 thru SO-4	Status-out
SPR	Status pulse record
TXA	Transmit add-on
TXO	Transmit originator
TXT	Transmit terminator

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

If the terminating station answers, then the signal on lead SI-3 is felt at the link input which causes U10-10 to go low and U10-11 to go high. These signals, in turn, generate U11-6 low, the status-out changes to "33," and the two stations are connected.

If the station goes on-hook, the signal on SI-2 is removed and the release counter U13, starts counting. After 1.6 seconds, U12-2 goes low and the status-out becomes "30." The terminating station is transferred to the trunk's time slot, the transfer link releases and CR7 goes off. Now, the terminating station is connected to the trunk.

If the originating and terminating stations are connected, and the terminating station goes on-hook, the signal on lead SI-3 is removed. U10-10 goes high, U10-11 goes low, U16-6 goes low and the terminating station release counter starts counting. After 300 to 350 milliseconds, U16-8 goes low, the status out becomes "38" and the originating station returns to the trunk's time slot.

2.03 Add-On Link. If the originating and terminating stations are connected through the transfer link, and desire to add the trunk to the connection, the originating station flashes the hookswitch. After 200 milliseconds, U12-10 goes low, U7-8 goes high. U7-9 and U7-10 are high; thus U7-8 goes low and initiates the busy-tone counter. If the add-on link is busy, AOB is high so U8-3 goes low, the status-out becomes "31" and busy tone is applied to both stations for 3 to 4 seconds. U5-11 then goes high; U6-4 is low, resetting the latch (U17-11 goes low).

If the add-on link is free (idle) then AOB is low, U8-4 is high. U8-6 goes low, after the hookswitch flash of the originating station. This changes the status-out to "32." Both the originating and terminating stations are transferred to the add-on link and the transfer link is released. The identity of the add-on link is "5"; when idle its status-out is "F." When the add-on link is seized, U53-16, U53-15, and U53-10 become low, U53-1 and U53-14 high. The status-out changes to "57" and AOB becomes high. All three parties are now connected through the analog circuit of the add-on link circuit and the highway amplifier.

Notice that the trunk and station A are considered as originating stations. If the terminating station goes on-hook, U53-10 becomes high resulting in a low level at U55-4. After 400 milliseconds, U61-11 becomes high and the status-out changes to "50," resulting in the removal of the signal on lead SI-1 by

the processor. This results in a high at U53-16 and a low at U53-1; the status changes now to "5F" and the originating station has been transferred to the trunk.

If the originating station goes on hook, U53-15 goes high, U53-14 low, U61-11 high (after 40 milliseconds), and the status-out becomes "58." The terminating station is transferred to the trunk while the add-on link releases and becomes idle.

If both the terminating and originating stations go on-hook, the status-out becomes "59."

The analog (speech) path is controlled by the digital circuitry which turns on and off the field effect transistors (FET's), Q3, Q4, Q5, Q6, Q8, and Q12. FET's Q3, Q4, Q8, and Q12 turn on during the add-on link's time slot while Q5 and Q6 turn on during the trunk's time slot.

Voice signals from the terminating station are applied at RXO where, through Q3, they are applied to U57-6. At the same time, Q4 turns on so that voice signals transmitted by the originating station are applied through Q4 to U57-6. Q5 turns on at the trunk's time slot, and signals transmitted by the trunk are received at U63-5, and through Q12 (which turns on at the add-on link's time slot) are applied to U57-6. This operational amplifier (OP/AMP) operates as a mixer and all speech signals are received at the emitter of Q10. At the trunk's time slot, Q6 turns on and, through the emitter follower of Q13, TXT and the highway amplifier, the trunk can receive both stations. Q8 turns on at the add-on link's time slot and through Q9, TXA and the highway amplifier, both stations are able to receive the trunk.

The IE signal is the attendant's intrude enable signal, which is normally high. Note that intrusion into the add-on link is not possible because both intrusion and add-on use the same output (TXA). Q11 and Q10 are used in this configuration for drive compatibility of the circuit.

E & M AND DX TIE TRUNK
(410172)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with E & M and DX tie trunks accessible directly from a station or via the console on outgoing calls. A strapping option is available which will allow all incoming calls to be routed to the attendant. Each tie trunk has strapping options to permit a maximum of six trunk groups to be arranged with E & M or Duplex (DX) signaling. (Duplex signaling is available on -002 and later generations.) Each trunk board also contains a pulse correction circuit for use in tandem operation. Add-on, conference, and consultation hold features are available on each trunk circuit and a busy switch is provided which may be used to manually make the circuit busy. A light-emitting diode (LED) provides a visual indication of a trunk's condition; busy, in-service, or manually made busy. Each board contains one trunk circuit and may be strapped for immediate start, wink start, and delay start. Strapping options are also available to allow the tie trunk to operate with either CDQ-2X or CDQ-2W interconnect devices.

1.02 Trunk Groups. The TD-100 tie trunks must be assigned to a group to enable the processor to seize them. The status-out and identity of an idle tie trunk is determined by the group to which it belongs. The idle status of tie trunk groups 1 through 6 is contained in table 1.00. Table 1.01 is a list of hexadecimal and alphanumeric equivalents.

1.03 E & M Type Signaling. In E & M type signaling, all communications are done over 2 leads; an "M" lead which transmits battery or ground signals to the signaling equipment and an "E" lead which receives open or ground signals from the signaling equipment. The local condition is reflected by the "M" lead and the distant condition by the "E" lead. In most cases, the signaling equipment requires a ground ground on the "M" lead and an open "E" lead when idle, and battery on the "M" lead and ground on the "E" lead when seized. This is the condition which is discussed in the circuit operation in this narrative. In some cases, however, the signaling equipment will require battery on the "M"

TABLE 1.00 Trunk Group Idle Status

TRUNK GROUP	IDLE STATUS
1	E2
2	F2
3	F5
4	6F
5	AF
6	2F

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

lead and an open "E" lead when idle, and ground on the "M" lead and battery on the "E" lead when seized. The E & M type signaling is thus duplex; that is, signals can be sent simultaneously in both directions without interference.

1.04 DX Signaling. DX signaling is often used instead of loop signaling on longer local and tandem trunks or tie trunks. A single DX signaling section is limited to a maximum loop resistance of 5000 ohms. A DX signaling circuit uses the same cable pair as the talk path. Both conductors individually carry currents resulting from differences in terminal ground potentials and battery supply voltages, so that current in the second conductor can cancel the effect of this unwanted current in the first conductor. In the DX mode of operation when an incoming call is received, the output of U84 will go positive and turn on transistor Q22 (equivalent to operating the E relay for issue -001).

On an outgoing call the M relay will operate. When the distant PABX answers, transistor Q22 will turn on (operate E relay for issue -001) via U83 pin 7 high.

1.05 Dial Pulse Correction. The E & M and DX tie trunk contains a dial pulse correction circuit which is enabled whenever the trunk is operating in

tandem (for example, an incoming tie line requesting an outgoing trunk or tie line). When operating in tandem, a certain amount of distortion can be introduced into the dial pulses. The correction circuit will reconstruct the dial pulses to the conventional 60% break—40% make configuration. The pulse correction circuit detects a leading edge of each pulse and flip-flop U88 pin 6 goes low. The flip-flop is reset after the leading edge has propagated through N stages of shift register U85. The width of the make or break portion of the dial pulse is obtained by multiplying the clock pulse time (12 milliseconds) by the number of stages of shift register U85 through which a leading edge is propagated. This circuit also detects an on-hook condition with U87 pin 8 being marked low.

1.06 Interconnect Devices. The E & M and DX tie trunk can be strapped to operate with a CDQ-2X or CDQ-2W interconnect device. The CDQ-2X and CDQ-2W devices are voice connecting arrangements which provide for the direct electrical connections of customer-provided equipment to telephone company private line facilities. They provide a 2-wire voice transmission interface and the telephone company provides the channel signaling. The primary function of these devices are as follows:

a. To protect telephone company facilities from potentially hazardous voltages which may be applied to the voice connecting arrangement.

b. To provide voice transmission to and from telephone company private line facilities.

c. To receive and transmit supervisory signals between the customer provided equipment and the facility signaling unit.

d. To receive dial pulse signaling from the customer-provided equipment and transmit to the distant equipment.

e. To deliver dial pulse signaling from the distant equipment to the customer-provided equipment.

The CDQ-2W interconnect device provides a contact type of signaling interface. The operation of the signaling system is duplex; that is, signals can be sent simultaneously in both directions without interference.

When the distant PABX seizes the line connected to the interconnect device, the P relay located within the interconnect device operates and provides a closure of contacts over leads CBS-1 (pin 3A) and CBS-2 (pin 3B). The local EPABX system must respond by connecting dial pulse receiving equipment to CBS-1 and CBS-2. When the distant equipment has completed dialing and the local EPABX has answerd, it must respond by providing a closure of contacts over leads CS (pin 6A) and CG (pin 6B). This will operate the A relay within the interconnect device and cause answer supervision to be transmitted to the distant equipment. A 2-wire voice transmission path is privided over the CT (pin 1A) and CR (pin 1B) leads.

On an outgoing call, the local EPABX causes the interconnect device to seize the tie trunk by providing a closure of contacts over the CS and CG leads by operating the M relay. When answer supervision is returned from the distant equipment, it is detected by the interconnect device. The P relay within the interconnect device operates which provides a closure of contacts over the CBS-1 and CBS-2 leads to repeat answer supervision to the local EPABX.

If the distant equipment disconnects first, the local EPABX will recognize an opening of the contact closure over the CBS-1 and CBS-2 leads as a disconnect signal (Q22 off) and will enable the CO release timer after a time between 100 and 600 milliseconds (depending on the strapping), the M relay will release and open the closure between the CS and CG leads.

If the local EPABX disconnects first, the contact closure over the CS and CG leads opens, which releases a relay within the interconnect device and signals the distant equipment which returns a disconnect signal which is transmitted to the local EPABX as an open between leads CBS-1 and CBS-2.

Bell System Practice specifies that, under normal conditions, the CDQ-2X interconnect device provides an E and M lead type of signaling interface. The CTE lead corresponds to the E lead and the CTM lead corresponds to the M lead. The CTM lead transmits battery and ground signals from the local EPABX toward the interconnect device while the CTE lead transmits open and ground signals from the interconnect device to the local

TABLE 1.02 Lead Designations for CDQ-2W and CDQ-2X

INTERCONNECT TYPE	LEAD DESIGNATION	FUNCTION
CDQ-2W	CT CR	Two-way voice transmission
	CS CG	Outgoing signals (to connecting arrangement)
	CBS-1 CBS-2	Incoming signals (from connecting arrangement)
CDQ-2X	CT CR	Two-way voice transmission
	CTM	Outgoing signals (to connecting arrangement)
	CTE	Incoming signals (from connecting arrangement)
	CG	Signal ground

EPABX. The local conditions is relfected by the CTM lead and the distant condition is reflected by the CTE lead. The operation of the signaling system is duplex; that is, signals can be sent simultaneously in both directions without interference.

When the distant PABX seizes the line connected to the CDQ-2X interconnect device, relay K1 within this device will operate and close a grounded contact over the CTE lead. The local EPABX must respond by connecting dial pulse receiving equipment to the CTE lead. When dialing is completed and the local EPABX has answered, the local EPABX must then provide battery over the CTM lead which operates the K2 relay within the interconnect device and transmits answer supervision to the distant equipment. A two-wire voice transmission path to the local EPABX is provided over the CT and CR leads.

On an outgoing call, the local EPABX causes the CDQ-2X interconnect device to seize the tie trunk by providing battery over the CTM lead. The CTM lead alternates between battery and ground following the dial pulses. The K2 relay within the interconnect device operates and releases, thereby repeating the dial pulses to the distant equipment. When answer supervision is returned, relay K1 within the interconnect operates and closes a contact to ground over the CTE lead to repeat answer supervision to the local EPABX.

If the distant equipment releases first, relay K1 within the interconnect device releases and opens the CTE lead to the local EPABX. The local EPABX recognizes this as a disconnect signal and places a ground on the CTM lead. If the local EPABX releases first, the signal on the CTM lead is changed from battery to ground and relay K2 inside the interconnect releases and signals the distant equipment. The distant PABX returns a disconnect signal which is transmitted to the local EPABX as an open circuit on the CTE lead.

1.07 Trunk Start. Each TD-100 tie trunk may be equipped for immediate start, delay dial, and wink start operation.

During immediate start, if the distant equipment is a non-senderized PABX, pulsing is started immediately after receiving second dial tone. In delay start operation, during idle conditions the tie trunk has a ground on the M lead and an open on the E lead. Upon seizure, the local EPABX receives a ground on the E lead from the distant equipment. Within 300 milliseconds, the local EPABX transmits battery to the distant equipment on the M lead to stop the outpulsing of digits. When the local EPABX is ready to receive digits (register attached), it transmits a ground to the distant equipment on the M lead. This must occur before the sender time-out of 4.7 seconds. At this time, the sender outpulses the necessary digits to the local EPABX.

For wink start operation during the idle conditions, the tie trunk has a ground on the m lead and an open on the E lead. Upon seizure, this local EPABX will receive a ground on the E lead from the distant equipment. When the local EPABX is ready to receive digits, it transmits a ground of approximately 200 milliseconds (minimum 140 milliseconds). This must occur before the sender time-out of 4.7 seconds. At this time, the distant equipment outpulses the necessary digits to the local EPABX.

1.08 Trunk Strapping. Numerous features and options are available from the tie trunk and are explained in this publication. Strapping necessary for these features and options is fully described in section OB-000-003, Feature Strapping, TD-100 EPABX.

2.00 DETAILED DESCRIPTION

2.01 General. The following paragraphs describe the E & M and DX tie trunk under various operational conditions. Table 1.03 lists some tie trunk terms and their meanings; table 1.04 shows the identity and status out of the tie trunk under various conditions.

2.02 Incoming Call - Day Operation. On an incoming call with the night switch off, transistor Q22 is on (E relay operated for issue -001) causing U43 pin 5 and U43 pin 8 to be low which enables counters U28, U34, and U45. After 200 milliseconds, the incoming latch is operated and U56 pin 9 is high. During this time, the status of the tie trunk is a binary coded hexadecimal "FF." The attendant is alerted of an incoming call by the buzzer on the console and a flashing TA lamp. At this time U44 pin 5 is high, U44 pin 6 is low and the tie trunk's status-out changes to "EE." When the attendant answers the call, a ground is placed on the TS lead and U41 pin 9 is marked high. The TA and TB lamps will both light and U72 pin 10 (write attendant number) is low. The processor sends SI-1, SI-3, and SI-11 signals and writes the attendant's number on the terminating register store of the tie trunk's time slot. At this time U44 pin 5 and U44 pin 8 will be low to inhibit counters U28, U34, and U45. The tie trunk's status-out now becomes "E7." The off-hook latch operates, marking U19 pin 8 high, U26 pin 12 low, and U5 pin 8 high, which causes U10 pin 8 to go high, turning on transistor Q20 and operating the M relay.

2.03 Incoming Call - Night Operation. With the night switch on, an incoming call will mark latch U44 pin 5 with a high and the trunk status-out becomes "EF." For unassigned night answer, a station user dials a predetermined access code and answers the call. The processor sends back SI-1, SI-3, and SI-11 signals and writes the station number in the terminating register store of the tie trunk's time slot. From this point, the operation is the same as described above for day operation.

2.04 Incoming Call - Register Unavailable. The status-out of a tie trunk changes from "FF" to "EO" approximately 200 milliseconds after receiving an incoming call, and the OHO lead, U25 pin 8 is marked low. The processor writes the tie trunk's number on the originating number store in the tie trunk's slot and returns an SI-10 signal. This causes U61 pin 5 to go high, indicating that the tie trunk is requesting a register or has a register attached. If a register does not become available within 4.7 seconds (and the trunk is not strapped for attendant intercept), U44 pin 5 goes high and lock-out is transmitted to the distant equipment by marking U29 pin 11 and U43 pin 3 low. The request for a register is removed and the tie trunk's status-out is "FF" (U11 pin 8 is high and U36 pin 6 is low). The tie trunk remains busy and the TA lamp is lit. The BLO latch is reset when the distant PABX

TABLE 1.03 Tie Trunk Terms

ABBREVIATION	MEANING
AIN	Artificial intrude
BLO	Busy lockout
BT	Busy tone
BUZ	Buzzer
CONF	Conference
CONN	Connect (inverted)
CPO	Camp-on
CSA	Called subscriber answered
HOT	Hold trunk (automatic)
HT	Hold trunk (manual)
I1, I2, I4	Identity 1, 2, and 4
LWT	Lamp wink trunk
OLS	Originator line scan
OHO	Off-hook originator
OHT	Off-hook terminator
RLSE	Release (inverted)
RTE	Ring tone enable
RXEN	Receive enable
RXO	Receive originator
RXT	Receive terminator
SCR	Scan channel read
SCW	Scan channel write
SI1	Seize
SI3	Off-hook terminator
SI4	Tested line is not busy
SI5	Intrude
SI6	Consultation hold
SI7	Add-on
SI8	Busy
SI9	Called subscriber answered - reset
SI10	Conference
SI11	New station number
SI12	Attendant recall
SO1-SO4	Status-out 1-4
SPR	Status pulse record
TA	Trunk A (lamp)
TB	Trunk B (lamp)
TLS	Terminator line scan
TS	Trunk seize
TXO	Transmit originator
TXT	Transmit terminator
1S	1 second
12MS	12 milliseconds
50MS	50 milliseconds

TABLE 1.04 Tie Trunk Circuit Conditions

CIRCUIT CONDITION	HEXADECIMAL CODE	IDENTITY 8 4 2 1 I1 I2 I3 I4	STATUS OUT 8 4 2 1 SO1 SO2 SO3 SO4
Trunk Busy	E7	1 1 1 0	0 1 1 1
Intrude	EB	1 1 1 0	1 0 1 1
Apply Ringtone	E3	1 1 1 0	0 0 1 1
Inhibit Decode Terminator	ED	1 1 1 0	1 1 0 1
Write Station Number	E5	1 1 1 0	0 1 0 1
Conference	E9	1 1 1 0	1 0 0 1
Clear Station Number	E1	1 1 1 0	0 0 0 1
Add-On	EE	1 1 1 0	1 1 1 0
Write Attendant Number	26, 66, A6	X X 1 0	0 1 1 0
Consultation Hold Request	EA	1 1 1 0	1 0 1 0
Consultation Hold	EC	1 1 1 0	1 1 0 0
C.O. Release	E4	1 1 1 0	0 1 0 0
"E0"	E0	1 1 1 0	0 0 0 0
"E2"	E2	1 1 1 0	0 0 1 0
"F8"	F8	1 1 1 1	1 0 0 0

releases and U27 pin 13 goes low, the M relay releases and the tie trunk becomes idle. If a tie trunk strapped for attendant intercept receives an incoming call, and is not assigned a register within 4.7 seconds, the attendant is alerted to answer the call. At this point the operation is the same as described previously.

2.05 Incoming Call - Trunk Start. On an incoming call in the immediate start mode, U31 pin 2 is high and U32 pin 6 is low. The RXO transmission path is enabled through FET Q15 by U32 pin 10 (RXEN, OLST and OLSU low). When the tie trunk has been connected to a register, the processor sends back a SI-6 signal, the tie trunk's status-out becomes "EC" and the distant PABX receives dial tone. U78 pin 12 goes low which causes U44 pin 8 to go low, U43 pin 8 to go high, and resets counters U28, U34, and U45.

On an incoming call in the delay start mode, U56 pin 9 is high and the M relay operates via U78 pin 8 and U12 pin 6 low (ONH-DD). When the tie trunk has been connected to a register, the processor sends an SI-6 signal. After 200 milliseconds, U80 pin 13 goes high and the M relay is released.

On an incoming call with wink start operation, the processor sends a SI-6 signal, U79 pin 12 goes low, U12 pin 6 goes low, and the M relay operates. When U79 pin 12 goes low, counters U28, U34, and U45 are enabled via U65 pin 1. After 200 milliseconds, U80 pin 6 goes low and U79 pin 12 goes high. The M relay is released and U79 pin 6 goes low to set U44 pin 8 low and inhibit counters U28, U34, and U45.

2.06 Incoming Call to Station. On an incoming call after the digits of the local station are dialed, the TD-100 circuitry determines whether the dialed station is busy or idle. If the dialed station is busy, a BLO (busy lockout) signal is generated. U35 pin 11 is low and U29 pin 11 goes low. The status-out of the tie trunk changes to "FF" and busy tone is transmitted to the distant PABX.

If the called station is idle, the processor sends a SI4 signal; U61 pin 5 goes low and the status-out of the tie trunk becomes "E3" (apply ringback tone). The voice paths, RXO and TXO, are enabled during the write scan of the tie trunk via U26 pin 6 and U32

pin 2. The called station number is written on the terminating side of the tie trunk's time slot. When the called station goes off-hook, the processor sends an SI-3 signal. The off-hook latch, U19 pin 9, is high and U26 pin 12 is low causing the M relay to operate.

2.07 Incoming Call to Attendant. If the calling line dials "0" for access to the TD-100 attendant, the processor writes the number of the tie trunk in the originating number store of the attendant link's time slot. An RTE (ring tone enable) signal is generated which sets latch U81 pin 5 high. The RXO and TXO voice paths are enabled via U32 pin 5 and the OLST and OLSU leads; the tie trunk functions as a line circuit. When the attendant answers, an SI-3 signal is generated via U46 pin 3 which causes U81 pin 8 and U5 pin 1 to go low and operate the M relay.

2.08 Incoming Call to Trunk (or Tie Trunk). An incoming tie trunk party may dial an access code for a trunk or another tie trunk. In this case, the tie trunk acts as a line circuit and is scanned on the terminating side of the trunk's (or tie trunk's) time slot. U22 pin 13 is made high by U30 pin 2 and U15 pin 3. The status-out of the tie trunk is "FF," and the TA lamp is lit. The TXT and RXT voice paths are enabled via Q4 and Q14 during the TLS signal and dial pulses are transmitted via the OHT signal. Transistor Q22 (E relay for issue -001) follows the dial pulse via U43 pin 5, U31 pin 13 and U29 pin 9. The M relay operates when the CSA (called subscriber answered) lead goes low. This is because U19 pin 6 is high, U12 pin 8 goes low and U5 pin 8 goes high to turn on transistor Q20.

2.09 Outgoing Call - Attendant Origination. The attendant may originate an outgoing tie trunk call by depressing an idle tie trunk key. This causes the TS lead to go low and seize a tie trunk. U41 pin 9 goes high and a WAN (write attendant number) signal is generated as U72 pin 10 goes low. The processor sends SI-1 and SI-3 signals which operate the M relay via U8 pin 6 and U10 pin 8. A voice path is established between the attendant and tie trunk and the attendant receives dial tone. Dial pulses on lead SI-3 are transmitted via the M relay. When the distant PABX answers, a ground is detected on the E lead, transmit supervision is transmitted on the CSA lead (pin 14A) and the answer latch is operated (U1 pin 11 low). When the distant equipment releases, transistor Q22 turns off (E relay releases for issue -001) and the central office release timer, U2, is enabled. After 100 to 600 milliseconds (depending on the strapping of the COR timer), U54 pin 11 goes low, U73 pin 2 (COR) goes low and the processor removes the SI-1 signal allowing the tie trunk to return to idle. If the attendant presses the release bar before the distant PABX answers, U8 pin 8 goes low and U72 pin 4 goes low. Transistor Q22 turns off (E relay releases for issue -001), the M relay drops and the RLSE relay operates to enable the CO release timer. U73 pin 2 (COR) is low and the processor sends an SI-1 signal. If the attendant releases after the distant PABX has answered U51 pin 8 and U8 pin 10 go low and a clear station number (U72 pin 4 low) signal is generated. The RLSE relay is operated by U8 pin 8 being low. Transistor Q22 (E relay for issue -001) will remain activated as long as the distant PABX is off-hook preventing a CO release. When the distant PABX releases, Q22 turns off and the CO release timer is enabled, U73 pin 2 (COR) goes low. The processor removes the SI-1 signal and the tie trunk becomes idle.

2.10 Outgoing Call - Attendant Transfer. After originating a call as described in paragraph 2.09, the attendant may transfer the tie trunk to a TD-100 station. When the attendant presses the attendant line key, the tie trunk is put on automatic hold (HOT); its status-out is "ED."

After dialing the station number, the attendant presses the CONNECT bar and the WST# (write station number) lead at U72 pin 2 will go low. The processor sends SI-1 and SI-11 signals; the attendant's latch U41 is reset and the status-out of the tie trunk changes to E3 (apply ring tone). When the station answers, an SI-3 signal (off-hook terminator) is received and the status-out of the tie trunk changes to E7 (tie trunk busy).

If the local station goes on-hook first, counters U3 and U4 will be enabled and after approximately 1.6 seconds, the M relay will operate. At this time, U8 pin 8 goes low and U72 pin 4 (clear station number) will go low. When the distant PABX releases, transistor Q22 turns off (E relay releases for issue 001). This enables the CO release timer and after a fixed time, 100 to 600 milliseconds (depending on the strapping), U72 pin 2 goes low and the processor removes the SI-1 signals.

2.11 Outgoing Call - Station Origination. When a TD-100 station goes off-hook and dials a tie trunk access code, the processor seizes an idle tie trunk by sending SI-1 and SI-3 signals. The M relay operates, the station receives second dial tone and the call proceeds as described in paragraph 2.09.

2.12 Outgoing Call - Station Transfer. A station user momentarily depresses the hookswitch to initiate a tie trunk transfer. This momentary depression, or flash, enables counters U3 and U4. A consultation hold request is generated with U14 pin 6 and U73 pin 12 low. The processor sends an SI-6 signal and the tie trunk status changes from "EA" (consultation hold request) to "EC" (consultation hold).

The station user may now dial a station number or may dial "0" for connection to the attendant.

If the dialed station is busy, the processor sends an SI-8 signal. Latch U77 pin 12 will be set high which will enable counter U3 and U4 by marking U77 pin 8 low. After 4 seconds, latch U77 is reset changing the status-out of the tie trunk from "EC" to "E7." Busy tone is transmitted to the originating station as Q10 is off and Q11 is on.

When the dialed, or terminating, station is free and goes off-hook to answer, and the transfer originator flashes the hookswitch a second time, the terminating station will be placed in a transfer link. The tie trunk receives an SI-7 signal which changes the status-out to "EE" (add-on). A three-way conversation is enabled between the two stations and the tie trunk. When one station goes on-hook, the other station number is placed on terminating side of the tie trunk's time slot and the tie trunk's status-out changes to "E7."

If the station momentarily depresses (flashes) the hookswitch and dials "0" (for attendant assistance), the processor sends an SI-12 signal to the tie trunk. U62 pin 6 goes low and the tie trunk's status-out changes to "E3" (apply ring tone). The attendant is alerted by the buzzer and flashing TA and TB lamps. When the attendant answers, U41 pin 9 and U62 pin 9 go high and U62 pin 8 goes low. The attendant is connected to the station via the AIN lead. When the station goes on-hook, U72 pin 4 goes low and the tie trunk's status-out becomes "F1." The processor sends SI-1, SI-3, and SI-11 signals and U62 pin 8 goes high. The attendant's number is written on the terminating side of the tie trunk's time slot and the voice path is enabled between the tie trunk and the attendant.

2.13 Outgoing Call - To Tie Trunk. An incoming trunk party may request and gain access to a tie trunk. The attendant accesses the tie trunk by pressing the attendant line key and dialing the tie trunk access code. The TA and TB lamps associated with the selected tie trunk light. The TA lamp associated with the incoming trunk winks (on automatic hold) and the attendant receives dial tone from the distant PABX.

The processor applies SI-1, SI-3 and SI-9 signals to the tie trunk and writes the tie trunk's number on the terminating side of the (incoming) trunk's time slot. The attendant then dials the distant PABX number; the dial pulses enter the tie trunk circuit via the SI-3 lead and are transmitted via the M relay in the same manner as from a station (see paragraph 2.11). The SI-9 signal from the processor marks U61 pin 9 high. With the exception of U61 pin 9, all conditions are identical to any outgoing call.

When the attendant presses the CONNECT bar (with U61 pin 9 high), the status-out of the tie trunk changes to "F8," and the tie trunk acts as a line circuit. Monostable U22 pin 13 goes high via U24 pin 1, putting the tie trunk into a tandem mode of operation. The status-out is "FF" and the TA lamp is lit.

The RXT and TXT FET's are operated to establish a voice path between the trunk and the tie trunk. The tie trunk transmits its off-hook condition to the trunk via the OHT lead. In all outgoing calls, pin 3 of counters U45, U34, and U28 is enabled and then reset after each dial pulse. This enables the tie trunk to disregard erroneous release signals from the distant PABX during dialing. The tie trunk may be strapped to disregard release signals of 8 seconds, 16 seconds, or 32 seconds.

2.14 Tie Trunk on Hold. When the attendant is connected to the tie trunk, its status-out is "E7." The attendant may put the tie trunk on manual hold by depressing the HOLD key, and may put the tie trunk on automatic hold by selecting another trunk or line. In either case, the status-out of the tie trunk becomes "ED."

When a tie trunk is on automatic hold, its corresponding TA lamp winks and its TB lamp lights. When the manual HOLD key is depressed, U38 pin 9 is low, U41 pin 6 is low, U54 pin 8 is high and U72 pin 1 is low. The TA lamp winks and the TB lamp is extinguished; the CONNECT and RELEASE bars and the function control keys (CONF, PAGE, CODE, etc.) are with respect to the tie trunk(s) on manual hold.

2.15 Tie Trunk in Conference. A tie trunk may be put into the conference circuit by the attendant. In this case, U63 pin 11 goes low, U72 pin 3 goes low and the status-out of the tie trunk becomes "E9." The processor sends a SI-10 signal and the attendant's latch is reset via U75 pin 1 high and U76 pin 8 high. The tie trunk's status-out changes to "E7" via U50 pin 6 high and U72 pin 11 low.

POWER SUPPLY CONTROL BOX
(410176)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The power supply control box (PSCB) is used in the TD-100 to provide 117 VAC to the ventilating fans, +10 volts to the alarm board, -12 volts to the music-on-hold (MOS) circuitry, and 30-Hz ringing voltage. Additional circuitry passes the music-on-hold signals and initiates a power failure transfer in the event of certain alarms.

2.00 DETAILED DESCRIPTION

2.01 General. The PSCB is shown in block diagram form in figure 1.00; all relays are shown in the power-off condition. Numbers shown such as 1-12, 3-6, etc., refer to terminal block and pin numbers: terminal block 1, pin 12; terminal block 3, pin 6. Table 1.00 lists some PSCB terms and their meaning.

2.02 Power Circuitry. With the POWER-ON switch in the on position, 117 VAC is applied to the input of transformer T1; the output is fed to a bridge rectifier consisting of diodes CR1 through CR4. The output of this rectifier passes through fuse F6 to provide a +10 volt supply to the alarm memory circuitry on the alarm PCB. This +10 volts is also used to operate relay K1.

When relay K1 operates, a set of contacts closes to turn on the POWER ON lamp and apply 117 VAC to transformers T2, T3, and T4. Transformer T2 passes a lowered AC voltage to another bridge rectifier CR6 through CR9 which, in turn, drives the voltage regulator, Q3. The output of Q3 is -12 volts and is used to power the MOS circuitry in the TD-100.

Transformer T3 is a transactor which changes the 60-Hz input to 30 Hz for use as an unbiased ringing supply. The ringing voltage will be passed to the output of the PSCB only if relay K4 is operated due to a ringing start signal appearing on the RSTB lead.

Transformer T4 provides a 10 VAC output to furnish a buzzer voltage supply for the private line and manual intercom circuit.

2.03 Overvoltage Alarm. The overvoltage alarm is activated if the alarm board detects a rise in the +5 volt supply that brings the voltage above 6.2 volts. When that occurs, the alarm board sends a ground on the OV lead to the PSCB which causes relay K3 to operate. Operation of K3 removes the ground from relay K1 thus causing a discontinuance of the -12 volts and the ringing supply voltage. The operation of relay K3 also removes the ground from the PO (power on) lead to cause a power failure transfer and produce an alarm.

2.04 High Temperature Alarm. When the temperature in the TD-100 cabinet exceeds 70° C (168° F), the major high temperature thermostat will close. This places a ground on relay K2 causing it to operate and resulting in the same actions as the operation of K3; that is relay K1 releases causing a discontinuance of the -12 volts and ringing voltage, and a power failure transfer occurs.

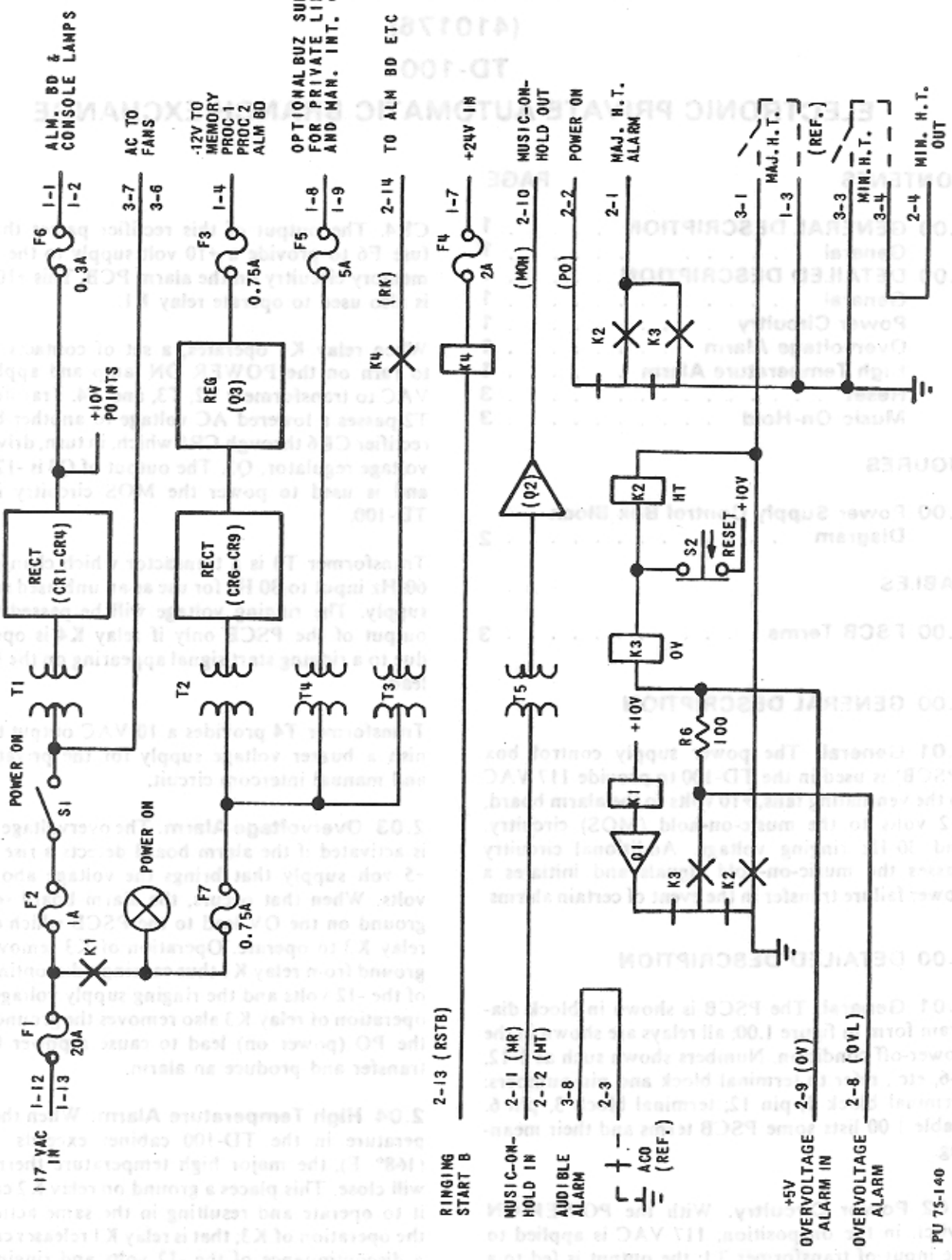

FIGURE 1.00 Power Supply Control Box Block Diagram

TABLE 1.00 PSCB Terms

ABBREVIATION	MEANING
AUDIO AL	Audio Alarm
HT ALARM	High temperature alarm
HTL MAJOR	High temperature lamp major
HTL MINOR	High temperature lamp minor
MOH	Music-on-hold
MR	Music ring
MT	Music tip
OV	Overvoltage
OVL	Overvoltage lamp
PO	Power-on
RK	Ringing key-phone
RSTB	Ringing start B

2.05 Reset. Switch S2 is the RESET switch. If relay K2 or K3 operates (for any reason), it locks through its own contacts. After the fault that caused the relay operation has been cleared, the relay(s) may be released by operating the RESET switch. This removes the +10 volts from the relays allowing them to release.

2.06 Music-On-Hold. Transformer T5 and transistor Q2 are provided to give impedance matching and unity gain to the music-on-hold signal. This signal passes through T5, into the unity gain amplifier Q2 and out of the PSCB on the MOH lead.

DIRECT INWARD DIALING TRUNK
(410177)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 DID Trunk Block Diagram 2

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with direct inward dialing trunks (DID) to permit incoming call completion directly to the desired station, without the assistance of the console attendant. Each DID trunk has its own built-in register and can accept from one to four digits for call completion. Three types of starts are available for 1800 ohm loops; immediate, delay, and wink. Features such as call forwarding to the attendant if the dialed station is busy, return of busy tone on the calling line, and automatic recall on called station disconnect are available, based on the option strapping of the trunk. The trunk may also be put into conference and camped on by the attendant.

2.00 DETAILED DESCRIPTION

2.01 General. Operation of the DID trunk may be divided into stages; the following paragraphs describe these stages. Figure 1.00 is a block diagram of a DID trunk. Table 1.00 explains some of the trunk abbreviations used in the TD-100 EPABX.

2.02 Trunk Seizure and Receipt of Dial Pulses. The status and identity of an idle DID trunk is a hexadecimal "FF" (see table 1.01 for binary coded hexadecimal and alphanumeric equivalents). Each tip and ring normally has a ground and battery potential respectively which is reflected to the central office. The trunk is seized through a loop (R = 1800 ohm) across the tip and ring from the central office, which operates the K1 relay. The output of the D flip-flop (U44-8) enables the incoming counter (U29). The status-out of the trunk changes from "FF" to "E7" (trunk busy). The TA lamp on the console lights (U40-8 high, U62-1 low). In response, the processor sends back a seize signal on lead SI-1 (low).

If the DID trunk is strapped for immediate start (pins 6 & 7), then U8 is set (U8-5 high, U17-8 low, U8-3 high) which enables the dial pulse detector circuit (U11, U5, and U4) and inhibits the incoming counter (U29-2 high).

For delayed start, pins 6 and 8 are strapped. After relay K1 is operated, relay RB is energized (via U19-12 high, U6-6 low, U6-3 high and U19-8 low), and a stop dial signal is transmitted to the central office (battery on tip and ground on ring). A seize signal from the processor is sent on the SI-1 lead, U19-8 and U8-5 go high and relay RB releases. Note that relay RB stays on for a minimum time of 100 milliseconds while U29-11 is high. After relay RB releases, the trunk is ready to accept the digits sent from the central office.

For wink delay start, pins 6 and 9 are strapped. When the processor sends a seize signal to the trunk, relay RB operates (U19-6 low) which enables

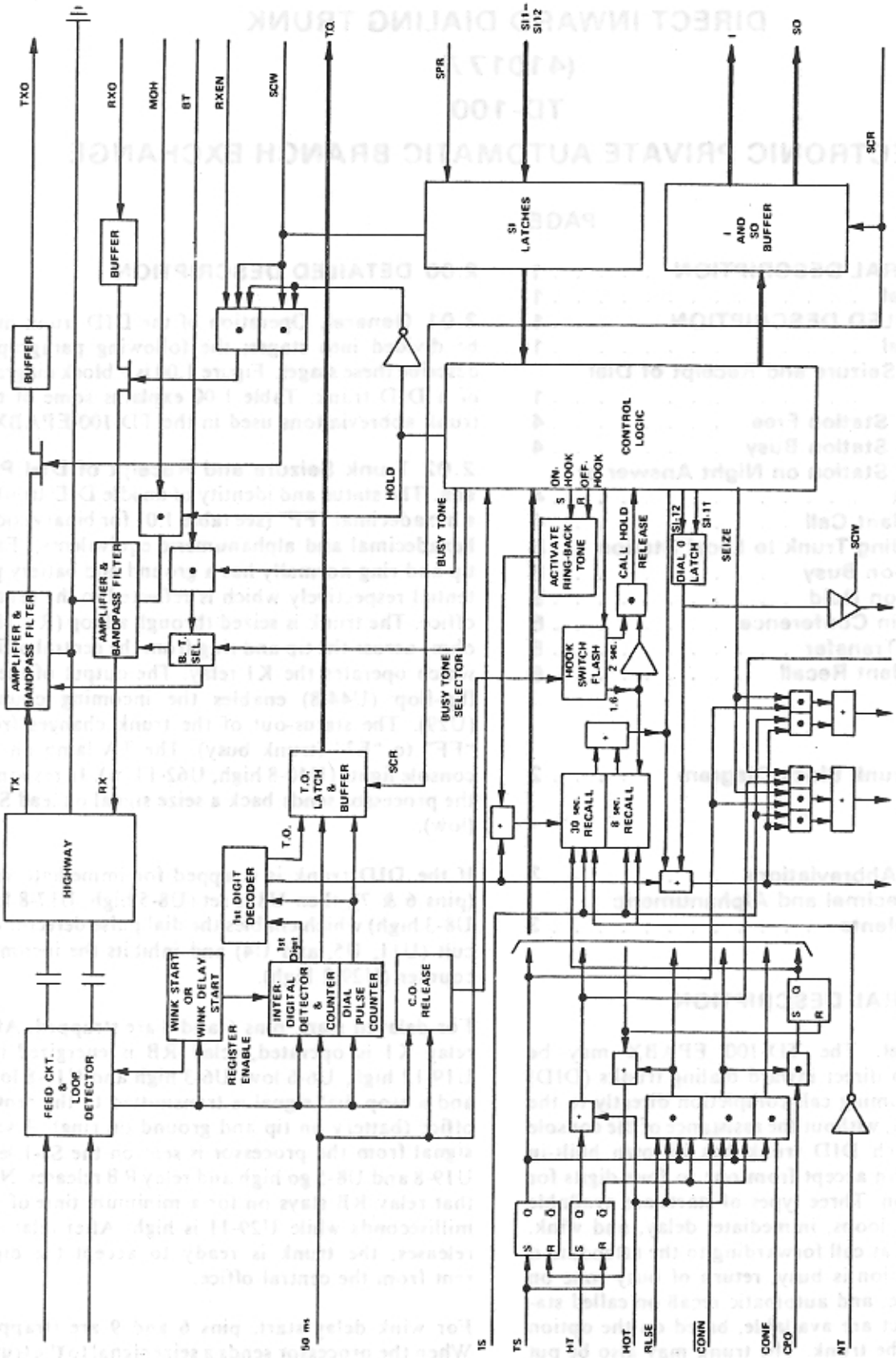

FIGURE 1.00 DID Trunk Block Diagram

PU 75-146

TABLE 1.00 Trunk Abbreviations

ABBREVIATION	MEANING
AIN	Artifical intrude
ANA	Assigned night answer
CONN	Connect
HT	Hold trunk
MOH	Music on hold
SCR	Scan channel read
SCW	Scan channel write
TA	Trunk A
TB	Trunk B
UNA	Unassigned night answer
VNI	Vacant number intercept

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

counter U18. U17-11 goes low after 200 milliseconds, which changes U19-6 to high, releases relay RB, and enables the dial pulse detector circuit by changing U8-5 to high.

Relay K1 follows the dial pulses from the central office and, via U44-9, they appear at the dial pulse counter, U11-14, and the interdigit detector U48, via U5-11. A low input will appear at U47-11 between every consecutive pulse (interdigit time 150 milliseconds). The output (U47-11 low) is clocked through U36 at SCW (scan channel write) and appears as a pulse at U35-3 once every 64 milliseconds. The leading edge of this pulse is used to step the digit counter, U4. A high output at U4-7 indicates that the first significant digit has been detected. In a similar manner, a high output at U4-15 indicates that the last digit has been detected. The pulse appearing at U35-3 is gated with SCR (scan channel read) which is used to reset the dial pulse counter U11 during every interdigit period, through U35-11, U35-6, and U35-9. Depending on the number of digits transmitted from the central office, pins 28 through 35 (U4) are strapped according to the system manual. If four digits are sent from the central office, the first digit is always absorbed and the second digit in becomes the first significant digit. If only two digits are sent, latches U5 and U34 are set with the first digit in.

In the case of four digits and three digits, the first significant digit represents the hundred of the station number. The D flip-flop (U5-5) is set low (see strapping), which enables the TO leads to be extended through U61-8 and U61-6. The second (tens) and third (unit) digits detected will appear at the TO leads respectively during SCR.

2.03 Dialed Station Free. If the dialed station is idle, the processor sends a low signal on lead SI-4 which resets the DID trunk dial pulse detector circuits (U8-1, U8-5, U4-1, and U5-1 all low) and inhibits the TO leads output U61-5 and U61-10 high). The signal on lead SI-4 also enables the ring tone through U87-5 (high) and, through U76-6 (low), and U72-13 (low), changes the status-out from "E7" to "E3." The dialed station rings and ring-back tone is returned to the calling line.

When the station answers, an SI-3 signal is received (U83-5 going low during SCW); during all this time the station remains off-hook. The output of the latch, U76-14, will be high causing a low at U19-1, due to a high at U90-9 and a low at U23-8 to operate the RB relay. This results in ground being applied on the ring lead and battery on the tip lead. The status out changes from "E3" to "E7."

2.04 Dialed Station Busy. If the dialed station is busy, the processor sends a low signal on lead SI-8. This signal resets the dial pulse detector circuits and sets U89-5 high, changes the status out from "E7" to "E8" (clear terminating number). Based on the strapping (pins 37 and 38), the calling line will receive busy tone since U83-11 and U84-8 are low and Q10 is off. If pins 37 and 39 are strapped, the calling line will receive ring-back tone, the attendant buzzer will be on, and the TA lamp will flash indicating an incoming call. Under this condition, the status-out from the trunk is "E3" (U72-13 low).

2.05 Dialed Station on Night Answer or Vacant. With the night switch on the console on NIGHT, and pins 37-39 strapped, the calling line will receive busy tone while Q1 is off and U81-11 and U81-8 are high. If the dialed number is a vacant number, the calling line will receive ring-back tone and the call will be directed to the attendant. This condition is achieved because the trunk will receive a VNI signal (vacant number intercept) from the class of service during the SCR and an SI-8 signal from the processor during SCW. The status-out changes from "E7" to "E3," regardless of the strapping (pins 37, 38, and 39), and U87-9 goes high at that instant.

If a vacant number is dialed when the unit is on NIGHT, the trunk status-out changes from "E7" to "EF." The central bell or assigned station will ring depending on whether it is on UNA (unassigned night answer) or ANA (assigned night answer) (U85-6 and U82-2 low). If the ANA station is busy, a camp-on status is sent on leads SI-8 and SI-11 (U78-5 high, U60-3 low).

2.06 Attendant Call. If the first significant digit dialed is the assigned attendant number (see strapping information), U5-5 remains high which inhibits the output of the TO leads; U50-8 goes low and the Q outputs of D flip-flops U87-9 are U87-5 go high. The status-out changes from "E7" to "E3," ring-back tone is applied to the calling line, and the attendant is alerted. If a vacant number is dialed, after the last digit, the call is routed to the attendant (U50-9 high, U50-8 low).

When the attendant answers, the status of the trunk changes from "E3" to "E6" (write attendant number) and U72-10 goes low while U47-10 goes high. The processor now sends SI-3 and SI-11 signals to change the status-out from "E6" to "E7." AN SI-11 signal sets U80-13 and U91-13 low and the latch output of U87-13 or U89-1 is reset to low. This removes the write attendant number status-out, "E6," due to a low at U47-9. An SI-3 signal operates relay RB by setting latches U23 and U90 (U23-8 and U90-8 are low.) The attendant is now connected to the calling line on the DID trunk's time slot.

2.07 Extending Trunk to Local Station. The DID trunk may be extended to a local station in the normal manner. The DID trunk goes on automatic hold when the attendant leaves the trunk and seizes the attendant line. The status of the trunk changes from "E7" to "ED" (U57-10, U51-8 and U75-8 are high, U72-1 is low). The voice path between the attendant and the trunk is inhibited by a low on U39-13.

If the station dialed is idle and the attendant presses the connect bar, a ground will appear on the $\overline{\text{CONN}}$ lead and the status-out is changed from "ED" to "E5" via U52-12 (high) and U63-6, U72-2 (low). In response, the processor sends an SI-11 signal that resets the attendant off-hook latches (U59-1 and U23-9 go to low) and changes the status out from "E5" to "E3" (apply ring-back tone). In addition, the processor clears the attendant number and writes the station number in the terminating number store of the memory. The calling line receives ring-back tone and the dialed station is scanned during the DID time slot. The 30 second time-out counter, consisting of U43 and U55, is enabled due to a low on U43-3 and U55-3. If the called station answers within 30 seconds, the processor sends back an SI-3 signal that sets the off-hook latches U23-13 and U23-8 low and changes the status-out from "E3" to "E7." If the station does not answer within 30 seconds, the DID trunk recalls the attendant. The latch U56 is set due to a high on U55-8 which changes the status outputs from "E3" to "E1" (clear status number). The attendant is alerted by the flashing lamps, TA and TB, while U56-8, U72-4, and U6-8 go low.

2.08 Camp-on Busy. If the trunk is extended to a busy station, the trunk camps on. A ground appears on the CPO lead from the attendant register. Latch U78 is set due to a high on U60-11 while U78-5 goes high. The calling line receives music-on-hold (MOH), if equipped, and the logic states of U27-4 and U73-4 are low. Transistor Q7 is off and Q8 is on. The 30-second time-out counter (U43 and U55) and the 8-second counter (U67) are each enabled by a low on pin 3 of the respective chip. These counters change the output status codes to the processors and apply a burst of tone to the dialed station. The status-out changes from "E5" to "F3" for 0-.5 seconds and to "ED" for 7.5 seconds continuously for each cycle. During status "F3," the processor checks the status of the dialed station and the DID trunk. Based on the strapping of pins 15, 42, and 43, a burst of busy tone is transmitted to the station via U65-12 and U65-8 going high, U39-1 going low, Q11 off, and Q12 on. If the dialed station does not hang up within 30 seconds, the trunk recalls the attendant; if the station does hang up within 30 seconds, then during status "F3," the processor sends back a signal on SI-4 that resets the camp-on latch (U78-5) low, and the counters are reset by a low on U76-10, U79-4, and U79-12. The status-out changes from "F3" to "E3" and the called line receives ring-back tone. When the station answers, the DID trunk receives a signal on lead SI-3, the off-hook latch (U23-8 low) is set, and the status-out changes from "E3" to "E7."

2.09 Trunk on Hold. When the attendant is connected to the trunk, the status out is "E7." The DID trunk will be put on manual hold if the manual hold key is depressed, and on automatic hold if the attendant selects another line or trunk. A ground appears on the HT lead and sets the HT latch (U59-9) to high.

This changes the status-out from "E7" to "ED" (U51-8 high), applies music-on-hold, if equipped, to the calling line (U73-5 high) and inhibits the $\overline{\text{CONN}}$ output lead (U63-4 low).

2.10 Trunk in Conference. The DID trunk may be put into the conference circuit by the attendant. A ground present on the conference lead generates a conference request code "E9" (U72-3 low). The processor returns an SI-10 signal to the trunk. This signal resets the attendant latch and changes the status-out from "E9" to "E7" (U74-9 and U59-1 low).

2.11 Trunk Transfer.

a. Station to station. A call from a DID trunk to a station may be transferred to another station. When the hookswitch is momentarily

operated from the transferring station, the on-hook time (200 milliseconds to 1.6 seconds) is detected by the processor, lead SI-3 goes high and counters U30 and U31 are enabled. A low appears at U30-2 and U31-2. After 200 milliseconds, latch U32 is set (U31-8 and U32-5 high). If an off-hook condition is detected (SI-3 low) before 1.6 seconds has elapsed, a consultation hold request is generated, which changes the status-out to "EA," and U68-12 and U71-12 stay low. The processor returns a signal on lead SI-6 and connects the station to a register if one is available. The transferring station receives transfer dial tone and the trunk status has changed from "EA" to "EC" (U27-5 low) to provide music-on-hold (if equipped). When the transferring station has dialed the new station number, the processor writes the originating and terminating numbers at the transfer link time slot in the memory (provided a link is available and the station is idle). Detection of a new hookswitch flash (now in transfer link) in the processor removes the signal on lead SI-6 and sends a signal on lead SI-7 to the DID trunk. The status-out of the trunk changes from "EC" to "EE" and the trunk and two stations are connected through the add-on link. When one of the stations goes on-hook, the processor removes the signal on the SI-1 lead from the trunk and sends a signal on leads SI-3 and SI-11. The new station number is written on the terminating side of the memory in the trunk's time slot. The status-out changes from "EE" to "E7." The signal on SI-11 resets U32 and the signal on SI-3 sets the off-hook latch U23-8 low. If, during transfer, a register, a transfer link, or an add-on link are not available, the processor removes the signal on SI-6 and sends a signal on SI-8. This is also true when the dialed station is busy. The signal on SI-8 resets U32, sets the busy tone latch (U53-8), and enables the 3.2 second timer (U30-3 and U31-3 low). The status-out changes from "EC" to "E7" and the station receives busy tone for 3.2 seconds. After 3.2 seconds, the busy tone latch is reset and the busy tone is removed (U53-8 and U30-11 are high).

b. Station to attendant. If a station in consultation hold dials "0," the processor sends a signal on lead SI-12 to the trunk that sets the station recall latch, U90-6, low. The status-out changes from "E7" to "E3," the station receives ring-back tone (U66-13 and U72-13 are low), and the attendant is alerted by the buzzer and flashing lamps. When the attendant answers, the attendant latch and the attendant answer latch are both set (U59-5 and U89-9 high) and the station recall latch is reset (U90-6 high). The status-out changes from "E3" to "E7" and a voice path between the station and the attendant is established (on the trunk time slot) via the AIN lead while the trunk voice path is inhibited (trunk's time slot) by U39-12 and U63-12 being high.

When the station goes on-hook, the station release counter (U30 and U31) is enabled and after 200 milliseconds, the clear station number latch (U32) is set through U80-4 being high and U32-10 being low. The status-out, "F1," is transmitted to the processor (U72-4 and U86-2 low). The processor then sends a signal on lead SI-11 which resets the attendant answer latch (U89-9 low). This, in turn, removes the station number and writes the attendant number in the terminating number store of the memory, on the link's time slot. The status-out changes from "F1" to "E7" and a voice path is established between the DID trunk and the attendant.

2.12 Attendant Recall. If the station connected to a DID trunk goes on-hook, the station release counter (U30 and U31) is enabled and after 1.6 seconds, latch U32 is set. The clear station number code, "E1," is transmitted to the processor (U31-8, U20-10, U32-9, and U47-3 high and U72-4 low) and relay RB is released (U19-12 high and U63-3 low). Regardless of the strapping of pins 6 and 4, the 8-second counter (U67-2 low) is enabled, and after 8 seconds, the attendant recall latch U56 is set (U67-11 and U56-5 high). The TA and TB lamps flash and the buzzer sounds. When the attendant answers, the attendant latch U59 is set and the 8-second timer U67 is reset. With the attendant latch on, the new status of the trunk is "E6." The processor sends back a signal on lead SI-11 which resets latch U56. If, at any time, a central office release is detected, the processor removes the signal on the seize lead, SI-1, which changes the status of the DID trunk to idle, "FF."

ALARM BOARD
(410178-001, -002, -003, -004, -005)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 General. The TD-100 EPABX is equipped with an alarm printed circuit board (PCB). This maintenance aid provides a common alarm reporting point and forwards major and minor alarm conditions to external equipment if desired. The PCB mounts in the upper shelf of the TD-100 cabinet in the extreme left-hand position; all connec-

tions are made via the PCB plug-in connector at the rear of the mounting shelf.

Differing versions of the alarm board in use; the 410178-003 (and earlier assemblies), the 410178-004, and the 410178-005. All assembly generations are similar in function but differ in configuration; therefore, the following paragraphs deal with each version separately.

2.00 FUNCTIONAL DESCRIPTION -003 AND EARLIER

2.01 General. The alarm board monitors voltages produced in the TD-100 power supply and issues an alarm when one or more of these voltages fails. The alarm board also registers temperature alarms and alarm conditions originating in the TD-100 timing circuitry. Switches on the alarm board permit testing of all alarm light emitting diodes (LED's), resetting alarms, and transferring the system to the power failure mode of operation. An alarm cut-off (ACO) switch is also provided. Switch and LED functions are described in table 1.00

3.00 CIRCUIT DESCRIPTION -003 AND EARLIER

3.01 General. The alarm board utilizes integrated circuitry arranged in such a manner as to provide the following prime functions: it monitors power supply voltages and generates a major alarm if one or more voltages fail; it monitors the status of the major data bus paths in the TD-100 EPABX and gives a major alarm if one or more fail; it monitors the status of the thermostats in the TD-100 cabinet and gives a minor or major alarm if the temperature rises above 60°C or 70°C, respectively; and it provides circuitry to initiate a power failure transfer in the event of a major alarm. A minor alarm condition is reported if various other circuits within the TD-100 fail. The alarm unit is shown in simplified block diagram form in figure 1.00. Although a third generation assembly is shown, the figure is functionally applicable to all generations.

3.02 Major Alarms. A major alarm is generated when one or more of the following circuits fail: power supply voltages, ring supply voltages, master clock, major data bus, or a temperature rise above 70°C. When any of these conditions occur, the associated LED lights. (In the case of a power failure, the PS LED extinguishes.)

The failure is presented to the major alarm driver circuit, Q19 and Q21. This will cause Q19 and Q21 to turn on, and Q20 and Q22 to turn off. Turning Q22 off causes relay K1 to be de-energized and initiates a change to the power failure transfer mode of operation. The alarm driver circuits also provides a delay of approximately 1 second; therefore, the alarm lamps will come on before the power failure transfer actually occurs.

3.03 Minor Alarms. A minor alarm is generated when a failure occurs in one or more of the following areas: attendants package (AT PAC), register (REG), transfer (XFER), trunks (TRK), options (OPT), links (LK), and (optionally) minor high temperature (HT MIN) alarm. Any one or more of these alarms will cause relay K2 to operate. This will activate the MIN alarm LED and the minor external alarm circuitry.

When a minor alarm occurs, the minor alarm driver, Q23 and Q 24, will de-energize causing the contacts of K2 to transfer. This puts a ground on the MIN LED and sends a ground to the external minor alarm equipment. The alarm driver circuit causes a delay of approximately 1 second between the actual alarm and the sending of the alarm indication.

3.04 Voltage Monitors. The voltage monitor circuits monitor the following voltages; -48V, -12V, +24V (A and B), +12V (A and B), +5 for the trunk (TRK), line and channel (CHAN) circuits. When all these voltages are present, the power supply alarm driver circuit (Q17) is held on. If one or more of these voltages fail, Q17 is turned off. This removes the drive from the PS (power supply) LED causing it to extinguish. At the same time, drive is removed from the major alarm circuit, Q19 to Q21, thereby releasing relay K1 and causing a transfer to the power failure mode (via contact K1/4). In addition, the XFER and MAJ LEDs light and the external alarm is activated.

The +5 volt circuit has a separate voltage monitor which senses overvoltage of the +5 volts. When the voltage exceeds 6.2 volts, the overvoltage detector sends a command to the power supply control box to activate the K3 relay. When relay K3 operates it

TABLE 1.00 Alarm and Switch Conditions (-003 assemblies and earlier)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
MAJOR	PS	Power Supply	ON	Green	When OFF: one or more voltages have failed.
	MC	Master Clock	OFF	Red	When ON: master clock timing has failed.
	BUS	Bus Path	OFF	Red	When ON: at least one system bus path (timing) has failed.
	OV	Over-voltage	OFF	Red	When ON: the +5 volt supply has exceeded +6 volts.
	H.T. MAJ	High temperature major	OFF	Red	When ON: cabinet temperature is above 70° C.
	MAJ	Major	OFF	Red	When ON: a major alarm is on.
MINOR	H.T. MIN	High temperature minor	OFF	Red	When ON: cabinet temperature is above 60° C.
	AT PAC	Attendant package	OFF	Red	When ON: attendant's package (console) failed.
	REG	Registers	OFF	Red	When ON: a register failed.
	TK	Trunks	OFF	Red	When ON: a trunk failed.
	OPT	Options	OFF	Red	When ON: an option has failed.
	LK	Link	OFF	Red	When ON: a link has failed.
	MIN	Minor	OFF	Red	When ON: a minor alarm is present.
	XFER	Transfer	OFF	Red	When ON: the system is in the power failure transfer mode of operation.
	ACO	Alarm Cut-Off	OFF	Red	When ON: The ACO switch is in the ACO position.

TABLE 1.00 Alarm and Switch Conditions (-003 assemblies and earlier) (Cont.)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
	TEST/ RESET	Switch	--	--	TEST position: all LED's LIGHT. RESET position: PS MC and BUS extinguish.
	XFER	Transfer Switch	--	--	When ON: system transfers to power failure transfer mode.
	ACO	Alarm Cut-Off Switch			When ON: external alarms are cut off.

sends a command to relay K1 in the power supply control box which causes the main power to be cut off. Therefore, an overvoltage on the +5 volt circuit causes a major alarm due to power failure. In this instance, the OV, PS, XFER, and MAJ lamps will all be lit and the system will switch to the power failure transfer mode of operation.

3.05 Ring Supply Monitor. Transistors Q12, Q14, and Q16 monitor the ring supply voltages. When these voltages fail, the power supply alarm driver, Q17, is cut-off, causing a PS alarm and power failure transfer as previously described in paragraph 3.04.

3.06 Master Clock Alarm. If the master clock alarm is activated, a high level will appear on the AL MC lead. This will cause the MC LED to light and operate the major alarm relay, K1. Operation of the K1 relay will cause a power failure transfer and the other actions common to a major alarm as previously described.

3.07 High Temperature Alarms. Two types of high temperature alarms are provided. One each for indication of a major and minor high temperature condition. A major high temperature alarm occurs when the cabinet temperature rises above 70° C (168° F) and a minor high temperature alarm occurs when the temperature rises above 60° C (140° F).

When a major high temperature alarm occurs, the HT MAJ input lead receives a ground from the power supply control box. The ground is applied directly to the HT MAJ LED to cause it to light. When the temperature rises above 60° C, a ground appears on the HT MIN lead and activates the HT MIN alarm lamp. If desired, the HT MIN alarm can be strapped, via pins 1 and 2, to activate the minor alarm relay, K2. When relay K2 operates, it places a ground on the MIN LED to light it and completes the ground path through to the external minor alarm equipment, if provided.

3.08 Unattended Night Answer. When the console attendant places the control switch in the NIGHT answer position, a ground appears on the alarm board at the UNAE lead to turn on relay K3. When relay K3 operates, it closes the circuits to the ring battery lead (RB); the UNAT, UNAA and UNAB leads are also looped through the alarm board by operation of relay K3.

3.09 Scan Status. The status of the channel, memory, and processor scan circuitry is monitored by the scan status circuit, H9 and U13. When one or more of the input signals is received during the wrong time period, the scan status circuitry will activate the retriggerable monostable multivibrator circuit (U3, U7, and U8), which, in turn, will activate the major alarm and the BUS alarm circuits.

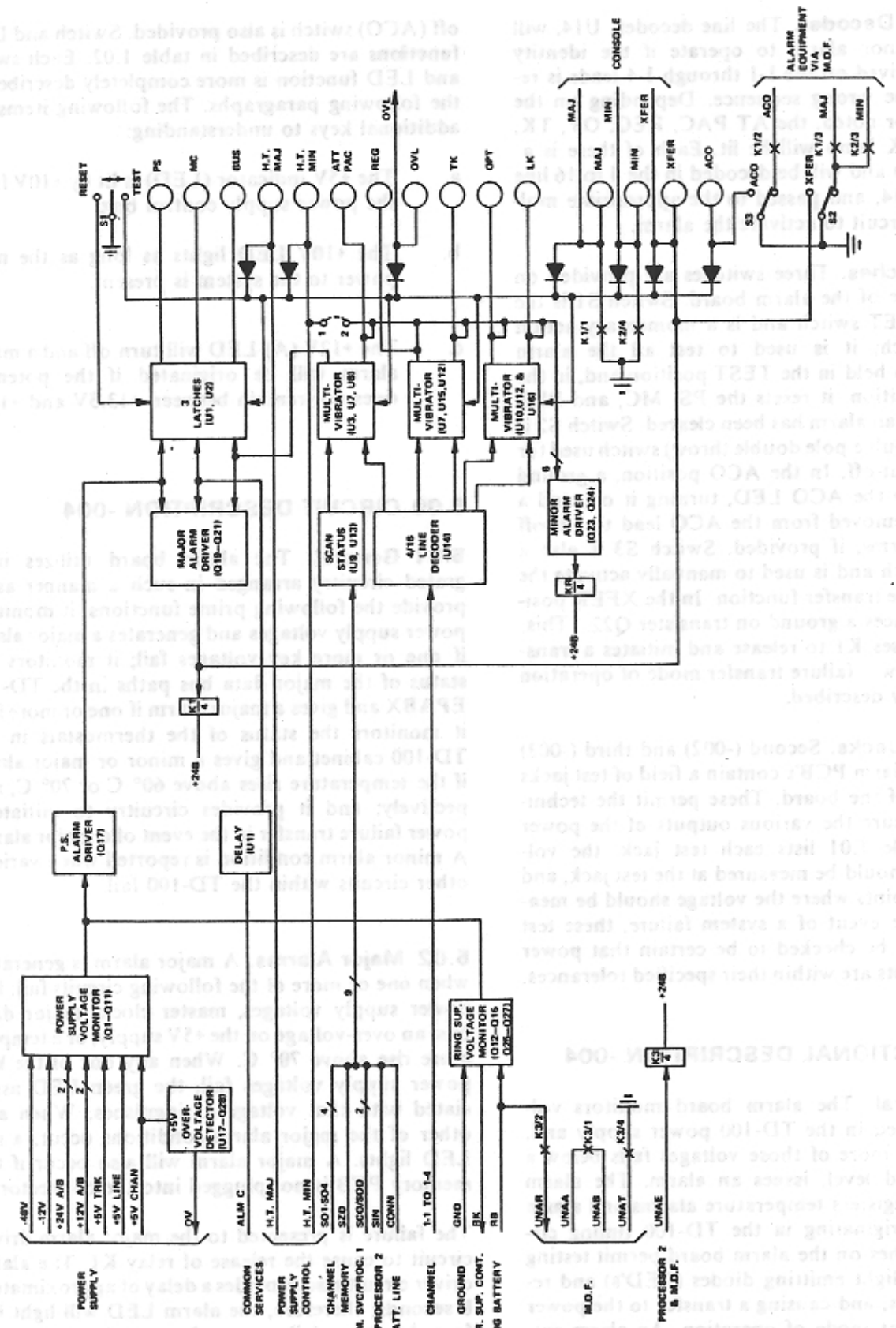

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FIGURE 1.00 Alarm Board, Simplified Block Diagram (-003 and earlier assemblies)

3.10 Line Decoder. The line decoder, U14, will cause a minor alarm to operate if the identity pattern received on the I-1 through I-4 leads is received in the wrong sequence. Depending on the type of error noted, the AT PAC, REG, OV, TK, OPT, or LK lamp will be lit. Each of these is a minor alarm and will be decoded in the 4 to 16 line decoder, U14, and passed to the appropriate multivibrator circuit to activate the alarm.

3.11 Switches. Three switches are provided on the faceplate of the alarm board. Switch S1 is the TEST/RESET switch and is a momentary action toggle switch; it is used to test all the alarm LED's when held in the TEST position and, in the RESET position, it resets the PS, MC, and BUS LED's after an alarm has been cleared. Switch S2 is a DPDT (double pole double throw) switch used for the alarm cut-off. In the ACO position, a ground is applied to the ACO LED, turning it on, and a ground is removed from the ACO lead to cut-off external alarms, if provided. Switch S3 is also a DPDT switch and is used to manually activate the power failure transfer function. In the XFER position, S3 places a ground on transister Q22. This, in turn, causes K1 to release and initiates a transfer to the power failure transfer mode of operation as previously described.

3.12 Test Jacks. Second (-002) and third (-003) generation alarm PCB's contain a field of test jacks at the top of the board. These permit the technician to measure the various outputs of the power supply. Table 1.01 lists each test jack, the voltage which should be measured at the test jack, and the actual points where the voltage should be measured. In the event of a system failure, these test jacks should be checked to be certain that power supply outputs are within their specified tolerances.

4.00 FUNCTIONAL DESCRIPTION -004

4.01 General. The alarm board monitors voltages produced in the TD-100 power supply and, when one or more of those voltages falls below a predetermined level, issues an alarm. The alarm board also registers temperature alarms and alarm conditions originating in the TD-100 timing circuitry. Switches on the alarm board permit testing of all alarm light emitting diodes (LED's) and resetting alarms, and causing a transfer to the power failure transfer mode of operation. An alarm cut-off (ACO) switch is also provided. Switch and LED functions are described in table 1.02. Each switch and LED function is more completely described in the following paragraphs. The following items are additional keys to understanding:

a. The +5V indicator (LED) is lit by +10V from the power supply control box.

b. The +10V LED lights as long as the main power to the system is present.

c. The +12V (A) LED will turn off and a major alarm will be originated if the potential does not remain between +13.5V and +10V.

5.00 CIRCUIT DESCRIPTION -004

5.01 General. The alarm board utilizes integrated circuitry arranged in such a manner as to provide the following prime functions: it monitors power supply voltages and generates a major alarm if one or more key voltages fail; it monitors the status of the major data bus paths in the TD-100 EPABX and gives a major alarm if one or more fail; it monitors the status of the thermostats in the TD-100 cabinet and gives a minor or major alarm if the temperature rises above 60° C or 70° C, respectively; and it provides circuitry to initiate a power failure transfer in the event of a major alarm. A minor alarm condition is reported when various other circuits within the TD-100 fail.

5.02 Major Alarms. A major alarm is generated when one or more of the following circuits fail: key power supply voltages, master clock, major data bus, an over-voltage on the +5V supply, or a temperature rise above 70° C. When any one of the key power supply voltages fail, the green LED associated with that voltage extinguishes. When any other of the major alarm conditions occur, a red LED lights. A major alarm will also occur if the memory PCB is not plugged into the connector.

The failure is presented to the major alarm driver circuit to cause the release of relay K1. The alarm driver circuit also provides a delay of approximately 8 seconds; therefore, the alarm LED will light before the power failure transfer actually occurs.

TABLE 1.01 Alarm Board Test Jacks (-002, 003)

DESIGNATION	FUNCTION	MEASURED POTENTIAL
RB	Ring battery for loop ringing on line cards.	85 to 120 V interrupted AC superimposed on -48 VDC. Measure between test jacks RB and GND D.
+5V M2	Logic voltage for middle subrack.	4.75 to 5.7 VDC Measure between test jacks +5V M2 and GND A.
GND D	Ground D.	
+5V M3	Logic voltage for bottom subrack.	4.75 to 5.7 VDC Measure between test jacks +5V, M3 and GND A.
-48V	Talk battery for line and trunk circuits.	-48 ± 6 VDC Measure between test jack -48V and GND C on the upper and lower motherboards.
-12V	Logic voltage for processor and memory boards.	-12 ± 0.6 VDC Measure between test jacks -12V and GND D.
+12VB	Lamp voltage for key telephones.	+12 ± 3 VDC Measure between test jacks +12VB and GND D.
RK	Ringing voltage for common audible ringer.	85 to 120 VAC Measure between test jacks RK and GND D.
GND A	Ground A.	
+24VB	Voltage for various console lamps and controls.	+24 ± 2.4 VDC Measure between test jack +24VB and GND B on the motherboard.

TABLE 1.01 Alarm Board Test Jacks (-002, 003) (Cont.)

DESIGNATION	FUNCTION	MEASURED POTENTIAL
+12VA	Bias voltage for speech common highway.	+12 ± 1.2 VDC Measure between test jacks +12VA and GND A.
+24VA	Voltage for operational amplifiers.	+24 ± 2.4 VDC Measure between test jacks +24VA and GND A.
+5V M1	Logic voltage for top subrack.	4.75 to 5.7 VDC Measure between test jacks +5V M1 and GND A.

5.03 Minor Alarms. A minor alarm is generated when a failure occurs in one or more of the following areas: +12V (B), ring battery(s), 10 VAC buzzer voltage, high temperature (lower range), or when the system is put into the power fail transfer mode of operation. Any one or more of these alarms will cause relay K2 to operate. This will activate the MIN alarm LED and the minor external alarm circuit.

When a minor alarm occurs, the minor alarm driver, Q35 and Q36, will de-energize causing the contacts of K2 to transfer. This puts a ground on the MIN LED and sends a ground to the external minor alarm equipment. The alarm driver circuit causes a delay of approximately 1 second between the actual alarm and the sending of the alarm indication.

5.04 Voltage Monitor. The voltage monitor circuits monitor the following voltages: -48V, -12V, +12V(A), +5V and +10V. If one or more of these voltages fail, drive is removed from the major alarm driver circuit, Q16, Q27, and Q23, thereby releasing relay K1 and causing a transfer to the power failure mode (via contacts K1/4). In addition, the XFER and MAJ LEDs light and the external major alarm is activated.

Transistors Q4, Q5, and Q6 monitor the ring supply voltages. When one or more of these voltages fail, a power failure transfer occurs as previously described.

The alarm board has a separate voltage monitor which senses overvoltage of the +5 volts. When the voltage exceeds 5.67 to 6.29 volts, the monitor sends a command to the power supply control box to activate relay K3. When relay K3 operates, it sends a command to relay K1 in the power supply control box which causes the main power to be cut off. Therefore, an overvoltage on the +5 circuit causes a major alarm due to power failure. In this instance, the OV, XFER, and MAJ LEDs will all be lit, and the system will switch to the power failure transfer mode of operation.

Master Clock Alarm. If the master clock fails, a high level will appear on the AL MC lead. This will cause the MC LED to light and operate the major alarm relay, K1. If the console switch is in the NIGHT answer position, operation of K1 will cause a power failure transfer and other actions common to a major alarm as previously described.

TABLE 1.02 Alarm and Switch Conditions (-004)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
MAJOR	MAJ	Major alarm	OFF	Red	When ON, major alarm exists.
	+5V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	+10V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	+12V(A)	Voltage	ON	Green	When OFF, indicates that voltage has failed or varied from the +10V to +13.5 range.
	+24V(B)	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	-12V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	-48V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	MC	Master Clock	OFF	Red	When ON, master clock timing has failed.
	BUS	Bus Path	OFF	Red	When ON, at least one system bus path (timing) has failed.
	OV	Over-voltage	OFF	Red	When ON, the +5V circuit voltage has exceeded the 5.67 to 6.29 volt limit.
	H.T.	High temperature	OFF	Red	When ON, cabinet temperature is above 70° C.
MINOR	MIN	Minor alarm	OFF	Red	When ON, minor alarm exists.
	+12V(B)	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	RB	Ring Battery	ON	Green	When OFF, indicates that voltage has failed.
	RK	Ring (key) battery	ON	Green	When OFF, indicates that voltage has failed.

TABLE 1.02 Alarm and Switch Conditions (-004) (Cont.)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
M	10 VAC	Voltage	ON	Green	When OFF, indicates that voltage has failed.
I	H.T.	High temperature	OFF	Red	When ON, cabinet temperature is above 60° C.
N	XFER	Transfer by Attendant	ON	Red	When ON, system is in power failure transfer.
O	ACO	Alarm Cut-Off	ON	Red	When ON, external alarms are cut off.
R	TEST	Test Switch	--	--	In test position, all LED's are tested; on release all LED's are reset if corresponding alarm has been cleared.
	XFER	Transfer Switch	--	--	When operated, system goes to power failure transfer mode.
	ACO	Alarm Cut-Off Switch	--	--	When operated, external alarms are cut off.

5.06 High Temperature Alarms. Two types of high temperature alarms are provided; one each for indication of a major and minor high temperature condition. A major high temperature alarm occurs when the temperature rises above 70°C (168°) and a minor high temperature alarm occurs where the temperature rises above 60° C (140° F).

When a major high temperature alarm occurs, the HT MAJ input lead receives a ground from the power supply control box. The ground is applied directly to the HT MAJ LED to cause it to light. When the temperature rises above 60° C, a ground appears on the HT MIN lead and activates the HT MIN alarm LED. If desired, the HT MIN alarm can be strapped, via pins 1 and 2, to activate the minor alarm relay, K2. When relay K2 operates, it places a ground on the MIN LED to light it, and completes the ground path through to the external minor alarm equipment, if provided.

5.07 Unattended Night Answer. When the attendant places the console control switch in the NIGHT answer position, a ground appears on the alarm board at the UNAE lead to turn on relay K3. When relay K3 operates, it closes the circuits to the ring battery lead (RB); the UNAT, UNAA, and UNAB leads are also looped through the alarm board by operation of relay K3. The major alarm and power failure transfer are also enabled to respond to a BUS alarm or MC alarm when the console switch is in the NIGHT answer position.

5.08 Scan Status. The status of the channel, memory, and processor scan circuitry is monitored by the scan status circuitry U2, U3, and U4. When one of the input signals is received during the wrong time period, the scan status circuitry will activate the retriggerable monostable circuit (U5, U6, U7, and U8), which in turn will (after a delay of 8 seconds due to Q31, etc.) activate the BUS alarm circuits and, if the console switch is in the NIGHT

answer position, a major alarm and power failure transfer will occur. If the processor 2 PCB is not plugged into the connector, a BUS alarm occurs, but no power failure transfer takes place.

5.09 Switches. Three switches are provided on the faceplate of the alarm board. Switch S1 is the TEST switch and is a momentary action toggle switch; it is used to test all the alarm LED's when held in the TEST (up or down) position, and when released, it resets the MC, and BUS LED's after an alarm has been cleared. Switch S2 is a DPDT (double pole double throw) switch used for the alarm cut-off. In the ACO position, a ground is applied to the ACO lamp, turning it on, and a ground is removed from the ACO lead to cut-off external alarms, if provided. Switch S3 is also a DPDT switch and is used to manually activate the power failure transfer function. In the XFER position, S3 places a ground on transistor Q22. This, in turn, causes K1 to release and initiates a transfer to the power failure transfer mode of operation as previously described.

6.00 FUNCTIONAL DESCRIPTION -005

6.01 General. The alarm board monitors voltages produced in the TD-100 power supply and, when one or more of these voltages falls below a predetermined level, issues an alarm. The alarm board also registers temperature alarms and alarm conditions originating in the TD-100 timing circuitry. Switches on the alarm board permit testing of all alarm light emitting diodes (LED's) and resetting alarms, and causing a transfer to the power failure transfer mode of operation. An alarm cut-off (ACO) switch is also provided. Switch and LED functions are described in table 1.03. Each switch and LED function is more completely described in the following paragraphs and a frontal view drawing of the fifth generation alarm board is shown in figure 1.01.

7.00 CIRCUIT DESCRIPTION -005

7.01 General. The alarm board utilizes integrated circuitry arranged in such a manner as to provide the following prime functions: it monitors power supply voltages and generates a major alarm if one or more key voltage fail; it monitors the status of the major data bus paths in the TD-100 EPABX and gives a major alarm if one or more fail; it monitors the status of the thermostats in the TD-100 cabinet and gives a minor or major alarm if the temperature rises above 60°C or 70°C, respectively; and it provides circuitry to initiate a power failure transfer in the event of a major alarm. A minor alarm condition is reported when various other circuits within the TD-100 fail.

7.02 Major Alarms. A major alarm is generated when one or more of the following circuits fail: key power supply voltages, master clock, major data bus, an over-voltage on the +5V supply, or a temperature rise above 70°C. When any one of the key power supply voltages fail, the green LED associated with that voltage extinguishes. When any other of the major alarm conditions occurs, a red LED lights. A major alarm will also occur if the memory PCB is not plugged into the connector.

Any failure causing a major alarm is presented at the input of U8. Relay K1 is energized through transistors Q30, Q32, Q33, and Q34. This alarm driver circuit provides a delay of approximately 8 seconds before releasing K1, therefore the LED will come on before the power failure transfer actually occurs.

7.03 Minor Alarms. A minor alarm is generated when a failure occurs in one or more of the following areas: +12V(B), ring battery(s) buzzer voltage, or high temperature (lower range). Any one or more of these alarms will cause relay K2 to release.

When a minor alarm occurs, the minor alarm driver Q35 and Q36, will allow K2 to release, thus, lighting the MIN LED and sending a ground to the external minor alarm equipment. The alarm driver circuit causes a delay of approximately 1 second between the actual alarm and the sending of the alarm indication.

7.04 Voltage Monitor. The voltage monitor circuits monitor the following voltages: -48V, -12V, +12V(A), +5V and +10V. If one or more of these voltages fail, drive is removed from the major alarm driver circuit thereby releasing relay K1 and causing a transfer to the power failure mode of operation. In addition, the XFER and MAJ LEDs light and the external major alarm is activated.

Transistors Q1 through Q6 monitor the ring supply voltages. When one of these voltages fails, a minor alarm occurs as previously described.

TABLE 1.03 Alarm and Switch Conditions (-005)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
MAJOR	MAJ	Major alarm	OFF	Red	When ON, major alarm exists.
	+5V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	+10V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	+12V(A)	Voltage	ON	Green	When OFF, indicates that voltage has failed or varied from the +10V to +13.5V range.
	+24V(B)	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	-12V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	-48V	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	MC	Master Clock	OFF	Red	When ON, master clock timing has failed.
	BUS	Bus Path	OFF	Red	When ON, at least one system bus path (timing) has failed.
	OV	Over-voltage	OFF	Red	When ON, the +5V circuit voltage has exceeded the 5.67 to 6.29 volt limit.
	H.T.	High temperature	OFF	Red	When ON, cabinet temperature is above 70° C.
MINOR	MIN	Minor alarm	OFF	Red	When ON, minor alarm exists.
	+12V(B)	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	RB	Ring Battery	ON	Green	When OFF, indicates that voltage has failed.
	RK	Ring (key) battery.	ON	Green	When OFF, indicates that voltage has failed.

TABLE 1.03 Alarm and Switch Conditions (-005) (Cont.)

ALARM TYPE	DESIGNATION	MEANING	NORMAL STATE	COLOR	FUNCTION
MINOR	BUZ	Voltage	ON	Green	When OFF, indicates that voltage has failed.
	H.T.	High temperature	OFF	Red	When ON, cabinet temperature is above 60° C.
	XFER	Transfer by Attendant	ON	Red	When ON, system is in power failure transfer.
	ACO	Alarm Cut-Off	ON	Red	When ON, external alarms are cut off.
		Test Switch	--	--	In test position, all LED's are tested; on release all LED's are reset if corresponding alarm has been cleared.
	XFER	Transfer Switch	--	--	When operated, system goes to power failure transfer mode.
	ACO TEST	Alarm Cut-Off Switch	--	--	When operated, external alarms are cut off.

The alarm board has a separate voltage monitor which senses overvoltage of the +5 volts. When the voltage exceeds 5.67 to 6.29 volts, the monitor sends a command to the power supply control box to activate relay K3. When relay K3 operates, it sends a command to relay K1 in the power supply control box which causes the main power to be cut off. Therefore, an overvoltage on the +5 volt circuit causes a major alarm due to power failure. In this instance, the OV, XFER, and MAJ LEDs will all be lit, and the system will switch to the power failure transfer mode of operation.

7.05 Master Clock Alarm. If the master clock fails, a high level will appear on the AL MC lead. This will cause the MC LED to light. If the console switch is in the NIGHT answer position, K1 will release to cause a power failure transfer.

7.06 High Temperature Alarms. Two types of high temperature alarms are provided; one each for indication of a major and minor high temperature condition. A major high temperature alarm occurs when the temperature rises above 70°C (168° F) and a minor high temperature alarm occurs when the temperature rises above 60°C (140°F).

When a major high temperature alarm occurs, the HT MAJ input lead receives a ground from the power supply control box. The ground is applied directly to the HT MAJ LED to cause it to light. When the temperature rises above 60°C, a ground appears on the HT MIN lead and activates the HT MIN alarm LED. If desired, the HT MIN alarm can be strapped, via pins B1 and B2, to release the minor alarm relay K2. When relay K2 releases, it places a ground on the MIN LED to light it, and

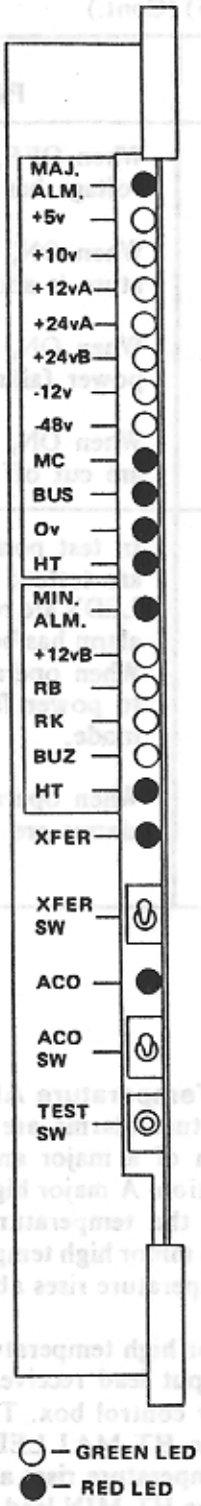

FIGURE 1.01 Fifth Generation Alarm Board Panel

on the MIN lead to the external minor alarm equipment and the console.

7.07 Unattended Night Answer. When the attendant places the console control switch in the NIGHT answer position, a ground appears on the alarm board at the UNAE lead to operate relay K3. When relay K3 operates, it closes the circuits to the ring battery lead (RB), and grounds lead UNAT; the UNAA/UNAB leads are looped through the alarm board by the operation of relay K3. The major alarm and power failure transfer are also enabled to respond to a BUS alarm or MC alarm when the console switch is in the NIGHT answer position.

7.08 Scan Status. The status of the channel, memory, and processor scan circuitry is monitored by the scan status circuitry U2, U3, and U4. When one of the input signals is received during the wrong time period, the scan status circuitry will activate the retriggerable monostable U5, which in turn will (after a delay of 8 seconds due to Q31, etc.) activate the BUS alarm circuits and, if the console switch is in the NIGHT answer position, a major alarm and power failure transfer will occur. If the processor 2 PCB is not plugged into the connctor, a BUS alarm occurs, but no power failure transfer takes place.

7.09 Switches. Three switches are provided on the faceplate of the alarm board. S1 is a SPDT (single plate double throw) switch and is used to manually activate the power failure transfer function. In the XFER position, S1 places a ground on the collector of Q33, which causes K1 to release and initiate a power failure transfer.

Switch S2 is also a SPDT switch, and is used for alarm cut-off. In the ACO position, a ground is applied to the ACO LED, turning it on, and a ground is removed from the ACO lead to cut off external alarms.

Switch S3 is the TEST switch; it is a momentary action toggle switch used to test all alarm LED's when held in the TEST (up or down) position. When released, it resets the MC and BUS LED's after the corresponding fault has been cleared.

ACCESS TEST SET
(410168)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The access test set is a maintenance aid available for the TD-100 EPABX to enable test calls to be made from the TD-100 cabinet. Any preselected channel (0 through 63) may be accessed by a test call and thus test the circuit to which that channel is assigned.

The access test set permits maintenance personnel to perform system tests and initiate test calls from the front of the TD-100 cabinet. The test set operator may choose any one of lines 295, 296, 297, 298, or 299 as an access test line to the system. When an access test line is selected at the test set, the station telephone set on that line is automatically disconnected from the system. When the test set is not being used, the station telephone sets on lines 295 - 299 will be connected to the system in the normal manner.

The test set may be a portable unit or mounted at the top of the TD-100 cabinet, above the printed circuit boards. Figure 1.00 shows the layout of the test set controls and indicators, and table 1.00 lists the function of each control and indicator.

2.00 DETAILED DESCRIPTION

2.01 General. Basically, the test set operating procedure is as follows:

a. Determine the circuit to be tested (register, link, trunk, etc.).

b. Obtain the channel (time slot) number of the circuit from table 1.01.

c. Set the UNITS and TENS switches on the test set to the channel number.

d. Access the system by operating one of the five LINE pick-up push buttons.

e. Momentarily operate the BUSY push button. This allows the test set calls to be routed to the selected channel.

The previous steps provide only the sequence of operation for originating a test call from the test set. Detailed procedures for receiving calls and originating different types of test calls from the test set are given in paragraphs 2.03 through 2.08.

Note that even though the desired channel is selected with the UNITS and TENS switches, there may be instances when the channel cannot be obtained when the BUSY push button is pressed. Even if the channel is free when the tester gains access to the system any regular station user originating or receiving a call may seize the channel selected for test if the call is processed between the time the tester gains access to the system and the time the BUSY push button is operated.

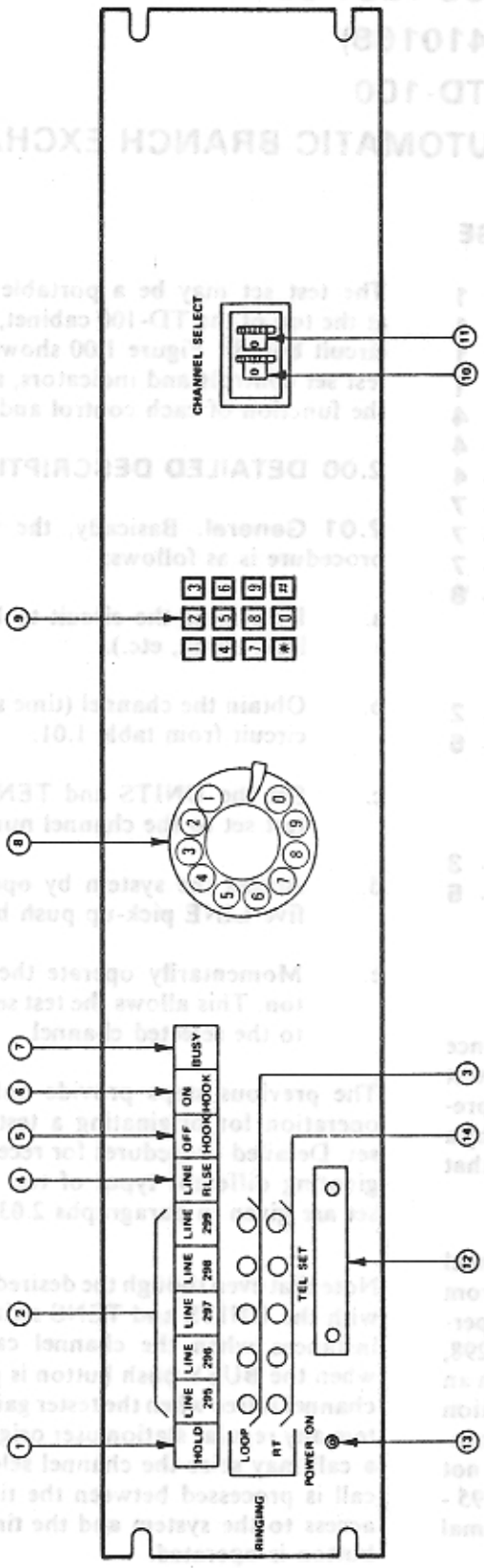

FIGURE 1.00 Access Test Set

TABLE 1.00 Indicators and Controls

ITEM	DESIGNATION	DESCRIPTION
1.	HOLD	Used to place station on "Hold."
2.	LINE 295 to LINE 299	Provide access to lines 295, 296, 297, 298, and 299. The integral lamps will "flash" on incoming calls and will light steady when the line is busy.
3.	LOOP 1-5	Will light when ringing generator is applied to the corresponding line.
4.	LINE RELEASE	A nonlocking push button used to release LINE push buttons.
5.	OFF-HOOK	A nonlocking push button used to simulate a station line off-hook condition when receiving or originating calls. This push button must be used to simulate the off-hook condition normally supplied by the station telephone set. The integral lamp will light after the push button is operated.
6.	ON-HOOK	A nonlocking push button used to simulate a station line on-hook condition. This push button must be used to simulate the on-hook condition normally supplied by the station telephone set. Operating this push button also extinguishes the OFF-HOOK lamps.
7.	BUSY	A nonlocking push button used to connect the test set to the channel selected with the UNITS and TENS switches.
8.	Rotary Dial	Provides dial pulses for calls originated from the test set.
9.	Push-Button Dial	Provides multifrequency TEL-TOUCH® tones for calls originated from the test set.
10.	TENS	Rotary switch used to select the tens number of the desired channel.
11.	UNITS	Rotary switch used to select the units number of the desired channel.
12.	TEL SET	Stand-off terminals used to connect the two-wire telephone set or the hand test telephone to the access test set.

TABLE 1.00 Indicators and Controls (Cont.)

ITEM	DESIGNATION	DESCRIPTION
13.	POWER ON	Light-emitting diode lights to indicate power is applied to the test set. Note that the test set does not have a power switch – power is on continuously.
14.	RT 1-5	Light emitting diode RT 1-5 lights to indicate ringing generator on corresponding RT- lead.

2.02 Circuit Operation. Calls made to and from the access test set are established through a telephone network provided on the set. The network is connected to the tip and ring of the selected line (295 through 299) through relay contacts on each line.

Each line has a separate relay and the desired line circuit is accessed by pushing the correct line button along with the OFF-HK (off hook) button and thus lighting the OFF-HK lamp. Operating the ON-HK (on hook) button releases the OH relay. The LINE RLSE (line release) button releases the operated line button and restores the circuit to normal.

Solid state circuitry controls channel selection. Decode counters U1 and U3 are clocked by signal $\overline{T4}$. The carry output of U1 is used as an enable pulse for U3 and SC1 (scan channel one) signal is used as a clear pulse for both counters. The outputs of U1 and U3 are connected to the binary to decimal decoders, U2 and U4. The outputs of U2 and U4 are fed to the units and tens switches of the channel selector. Figure 1.01 is a timing chart selection with the access test set.

Channel selection is dependent upon making all circuits of a type busy during one 64 microsecond scan period except the one to be seized. The ES (enable seizure) lead is held low for all time slots except the one selected. This is done automatically by the access test set.

2.03 Test Preparation. The only preparation required is to connect a two-wire telephone set or a hand test telephone to the two stand-off terminals on the front of the test set. Note that even though the two-wire telephone set or the hand test telephone is equipped with a dial, any dialing required should be done with the rotary dial or the Tel-Touch pad on the test set.

2.04 General Procedures. The access test set may be used to conduct system tests using one of lines 295, 296, 297, 298, or 299. Calls may be originated to local stations or outgoing trunks at the test set or received at the test set from local stations and incoming trunks. Paragraphs 5.02 through 5.05 give detailed procedures for different call types. In addition, the following general procedures must be followed to successfully complete test calls.

a. The two-wire station instrument or hand test telephone connected to the stand-off terminals at the front of the test set is used mainly for transmission testing. The off-hook and on-hook conditions normally provided by the telephone set must be simulated by using the OFF-HOOK and ON-HOOK push buttons on the test set. Also, the test set rotary dial or Tel-Touch pad must be used when dialing.

b. Prior to originating or receiving a test call, the LINE push button (295 - 299) on which the test is to be completed on should be operated (depressed). This enables the station telephone and lights the line lamp if a key set is provided. Should a nonoperated LINE push button integral lamp light or flash, it indicates the station user is using the line or being called. Operation of the LINE push button at this time would disable the station telephone and transfer the line circuit connection to the test set.

TABLE 1.01 Channel Allocations

CIRCUIT	CHANNEL	CIRCUIT	CHANNEL
Trunk 1	50	Local Link 9	51
Trunk 2	53	Local Link 10	54
Trunk 3	56	Local Link 11	57
Trunk 4	59	Local Link 12	47
Trunk 5	58		
Trunk 6	1	Option 1	0
Trunk 7	4	Option 2	3
Trunk 8	7	Option 3	6
Trunk 9	10	Option 4	9
Trunk 10	13	Option 5	12
Trunk 11	16		
Trunk 12	19	Spare 2-1	41
Trunk 13	22	Spare 2-2	44
Trunk 14	25		
Trunk 15 or Tie Line 1	28	Transfer Link 1	2
Trunk 16 or Tie Line 2	31	Transfer Link 2	5
Trunk 17 or Tie Line 3	34	Transfer Link 3	8
Trunk 18 or Tie Line 4	37	Add-On Link	63
Trunk 19 or Tie Line 5	40		
Trunk 20 or Tie Line 6	43	Conference Link 1	11
Trunk 21 or Tie Line 7	46	Conference Link 2	14
Trunk 22 or Tie Line 8	49	Conference Link 3	17
Trunk 23 or Tie Line 9	52	Conference Link 4	20
Trunk 24 or Tie Line 10	55		
Register 1	15	Attendant Link 1	23
Register 2	18	Attendant Link 2	26
Register 3	21	Attendant Register 1	29
Register 4	24	Spare 1-1	32
		Spare 1-2	35
		Spare 1-3	38
Local Link 1	27		
Local Link 2	30		
Local Link 3	33		
Local Link 4	36	Vacant	60
Local Link 5	39	Vacant	61
Local Link 6	42	Vacant	62
Local Link 7	45		
Local Link 8	48		

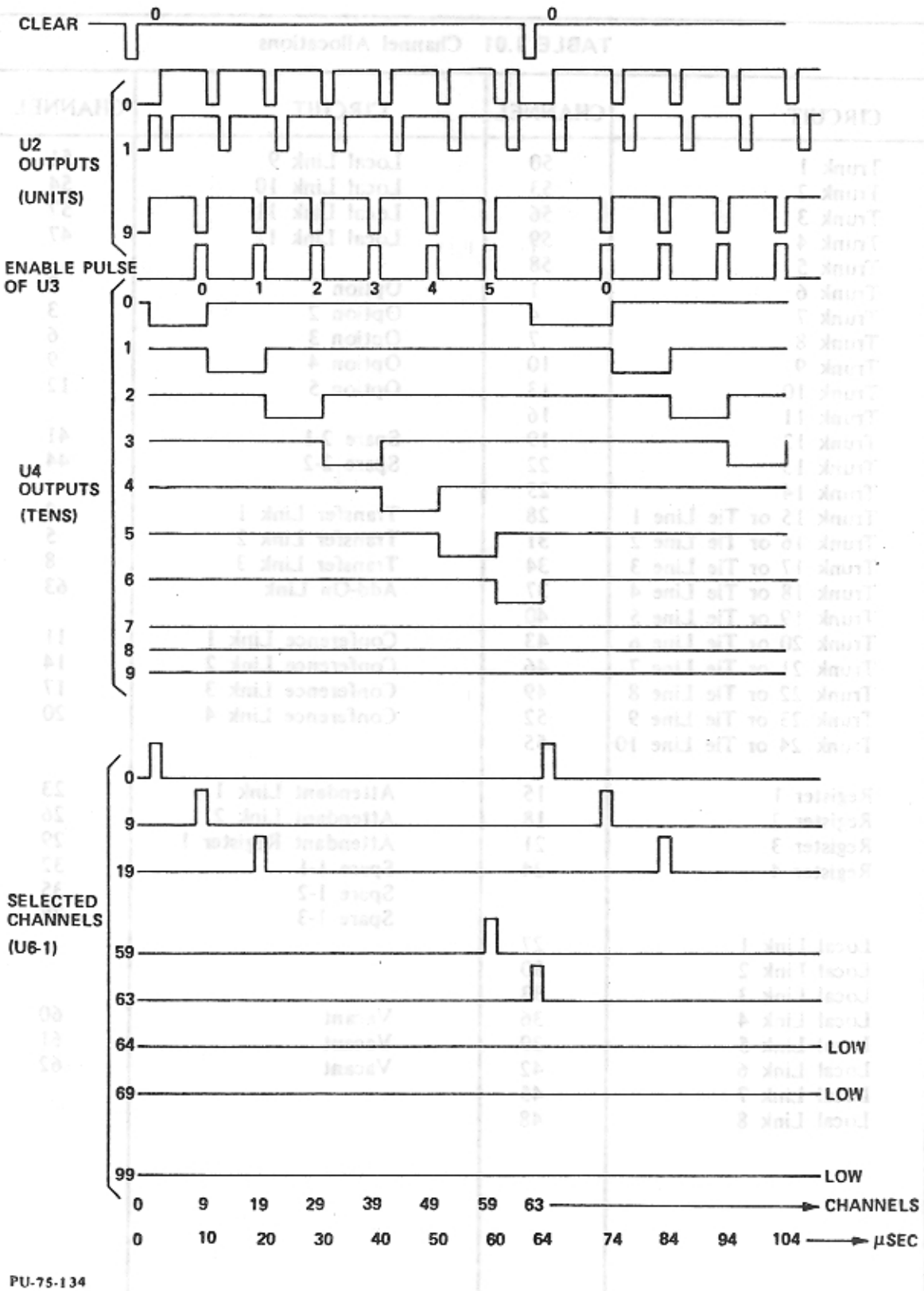

FIGURE 1.01 Channel Selector Timing Chart

c. Calls between the test set and stations 295 - 299 can be made. To call station 295 from the test set, for example, access the system over one of lines 296 - 299 and then dial 295. Operate the HOLD push button to place the originating station on hold and then operate 295 push button. Lamps associated with line 295 will flash in response to ringing.

d. If, after operating the BUSY push button, reorder tone is received, this indicates that the channel selected for testing (TENS, UNITS switches) has been allocated to another call. Release the call and retest when the channel becomes idle.

2.05 Calls to Test Set. Calls may be made to the test set from a station telephone set, a trunk line, or from the attendant's console. The calls may be received over lines 295, 296, 297, 298, or 299.

a. To receive an incoming call, depress the LINE push button assigned to the line on which the call is to be received. The incoming call is visually indicated by the LINE lamp flashing and the appropriate LOOP and RT lamps responding to the interrupted ringing.

b. To answer the call, operate the OFF-HOOK push button. The OFF-HOOK lamp and the LINE lamp light. The associated LOOP and RT lamps extinguish.

c. To verify transmission, talk and listen using the two-wire station instrument or the hand test telephone.

d. To release from the call, operate the ON-HOOK push button. The LINE lamp and the OFF-HOOK lamp extinguish. To release the LINE, momentarily operate the LINE RELEASE push button.

2.06 Register Selection. To test a specific register, proceed as follows:

a. Select the channel number of the register to be tested from table 1.01, and set the UNITS and TENS switches to the channel number.

b. Depress a LINE push button.

c. Operate the BUSY push button.

d. Operate the OFF-HOOK push button. The OFF-HOOK and the LINE lamps light. The test set should now be connected to the desired register. Dial tone will be heard on the two-wire telephone set or the hand test telephone. The BUSY LED (light-emitting diode) on the front of the register board lights. After eight or 16 seconds (strapping option), the register will time-out and busy tone will be heard. The BUSY LED on the register board extinguishes.

e. Terminate the call by operating the ON-HOOK push button. The LINE and the OFF-HOOK lamps extinguish.

f. Operate the LINE RELEASE push button to release the LINE push button.

2.07 Link Selection. To check a specific link, proceed as follows:

a. Select the channel number of the link to be tested from table 1.01 and rotate the UNITS and TENS switches to correspond to the channel number.

b. Depress a LINE push button.

c. Depress the BUSY push button; the BUSY lamp lights.

d. Operate the OFF-HOOK push button. The integral OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

e. Dial the first two digits of a station telephone set using the rotary dial or Tel-Touch pad on the test set panel.

f. After dialing the second digit, operate the BUSY push button.

g. Dial the third digit. The BUSY LED of the selected link (on front of link board) lights.

h. The call to the dialed station is completed in the normal manner.

i Terminate the call by operating the ON-HOOK push button. The integral LINE lamp and the OFF-HOOK lamp extin-

guishes. The BUSY LED on the links board also extinguishes.

j. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

2.08 Trunk Selection. When it is desired to check a specific trunk, proceed as follows:

a. Select the channel number from table 1.01 and rotate the UNITS and TENS switches to correspond to the channel number.

b. Depress a LINE push button.

c. Operate the OFF-HOOK push button. The integral OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

d. Operate the BUSY push button.

e. Dial the digit(s) to access the selected trunk (use the rotary dial or Tel-Touch pad on the test set panel).

f. The BUSY LED on the front of the selected trunk board lights.

g. A test call over the trunk may now be completed to test the transmission.

h. Terminate the call by operating the ON-HOOK push button. The integral LINE lamp and the OFF-HOOK lamp extinguish. The BUSY LED on the trunk board extinguishes.

i. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

PRIVATE LINE AND MANUAL INTERCOM
(410191)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with up to three private line and manual intercom printed circuit boards (PCB's). Each private line and manual intercom PCB contains three manual intercom circuits and two private line circuits.

2.00 DETAILED DESCRIPTION

2.01 Manual Intercom. The purpose of the manual intercom is to provide a voice path between two key telephone instruments without holding a channel and the associated equipment in the TD-100.

Each manual intercom circuit consists of a lamp driver and two high impedance current sources. With the two key telephone instruments on-hook, transistors Q101 and Q102 are off. When one instrument goes off-hook, Q101 and Q102 turn on limiting the DC current to 120 milliamps. The emitter circuit of Q102 is used to turn on Q103 which biases the lamp driver Q104 on. The key telephone manual intercom lamp lights and when the second station user goes off-hook the voice path is complete.

2.02 Private Line. Each private line circuit provides a direct line from a station within the EPABX area to the central office. This enables the station user to make and receive calls, both C.O. local and toll, without accessing a channel and associated equipment. The same C.O. line may be shared by two station users according to strapping on the PCB.

On an incoming call, ringing current flows through C401, R402, R401, relay K401 (710 ohm coil), a break contact of K403, a break contact of K402, and through K401 (42 ohm coil) causing it to energize. C402 charges through Q401 and U402-6 goes to approximately +22 VDC thus breaking down zener Q403. Q404 turns on and K402 energizes.

The make contacts of K402 close allowing the ringing current to pass from the RK (ringing key) lead through the break contact of K403 and the make contact of K402 to the key telephone on the RT (ringing) lead. The make contact (K402) in the base circuit of Q406 forces a high on U1-3 allowing an LF (lamp flash) signal to switch Q407 and Q408 on and off to flash CR412 and lamp L on the key telephone. K403 does not operate due to the current limiting resistor 406.

When the call is answered, a ground is applied to the A lead just before the loop is applied across tip and ring. The ground on the A lead causes relay K403 to operate and K402 releases. The release of K402 opens the RT lead to cut off the ringing and applies a low to U1-3 which inhibits the lamp flash. K403, in operating, turns Q405 off applying a high to U2-4 and, since U2-5 is high, U2-8 goes high lighting lamp L. The operation of K403 allows K401 to operate with the loop current.

The station instrument is now connected through to the C.O. Diodes CR401 and CR402 provide a low impedance path for voice signals. When the station user goes on-hook, the ground is removed from the A lead which opens the loop to the C.O. Relays K401 and K403 release and the circuit is idle.

When a station user goes off-hook to originate a call and depresses the appropriate (private) line key, a ground is applied to the A lead and the loop to the C.O. is completed. Relay K403 is energized through CR404; relay K402 remains de-energized through CR405. The operation of K403 forces the collector of Q405 high applying voltage to light lamp L and CR412.

A break set on K403 opens to prevent ringing and another break set (K403) opens to allow K401 to operate and connect the station instrument to the C.O. line. Receipt of dial tone and dialing may take place normally.

If a private line call is in progress and the station user presses the hold key, the ground is removed from the A lead. Relay K402 operates as U402-6 goes high; K402 operated holds K403 operated.

Both Q405 and Q406 are turned off allowing LW (lamp wink) to be applied to lamp L and CR412. K402 and K403, being operated, provide a hold path for the C.O. line.

When the station user releases the hold key, the private line key is also released disconnecting the station instrument from the line circuit. The DC path for the C.O. line is now through R403. The C.O. line is now on hold, and will remain on hold until reaccessed by the station user or released by the C.O.

2.03 Strapping. The private line and manual intercom PCB may be strapped to accommodate loop ringing, two-party line service, and STC interconnect devices. Consult OB-000-003, Feature Strapping TD-100 for full details.

PAGING ACCESS
(TD-4101927-001, -010)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with up to three optional paging access circuits. These form part of a public address system whereby a station user may dial a preselected access code, wait for a short burst of tone and then make the desired announcement. With the answer back feature, another station user may dial another access code and be connected to the paging party. Each paging access circuit contains an analog (speech) portion, a digital (control) portion for circuit supervision, and power supply filtering.

A lamp is provided on the attendant's console to indicate the status of the paging access circuit. Two busy switches are provided; one on the printed circuit board (PCB) and one for remote location such as near the paging amplifier.

2.00 DETAILED DESCRIPTION (TD-4101927-001)

2.01 General. The following paragraphs describe the operations of the paging access circuit.

2.02 Power Supply Filter. The power supply filtering consists of a high and low frequency decoupling network. In the +5 volt circuit, there is a 2-ampere fuse and a power-on light emitting diode (LED). Also provided are shunt resistors to charge the decoupling filters slowly to prohibit contact burning.

2.03 Operation. Operational amplifier, U2, and field-effect transistor (FET) Q20 comprise a weinbridge oscillator set to a frequency of 480 Hz. This tone is switched (during the first half of the channel scan microsecond) onto the common speech highway for a duration of approximately one second. The tone is a signal to alert the paging access user that the paging circuit is open and to alert the audience that a page is about to be made.

The attendant may access the paging circuit by depressing the "PAGE" button on the console. This will access all paging groups; to access only a desired paging group, the attendant must dial the pre-assigned digit for that group.

Depressing the "PAGE" button on the attendant's console causes a binary coded hexadecimal to be placed on the I and SO leads. Table 1.00 is a list of binary and hexadecimal equivalents. This signal may be "BB," "BD," or "BE," depending on the strapping of U7-8. For paging group 1 ("BB"), strap terminal C to terminal 1; for paging group 2 ("BD"), strap terminal C to terminal 2; for paging group 3 ("BE"), strap terminal C to terminal 3. Complete strapping information is available in ITT Publication OB-410-192, entitled Paging Access Strapping.

The following description is applicable whether the paging access circuit is seized by a station user or by the attendant. Table 1.01 lists abbreviations and their meanings applicable to this circuit.

TABLE 1.00 Binary and Hexadecimal Equivalents

BINARY BITS				HEXADECIMAL EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

TABLE 1.01 Paging Access Terms

ABBREVIATION	MEANING
BZ	Busy (from remote location)
I-1, I-2, I-3	Identity
MOH	Music on hold
PAG	Paging (key on attendant's console)
PGL	Paging lamp
R	Ring
RXEN	Receive enable
RXT	Receive terminator
SCR	Scan channel read
SCW	Scan channel write
SI-1	Seize
SI-2	Off-hook originator
SI-3	Off-hook terminator
SO-1, SO-2, SO-3, SO-4	Status-out
SPR	Status pulse record
T	Tip
TXT	Transmit terminator

Upon receipt of a status code ("BB" for example) from the paging access circuit, the processor sends back a signal on leads SI-1 and SI-2. Counter U12 ensures that lead SI-2 goes low within 300 milliseconds of SI-1 going low. If this time interval is exceeded, U12 times out and releases the circuit. The lows on SI-1 and SI-2 cause U13-5 and U16-10 to go low, lighting the busy LED, CR15 (indicating a seizure), and causing Q8 to turn on. Q8 applies a ground to the PGL (paging lamp) lead to light the PAGE lamp on the attendant's console. At this time, Q18 and Q21 are turned on to gate RXEN (receive enable) and SXW (scan channel write) signals through U19 and U17 which connect the TXT (transmit terminator) and RXT (receive terminator) leads to the highway.

When lead SI-1 goes low, U13-6 becomes high and relay K1 operates to make the tip and ring connections to the public address amplifier. (The impedance is 600 ohms.)

U11-6 goes low for one second, turning on Q19, and allowing a burst of 480-Hz tone to go out on the tip and ring to the public address amplifier and back on the TXT leads to the station user. The station user (or attendant) may now make the desired page which is transmitted on the RXT leads, through U1 and the low pass filter onto T1 and out on the tip and ring. The frequency is 200 to 4000 Hz, and the transmit level is -5 dB.

When the paging circuit is idle, music on hold (if equipped) is transmitted to the public address amplifier through Q23 and U1. The on-board busy switch S1, when closed, places a low on U14-5 and U15-13. Transistor Q8 is turned on, causing the "PAGE" lamp on the attendant's console to light. Since the circuit is idle, U16-2 and U16-10 are high, LED CR15 flashes with the one-second pulse from U16-5. The remote busy switch, usually located near the public address amplifier, when closed, turns on Q9 which turns on Q10. The ground now appearing on the collector of Q10 has the same result as closing S1. Both busy switches are inhibited by a real busy condition since U16-2 and U16-10 would both be low.

3.00 DETAILED DESCRIPTION (TD-4101927-010)

3.01 General. The following paragraphs describe the operation of the paging access with answer back circuit.

3.02 Power Supply Filter. The power supply filtering consists of a high and a low frequency decoupling network. In the +5 volt circuit, there is a power-on light emitting diode (LED). Also provided are shunt resistors to charge the decoupling filters slowly to prohibit contact burning.

3.03 Operation. Operational amplifier U18 is used in a wein-bridge oscillator set to a frequency of 480 Hz, with amplitude limiting provided by CR5 and CR19. This tone is switched (during the scan channel write microsecond) onto the highway for a duration of approximately one second. The tone is a signal to alert the paging access user that the paging circuit is open and to alert the audience that a page is about to be made.

The attendant may access the paging circuits by depressing the "PAGE" button on the console. This will access all paging groups; to access only a desired paging group, the attendant must dial the preassigned access code for that group. When idle, each paging circuit will place a binary coded hexadecimal idle code on the I and SO leads during the scan channel read microsecond. Table 1.00 is a list of binary and hexadecimal equivalents. This signal may be a "BB," "BD," or " BE," depending on the group strapping for priority encoder U10. For paging group 1 ("BB"), strap terminal C to terminal 1; for paging group 2 ("BD"), strap terminal C to terminal 2; for paging group 3 ("BE"), strap terminal C to terminal 3. Complete strapping information is available in ITT Publication OB-410-192, Paging Access Strapping.

The following description is applicable to any paging group seized by the attendant or a station user. Table 1.01 lists abbreviations and their meanings applicable to this circuit.

When the proper access code for a paging group is dialed, the processor searches for the corresponding idle status code, "BB" for example, from a paging circuit. Upon receipt of the idle status code, the processor sends back a signal on leads SI-1 and SI-2. Counter U8 ensures that lead SI-2 goes low within 300 milliseconds of SI-1 going low. If this time interval is exceeded, U8 times out and releases the circuit.

The low on SI-1 causes U3-9 and U4-8 to go low, lighting the busy LED, CR14 (indicating a seizure). The low on SI-1 causes U13-13 to go low, which causes Q14 to turn on and apply ground to the PGL (paging lamp) lead to light the page lamp on the attendant's console. The low on SI-1 also causes U10-3 to go low, generating a "B9" status code, which informs the processor that a page is being made on a circuit with answer back.

For the speech path to be enabled, the low on SI-1 causes U13-5 and U13-13 to go high, which gate the RXEN (receive enable) and SCW (scan channel write) signals through U12 and U14 to Q5 and Q6. This connects the RxT (receive terminate) and TxT (transmit terminate) leads to the common speech highway. U4-10 goes high, turning Q13 and shorting to ground the base of Q12, thus removing the music from the MOH lead to operational amplifier U19. When lead SI-1 goes low, U17-3 and U17-4 go high, triggering the monostable which times out in approximately one second. Strapping for the terminals associated with this monostable is described in OB-410-192.

For example, if terminal A is strapped to D, and E is strapped to F, U14-8 will go high when SI-1 goes low, operating relay K1 to make the tip and ring connection to the public address amplifier. (The impedance is 600 ohms.) U17-6 goes low one second, turning on Q9, and allowing a burst of 480 Hz tone to go out on the tip and ring to the public address amplifier and back on the TxT leads to the station user. The station user may then make the desired page which is transmitted on the RxT leads, through U19 and the low pass filter onto T1 and out on the tip and ring. The frequency range is 200 to 4000 Hz, and the transmit level is -5 dB.

Relay K2 allows through-pulsing from the paging circuit by monitoring the SI-2 lead. When SI-2 goes low, U14-12 goes high, allowing Q18 to turn on and operate K2. The SI-2 lead pulses as digits are dialed by the station user, which, in turn, causes relay K2 to pulse.

To use the answer-back feature, another station user may dial the proper answer-back code which causes the processor to search for the identity and status out code of the paging circuit ("B9"). The line number of the answer-back station is then placed in the terminator storage of the memory, and the two station users may converse.

The processor causes the SI-3 lead to go low, which makes U12-4 and U12-10 low. This removes the RXEN and SCW signals from Q5 and Q6 so that the conversation is not placed on the public address amplifier. The low signals on leads SI-2 and SI-3 make U6-4 high, which causes U16-5 to be set high. The low on U15-11 and U15-5 then turns off Q17 and Q18, dropping relays K1 and K2. These relays will remain off until the circuit becomes idle and is again seized. U16-5 is reset low when SI-1 goes high (idle).

Attendant paging differs by the method by which the circuit is seized. Depressing the "PAGE" button on the console grounds the PAG lead to U6-12. If the circuit is presently idle, then U6-11 is low, and U6-13 goes high; the attendant paging with answer back status code "AA" is placed on the I and SO bus. The processor recognizes this code and marks the SI-1 and SI-2 leads low to seize the circuit.

The on-board busy switch S1, when closed, places a low on U3-12 and U4-1. Transistor Q14 is turned on, causing the "PAGE" lamp on the attendant's console to light. Since the circuit is idle, U3-1 and U3-9 are high, and LED CR14 flashes with the one-second pulse from U4-6. The remote busy switch, usually located near the public address amplifier, when closed, turns on Q15 which turns on Q16. The ground now appearing on the collector of Q16 has the same result as closing S1. Both busy switches are inhibited by a real busy condition since U3-1 and U3-9 would both be low. A real busy condition will also place a ground on the COMM lead via U15-3. This ground will make busy other paging circuits with answer-back to avoid conflicts when the answer-back feature is used.

DICTATION ACCESS
(410193)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with a dictation access printed circuit board (PCB). This PCB contains three dictation access circuits, each capable of controlling one dictation machine. This feature enables any station user (with proper class of service) to dial an access code and then, by dialing additional digits, either control the dictation machine and record or play back voice messages.

2.00 DETAILED DESCRIPTION

2.01 General. The dictation access circuit is seized by dialing a preassigned access code. The processor 2 PCB contains the strapping field for this feature; see section OB-000-003, Feature Strapping TD-100.

When idle, the dictation access status-out is a hexadecimal "B8." (Table 1.00 lists hexadecimal and alphanumeric equivalents.) The I-2, SO-2, SO-3, and SO-4 leads are low; the SO-1 lead is high. When the access digit(s) is dialed, processor 2 sends a low in the dictation access time slot on leads SI-1 and SI-2 and the status-out changes to "B3," with leads I-2, SO-1, and SO-2 low and leads SO-3 and SO-4 high. U106-5 goes low, lighting LED CR112 to indicate a busy circuit; both the remote and the PCB mounted busy switches are now disabled. (The busy switches, when not disabled, and when operated, force a low on U103-6 to inhibit the I-2 and SO-1 through SO-4 leads.)

Assuming neither of the busy switches are operated, upon receipt of a signal from the processor, relay K101 operates to complete the T (tip) and R (ring) loop to the dictation machine with an impedance of 600 ohms. Transistors Q101 and Q102 are current sources to provide a DC path to the dictation machine, and relay K101 pulses with subsequently dialed digits for its control.

A combination of signals on leads SI-1, RXEN (receive enable), and SCW (scan channel write) turn on transistors Q106 and Q105. These transistors connect T and R to TXT (transmit terminator) and RXT (receive terminator) to complete the voice path. The transmission level at T and R is -5 dB.

U106 is a counter which is enabled when lead SI-1 is low and lead SI-2 is high. If lead SI-2 does not go low within 400 milliseconds of SI-1, then lead SO-4 goes low and the processor releases the dictation access circuit.

Q107 and Q108 turn off Q105 when the 5V fuse blows.

TABLE 1.00 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

DATA MONITOR TEST SET
(410207)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 Data Monitor Test Set Block Diagram 2

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1.00 Binary and Hexadecimal Equivalents 3

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with one data monitor test set. The data monitor test set consists of one printed circuit board that is inserted into the TD-100 cabinet when testing is required. This PCB is provided with switches, LED (light-emitting diode) indicators, and displays to monitor the flow of data through the processor during operations initiated by the processor and by other TD-100 circuits.

The processor can be directed to perform a particular task by selecting an appropriate input to the processor via four thumbwheel switches provided on the data monitor test set PCB. A switch is also provided to display or store the inputs and outputs to and from the processor. Other switches are provided to monitor the stored information bit-by-bit, and to read the status-in with high levels represented by indicators that are selectably on or off.

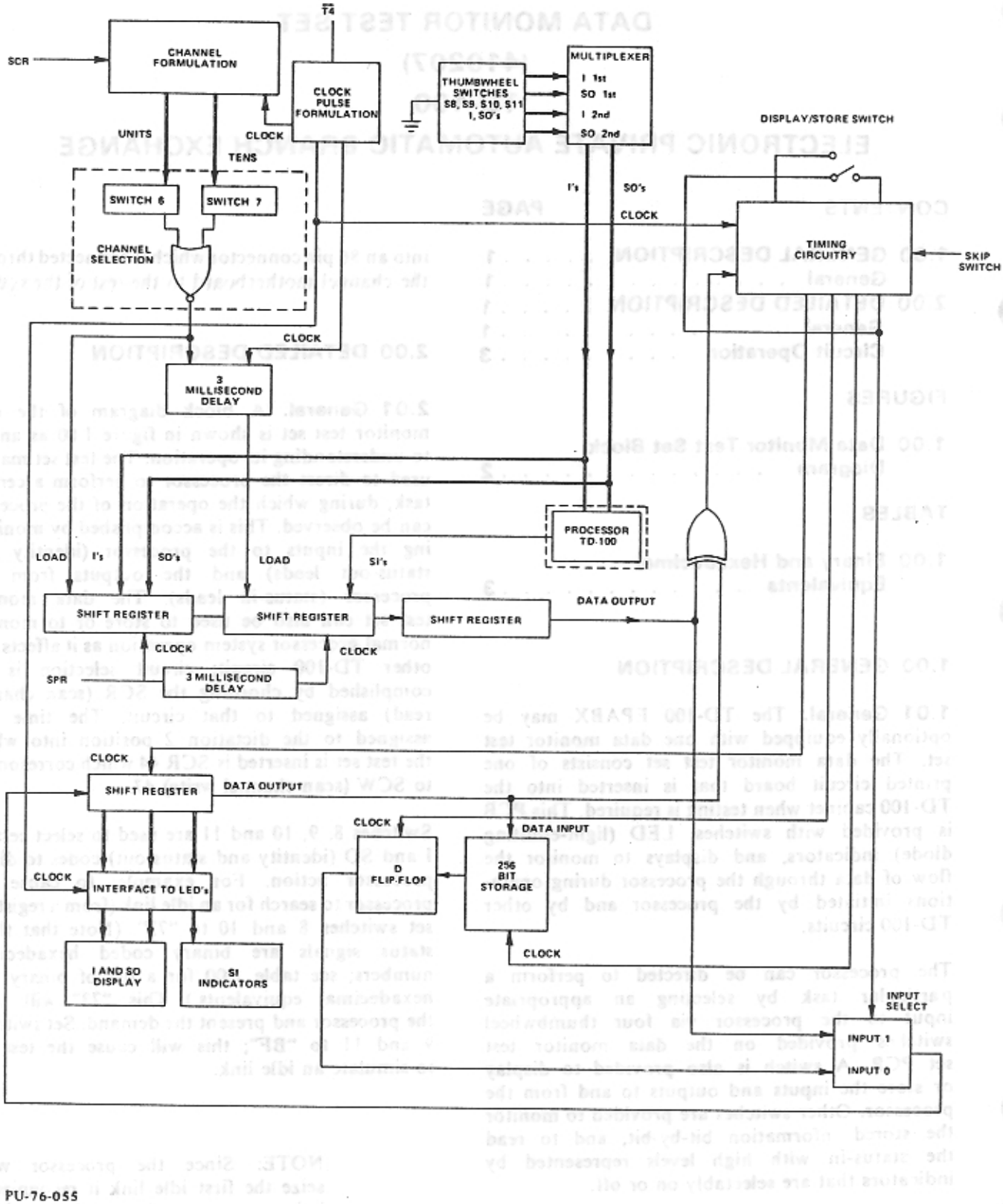
The data monitor test set PCB is used in the dictation 2 position in the channel subrack. It plugs into an 86 pin connector which is connected through the channel motherboard to the rest of the system.

2.00 DETAILED DESCRIPTION

2.01 General. A block diagram of the data monitor test set is shown in figure 1.00 as an aid to understanding its operation. The test set may be used to direct the processor to perform a certain task, during which the operation of the processor can be observed. This is accomplished by monitoring the inputs to the processor (identity and status-out leads) and the outputs from the processor (status-in leads). The data monitor test set can also be used to store or to monitor normal processor system operation as it affects any other TD-100 circuit; circuit selection is accomplished by choosing the SCR (scan channel read) assigned to that circuit. The time slot assigned to the dictation 2 position into which the test set is inserted is SCR 44 which corresponds to SCW (scan channel write) 47.

Switches 8, 9, 10 and 11 are used to select certain I and SO (identity and status-out) codes to direct processor action. For example; to cause the processor to search for an idle link (from a register), set switches 8 and 10 to "73". (Note that these status signals are binary coded hexadecimal numbers; see table 1.00 for a list of binary and hexadecimal equivalents.) This "73" will seize the processor and present the demand. Set switches 9 and 11 to "BF"; this will cause the test set to simulate an idle link.

NOTE: Since the processor will seize the first idle link it recognizes, it is necessary to insure that no idle links are present except the one simulated by the data monitor test set.



PU-76-055

FIGURE 1.00 Data Monitor Test Set Block Diagram

TABLE 1.00 Binary and Hexadecimal Equivalents

BINARY BITS				HEXADECIMAL EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

The processor will seize the data monitor test set as a link during the time slot selected by switches S6 and S7. The displays and associated circuitry monitor the I and SO inputs to the processor during the selected time slot while the LED's monitor the SI outputs from the processor.

If the demand feature is not required, the test set may be used to examine the status-in and status-out leads of any circuit of the system by simply selecting the assigned SCR of that circuit via switches S6 and S7.

2.02 Circuit Operation. The SCR signals are delayed by 1 microsecond and used to load the predetermined input (45) into binary counters U37 and U47. An output of 9 from counter U47 advances the count of U37 by one. This same output clears U47 via U48 and the associated circuitry. U48 and U38 are BCD-to-decimal decoders; with the continuation of clock pulses to U37 and U47, the outputs of U38 and U48 advance through 63 (lows on U38-7 and U48-4). Counters U37 and U47 are then reset through U25, U26, and U27, and the counters count again from 0 through 63. The outputs of U38 and U48 are wired to the inputs of thumbwheel switches S6 and S7. A particular channel assigned to a circuit is selected by choosing the tens digit on S7 and the units digit on S6; when a match occurs between the inputs to the switches and their settings, U26-1 goes high. The circuitry is shown in the block diagram as the channel formulation block.

Through a 4-bit shift register, U4, a delay of 3 microseconds is applied to the selected SCR. U31 is loaded with signals from the I and SO leads by the loading signal at the selected channel's SCR; signals from the SI leads are loaded into U31 and U21 3 microseconds later at SCW. After being loaded, the information is clocked to appear bit-by-bit at U44-3. If the MONITOR/STORE switch is in the STORE position, the status and identity information will be stored in the 64 by 4-bit shift register, U42. The data is shifted from U28, to U18, to U8, and finally to U7. A comparison is made to determine if the new data is different from the last data stored. Only if different data is present, will it be stored at U42. Even though all data is displayed on the LED

indicators and displays, the extremely short duration will prevent its being read unless the data is repetitive for a substantial length of time.

To read the information stored in U42, the MONITOR/STORED switch must be in the MONITOR position. When the SKIP switch is operated momentarily, the first set of data will be displayed. The digital displays will show the identity and status-out; the LED's CR9 through CR21 will show the status-in commands. When the SKIP switch is again depressed, the next set of data will be displayed in a similar manner. Note that since data is not stored unless it represents new information, the displayed identity or status will change each time the SKIP switch is thrown until the contents of U42 have been fully displayed. The capacity to U42 is 256 bits, therefore it has the capability to store 8 complete sets of identity, status-out, and status-in information.

The SWB switch is a two-position toggle switch. Its purpose is to select whether LED's CR9 through CR21 will be lit or extinguished to indicate a valid data bit. With a given set of data displayed, operation of the SWB switch will cause all lit LED's to extinguish and all extinguished LED's to light. LED CR22 is a probe indicator; it is used to display a matching condition when the present logic level (high or low) is detected by the test probe. The probe is of the latching type, requiring a match for only a very short period of time to light the indicator.

CALL FORWARD, FOLLOW ME
(410224)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with a call forward, follow me (CFFM) printed circuit board (PCB). This CFFM PCB provides the system with the feature of call forwarding to allow a station user to program a station number to which all calls will be forwarded. The PCB is located in the "Feature 2" position in the channel subrack.

The station user wishing call forwarding dials the required access code; on receipt of a second dial tone, the number of the station to which calls are to be forwarded is dialed. Busy tone is then returned to the station user; the dialed station is not rung at this time. Deactivation of the CFFM circuit is accomplished when an assigned station number is dialed from that station.

The CFFM circuit has the capability to provide call forwarding to a maximum of four stations with no station restrictions. The CFFM PCB prevents multiple forwarding, forwarding from station hunt, and forwarding from assigned night service.

2.00 DETAILED DESCRIPTION

2.01 General. The following paragraphs provide a detailed description of CFFM circuit operation. Table 1.00 is a list of CFFM lead designations and terms with their meanings and figure 1.00 is a timing diagram of the CFFM functions.

2.02 Circuit Access. The station user dials a preselected access code for the CFFM circuit: this access code is strapped on the processor 2 PCB. When the final access code digit is dialed by the station user, processor 2 generates a hexadecimal "DD" on leads B, D, C, E, and F. (Table 1.01 is a list of binary and hexadecimal equivalents.)

This "DD" generates no action in the PROMS of processor 2, but in the CFFM circuit, it is NAND-gated with the S01 and S02 signals. This stores a logic high in the 64-bit shift register, U12, at the register's time slot. The "DD" is also NAND-gated at U25 with local status signals and delayed by 3 microseconds at the 3-bit shift register, U35.

The 3Q output of U35 goes low for 1 microsecond which, via buffer U34, drives lead SI-7 low for 1 microsecond at the register's time slot. This is the reset signal to the register which changes its status-out to dial tone enable and provides dial tone to the station user. Upon receipt of this dial tone, the station user may dial the station number to which calls are to be forwarded.

2.03 Forwarding Number Storage. When the station user dials the last digit of the number to which calls are to be forwarded, NAND gate U3 pin 5 goes high. At least one of the TO-5 through TO-8 leads will be low thus enabling T4 to be clocked at U4 pin 1. This clock pulse coincides with the recirculating high on pin 1 of U12 and the

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1.00 GENERAL DESCRIPTION

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The 3Q output of U35 goes low for 1 microsecond which, via buffer U34, drives lead SI-7 low for 1 microsecond at the register's time slot. This is the reset signal to the register which changes its status-out to dial tone enable and provides dial tone to the station user. Upon receipt of this dial tone, the station user may dial the station number to which calls are to be forwarded.

2.03 Forwarding Number Storage. When the station user dials the last digit of the number to which calls are to be forwarded, NAND gate U3 pin 5 goes high. At least one of the TO-5 through TO-8 leads will be low thus enabling T4 to be clocked at U4 pin 1. This clock pulse coincides with the recirculating high on pin 1 of U12 and the

TABLE 1.00 CFFM Terms

ABBREVIATION	MEANING
B, C, D, E, F	Access code leads
NE	Number enable
NT	Night transfer
OO-1 – OO-4	Originating number – tens (BCD)
OO-5 – OO-8	Originating number – units (BCD)
POR	Power on reset
SH	Station hunt
SI-7, SI-8	Status-in
SO-1, SO-2	Status-out
TO-1 – TO-4	Terminating number – tens (BCD)
TO-5 – TO-8	Terminating number – units (BCD)
$\overline{T4}$	Clock

steady high at the Q output of U23. A pulse will be NAND-gated through and will appear at U4 pin 6 to clock the storage registers U7 and U45, and U10 and U48. This causes storage of the originating and terminating numbers.

This same pulse is also NOR-gated at U15 and NAND-gated at U24; its leading edge triggers monostable multivibrator U23 to change its Q output from low to high for just over 1 microsecond. This high is NAND-gated with itself at U24, and through U12 generates a low on the SH lead. This prevents the memory from storing the terminator's number and, via U25, presents a high at the input of the 3-bit shift register U36. The $\overline{3Q}$ output of U36 goes low for 1 microsecond 3 microseconds later; this signal, via the AND buffer U34, is extended to leads SI-7 and SI-8. The signals on these leads cause the status-out of the register to change to clear station number (originator) and force a busy lockout to the station.

The logic high at the Q output of U23 is also the data input of flip-flop 5; it is stored in U5 via the trailing edge (clock) at the 1 microsecond pulse appearing at U4 pin 6.

By setting flip-flop U5 (making the $\overline{Q}$ output low), the originating and terminating storage registers, U7 and U45, and U10 and U48 are locked loaded. The Q output of U5 enables the next NAND gate (U26) to provide for storing the next CFFM numbers. The same procedure is repeated with the two flip-flops of U38. All registers and flip-flops on the CFFM board are initially reset from the RC network ground generated at pin 9 of NAND gate U24 when power is applied to the PCB.

2.04 Call Forwarding. When a station user dials another station number, at the end of dialing, the originator's number appears on leads 00-1, 00-2, 00-3, 00-4 (tens) and 00-5, 00-6, 00-7, 00-8 (units). The terminator's number appears on leads TO-1, TO-2, TO-3, TO-4 (tens) and TO-5, TO-6, TO-7, TO-8 (units) in the register's time slot.

The CFFM circuit continuously monitors the terminator's number with the four sets of comparators, U8 and U46, U19 and U51, U30 and U56, and U41 and U61; whenever a successful comparison occurs with the number stored in the station user storage (registers U7 and U45. U18 and U50, U29 and U55, and U40 and U60) a single 1 microsecond pulse is generated.

For example, if the terminator's number compares with the number stored in storage registers U7 and U45, a 1 microsecond pulse is generated on pin 9 of U8 and U46 at the register's time slot. This pulse is gated:

a. Through NAND gate U23 which is inhibited because the input terminal, pin 13, is low.

b. Through NAND gate U3 which drives 64-bit shift register U62. The output signal from U62 (pin one) is inverted by U39 and then

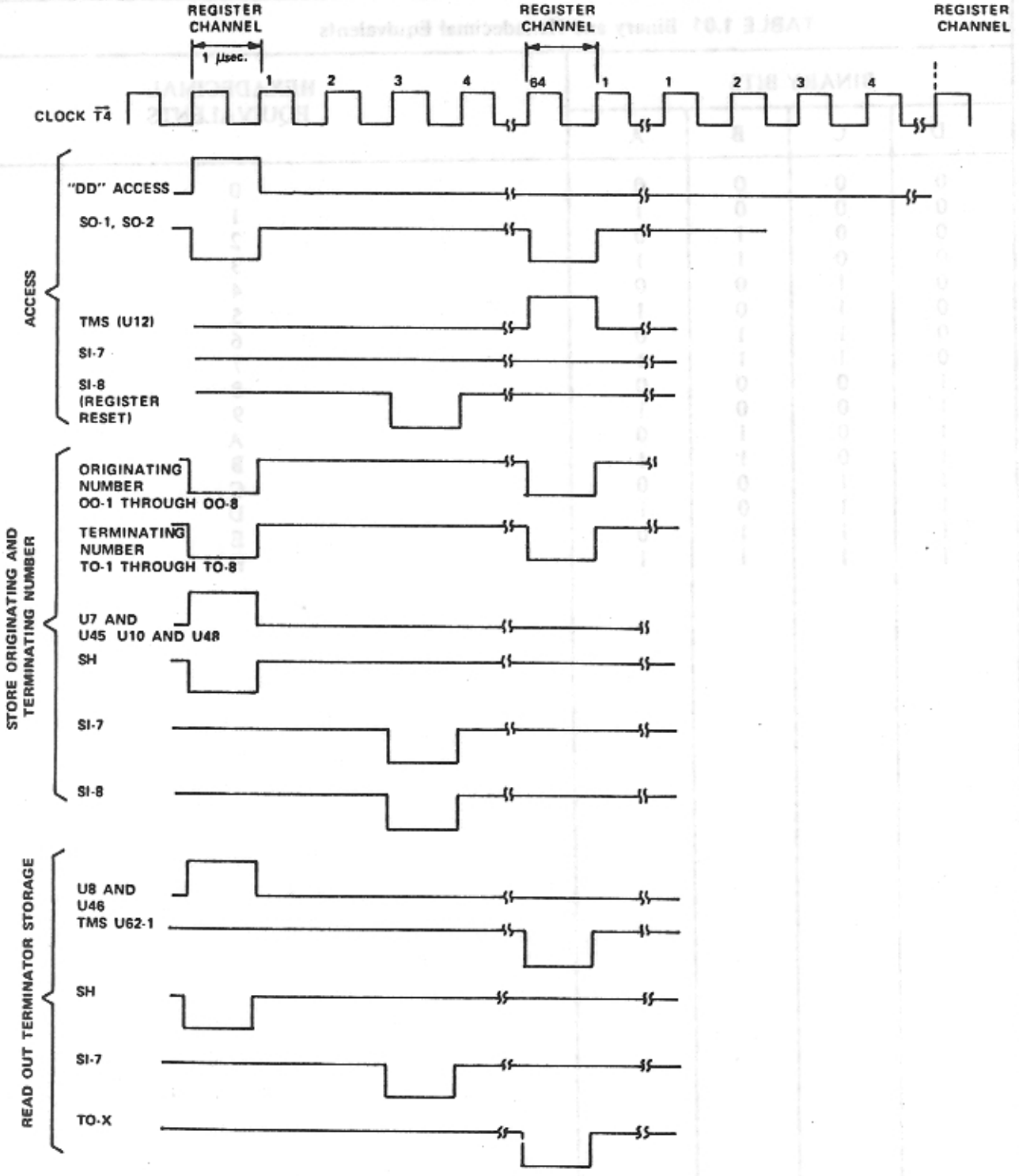

FIGURE 1.00 CFFM Timing Diagram

TABLE 1.01 Binary and Hexadecimal Equivalents

BINARY BITS				HEXADECIMAL EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

connected to the inputs of NAND gates U11 and U49. These NAND gates have their open-collector outputs connected to the TO-1 through TO-8 leads; they are enabled by this signal for one microsecond to load the TO-1 through TO-8 leads with the number stored on registers U10 and U48. (This number is the terminator's number as dialed by the CFFM station user.)

c. Through NOR gate U57 to drive NAND gate U25 which, in turn, drives the 3-bit shift register U35. The $\overline{3Q}$ output of U35 goes low for 1 microsecond and, via buffer U34, drives lead SI-7 low for 1 microsecond. This is the reset signal to the register at the write time slot. NOR gate U57 also drives NAND gate U24 to generate a low for 1 microsecond on lead SH to prevent the memory from storing the terminating number appearing at the TO-1 through TO-8 leads at this time. At the next scan (64 microseconds later), the TO-1 through TO-8 leads will be loaded with the number stored in the CFFM storage circuit; this is the terminator's number stored in the memory and scanned later to answer the call.

2.05 Release. The CFFM circuit continuously monitors and compares the 00-1 through 00-8 and TO-1 through TO-8 leads. When the station user of the CFFM feature dials the home station number from that station, both comparators U8-U46 and U20-U42 will generate a successful comparison signal. These signals are 1 microsecond highs which are NAND-gated at U28. The U28 output pulse goes through AND gate U17 and clears the storage registers U7 and U45 which contain the originator's number, and through U10 and U48 which contain the follow-me station's number. The same pulse also clears flip-flop U5; this changes the 1Q output to a logic low and thus blocks NAND gate U3 to prevent the pulse from driving U30, the 64-bit shift register.

The comparison pulse generated by U8 and U46 at pin 9 drives NOR gate U57. The output of U57, via NAND gate U24 and buffer U1, drives lead SH (to the memory) to prevent storage as described in paragraph 2.04. Via NAND gate U25, the pulse also drives U35 (delayed for 3 microseconds) and then via U34 drives lead SI-7 low for 1 microsecond to reset the register. After the register is reset, the processor generates command signals to return busy tone to the calling party. This is the signal to the calling party that the CFFM is deactivated and that incoming calls will no longer be forwarded.

MESSAGE REGISTRATION IA AND IB (TD-4102267-ISS D, TD-4102277-ISS B) TD-100 ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with message registration capabilities. This provides a DC mark as evidence of completion (answer) of an outgoing trunk call. The mark (ground) is normally used to increment a message register, or peg count meter. Each TD-100 station line that is to be monitored is assigned a separate message register.

The message registration feature is provided for 75 station lines by the Message Registration IA PCB (printed circuit board), circuit number TD-4102267. This PCB is used in position 27 (spare 3) of the trunk subrack. Additional capabilities are possible with a piggy-back addition. This PCB which plugs onto the main PCB, is called Message Registration IB and is circuit number TD-4102277. It provides message registration for an additional 25 station lines and the ability for reception of a trunk answer condition via a third wire, or sleeve lead.

2.00 DETAILED DESCRIPTION

2.01 General. When power is first applied to the PCB, a logic low on the POR (power on reset) lead resets the meter driver circuitry through U46-8, Q2 and Q1. Section 1 of U11, a 64-bit shift register, is readied to load new data by a logic low on U6-4. When the POR lead goes high, the meter driver circuits are enabled and U11 (section 1) is under the control of U9-8. (Figure 1.00 is a block diagram of the message registration PCB's.)

U3 and U4 monitor the identity and status out of each channel. This is a check for an idle condition on the trunks in each trunk group selected by strapping. As long as all trunks are idle, U13 is inhibited by the output of U11.

When a trunk is seized (for any reason), its identity and status out changes; this change causes an active bit (logic low) to begin circulating in U11 in the position corresponding to the trunk's time slot. This low appears at U11-3 every 64 microseconds and enables U13. When an outgoing trunk call is answered, the CSA (called subscriber answered) lead is marked low at the SCW (scan channel write) of the trunk. This low is clocked through section 2 of U11 and appears at U11-4 60 microseconds later. U14 provides the CSA mark with an additional 1 microsecond delay to place it and the trunk seized mark from U11-3 in synchronization at the SCR (scan channel read) of the trunk. With T10 strapped to T11, the CSA mark is applied to U13, pins 1, 13 and 3. CSA, gated with $\overline{T4}$ and the trunk seized mark, causes U13-6 and U13-12 to go high and enable U58 and U36.

U47 and U57 are BCD to decimal decoders; their function is to translate the information on the TOC 1 through 8 leads into TD-100 station numbers. Tri-state devices U58 and U36 gate the binary coded information to U57 and U47 when enabled by U13. This information is decoded to a particular tens and units digit corresponding to a TD-100 station number. The resultant tens and units signals enable a monostable multivibrator, which pulses a transistor to switch ground onto a line and increment a message register.

When the message registration IB piggy-back board is added, an additional 25 station lines may be monitored as previously described. The addition of this board also provides for trunk answer detection by means of a third wire, or sleeve lead. The signal on this lead may be either -48 volts or ground; strapping options are provided on the PCB to accommodate both methods.

On receipt of this signal from the trunk, the detector circuitry allocated to that trunk provides a logic low to an input of U10, U11, U12, or U13. U19, U20 and U21 work with SC60 (scan channel 60) to comprise a trunk time slot encoder. They gate the pulse from a particular trunk into the proper time slot for that trunk. This signal then appears at U18-8 during the time slot of the trunk from which it originated. It is routed back to the main PCB as an input to U13 to be used in place of the CSA lead signal. In this case T10 and T11 are not strapped.

2.02 Strapping. Certain strapping must be applied to the message registration IA and IB PCB's. ITT publication OB-410-226, entitled Feature Strapping, TD-100 Message Registration contains full details.

TOLL RESTRICTOR
(TD-4102287-001, -010)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with a toll restrictor printed circuit board (PCB), which may be inserted into position 10 through 14 of the TD-4101716-002 channel motherboard or position 10 through 13 of the TD-4101716-003 channel motherboard.

This PCB is capable of denying or allowing up to seven digits and absorbing up to three digits on a per-trunk-group basis. It can accommodate a total of as many as eight different trunk and tie line groups. It also provides the facility to accommodate dial tone delay (400 ms to 6.4 seconds) from the central office. Deny, allow, or absorb codes are programmed into a memory composed of four 256 x 8 bit programmable read only memories (PROM's). Decisions can be made on up to seven digit numbers depending on the programming of the PROM's.

A block diagram of the TD-100 toll restrictor is shown in figure 1.00.

When a toll-restricted station attempts to access a trunk by dialing an access code, the associated register goes into a digit-monitoring mode and its identity and status-out becomes "78." (This "78" is in binary coded hexadecimal form; table 1.00 lists binary and hexadecimal equivalents.) When the register is idle, its identity and status-out is "7F." These two codes are detected by the toll restrictor; "78" initiates and holds the restricting function while "7F" clears it after an allow or deny decision has been made.

> NOTE: The process of allowing or restricting a station is always done on the basis of the register's time slot.

Digits dialed pass through the interface, are stored in the seven-digit storage register, and are compared with the contents of the memory. Depending on whether or not a match occurs, the decision-making circuitry will provide an allow or deny code at the outputs (TO-1 to TO-4).

The trunk/tie line group detector enables programming of the toll restrictor on a per group basis (trunk or tie line groups). A maximum of eight such groups is provided. The delay circuitry accommodates a CO dial tone delay. If a number is dialed during the delay time, the originating station is automatically locked out.

2.00 DETAILED DESCRIPTION

2.01 Register Toll Monitor. When a register goes into the toll monitoring mode, it marks its I and SO (identity and status-out) leads with a hexadecimal "78." This "78" is received by the toll restrictor at the SCR of the register and causes U54-1 to go to a logic 1 (high). At this

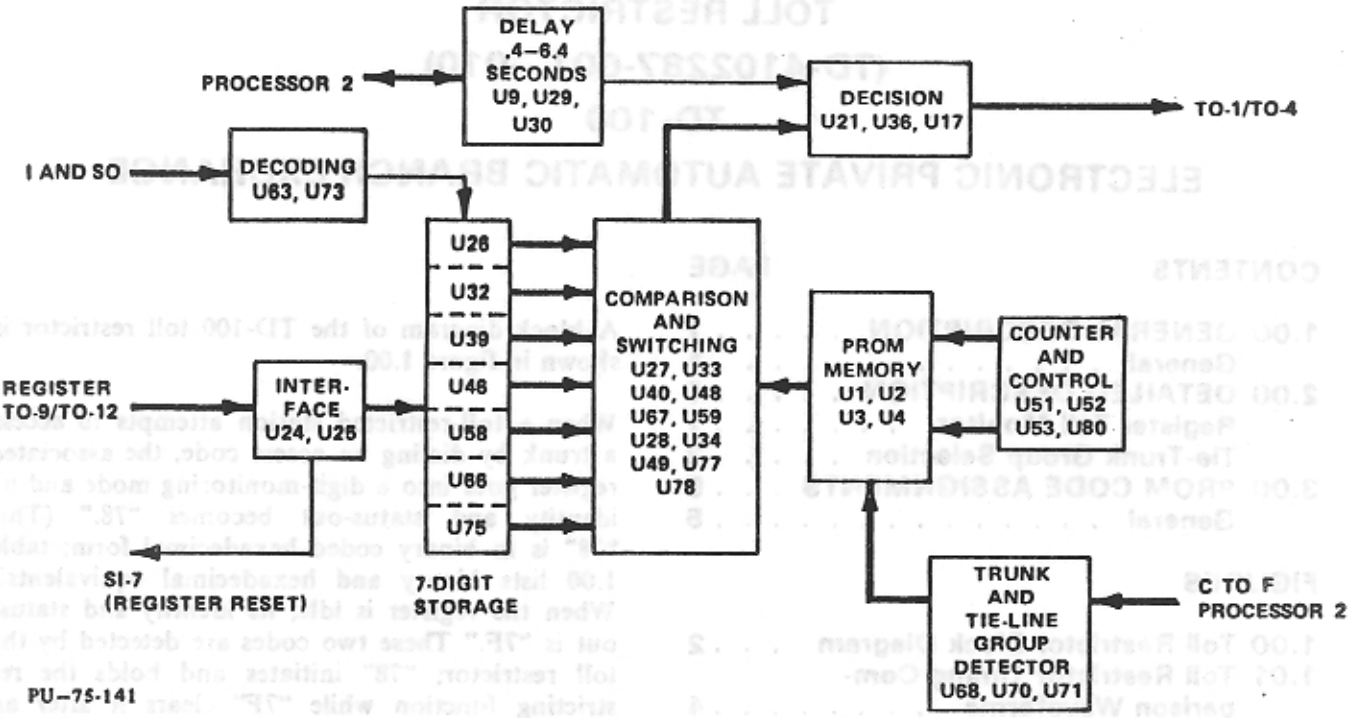

FIGURE 1.00 Toll Restrictor Block Diagram

TABLE 1.00 Binary and Hexadecimal Equivalents

BINARY BITS				HEXADECIMAL EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

time U57-6 is low, and the outputs of U26, a 64 x 4 bit shift register, are high. This generates a low at U10-4, and causes U26 to store any information appearing at its inputs.

Similarly, the outputs of shift registers U32, U39, U46, U58, U66 and U75 are all high and generate high levels at their respective control leads (pins 2, 5, 9 and 14). As the first digit is dialed, it will appear on the TO9, TO10, TO11 and TO12 leads and be presented through U24 and U25 to the inputs of the shift registers. Only U26 will accept and store it. Simultaneously, U61-3 goes high (indicating a digit in); after a 3 microsecond delay due to U56, a low is marked on the SI-7 lead. The SI-7 (at the SCW of the register) resets the register so that the next digit will also appear on the TO-9 through TO-12 leads. This register reset function occurs each time a digit enters the roll restrictor.

The number stored in U26 appears 64 microseconds later at the inputs of U27; U22-6 goes high generating a high at U10-4 which forces the shift register to recirculate the number. Thus, the first digit dialed is stored at U26 and appears at the inputs of U27 every 64 microseconds.

The high level at U22-6 generates a low at U38-6 and enables U32 to accept new information. As the second digit is dialed, U32 stores it; an SI-7 signal is generated, and after 64 microseconds, U22-8 goes high enabling U39 to accept the third digit. The above sequence continues until a maximum of seven digits have been stored.

All the digits stored (seven, maximum) are presented at the A inputs of the six-bit comparators U27, U33, U40, U48, U59, U67 and U77. The B inputs of the above comparators are provided through multiplexer U41 and depend on the programming of the PROM's P1, P2, P3, and P4. The programming of the restricted, allowed, or absorbed numbers is done such that the first three digits are presented at the B inputs of the comparators U27, U33 and U40. If they match the first three digits dialed, a "wait for more digits" command is generated and the next three digits are presented at the B inputs of comparators U48, U59 and U67. If these three digits match, a "wait for seventh digit" command is generated and the seventh digit comparison is done by U77. The timing waveforms for this sequence are shown in figure 1.01.

The codes are read out of the PROM's and presented at the B inputs of the comparators (U27, U33, U40, U48, U59, U67 and U77) in the following manner. The quad-D flip-flops U28, U34, U49 and U78, in conjunction with U41 and the clocking circuitry, act as a four-digit serial-to-parallel converter. Thus, for a three-digit number, the first digit would be stored at the outputs of U28 through U49 and U34, the second digit would be stored at the outputs of U34 through U49, and the third digit would be stored at the outputs of U49. Assuming a four-digit number, the fourth digit would be stored at the outputs of U78. Note that as soon as U28 stores a digit, U10-13 goes low, changing U22-11 to high and also enabling U76-12 to clock U78. At the end of each group of three or four digits, a binary coded hexadecimal character (A, B, C, D, E or F) is programmed and is decoded by U3. A high is generated at U11-8 and thus at U44-5. This disables the NOR gate, U37, so that further advancement of the PROM address counters (U53, U52 and U51) is inhibited. Thus, the number is stored, and remains at the outputs of U28, U34, U49 and/or U78 until U44 is reset. Note that U44 is reset during SC0 (scan channel zero) and at the same time U28, U34, U49 and U78 are cleared so that a new number can be stored. The four PROM's are scanned in turn as pin 14 goes low; as each PROM is enabled, the other three are disabled. This function is obtained through U80 which decodes the extended counting of U51.

2.02 Tie-Trunk Group Selection. The tie-trunk group selection is accomplished by U69, U70, U71 and U50. U69 detects the tie-trunk group code and recirculates it until it is decoded by U70 and U71. Depending on the strapping, the eight to one multiplexer, U50, will produce a high level at U61-13 and U61-10. Thus, a low level at U61-11 or U61-8 will mean successful comparison of the number dialed with a number in a specific PROM which has been assigned to this tie-trunk group.

A number which is not programmed in the PROM group corresponding to the tie-trunk group may be also dialed and stored. In this case, a deny or allow condition will be produced at the output. The hexadecimal character "B" is programmed at the beginning of each group such that there is an

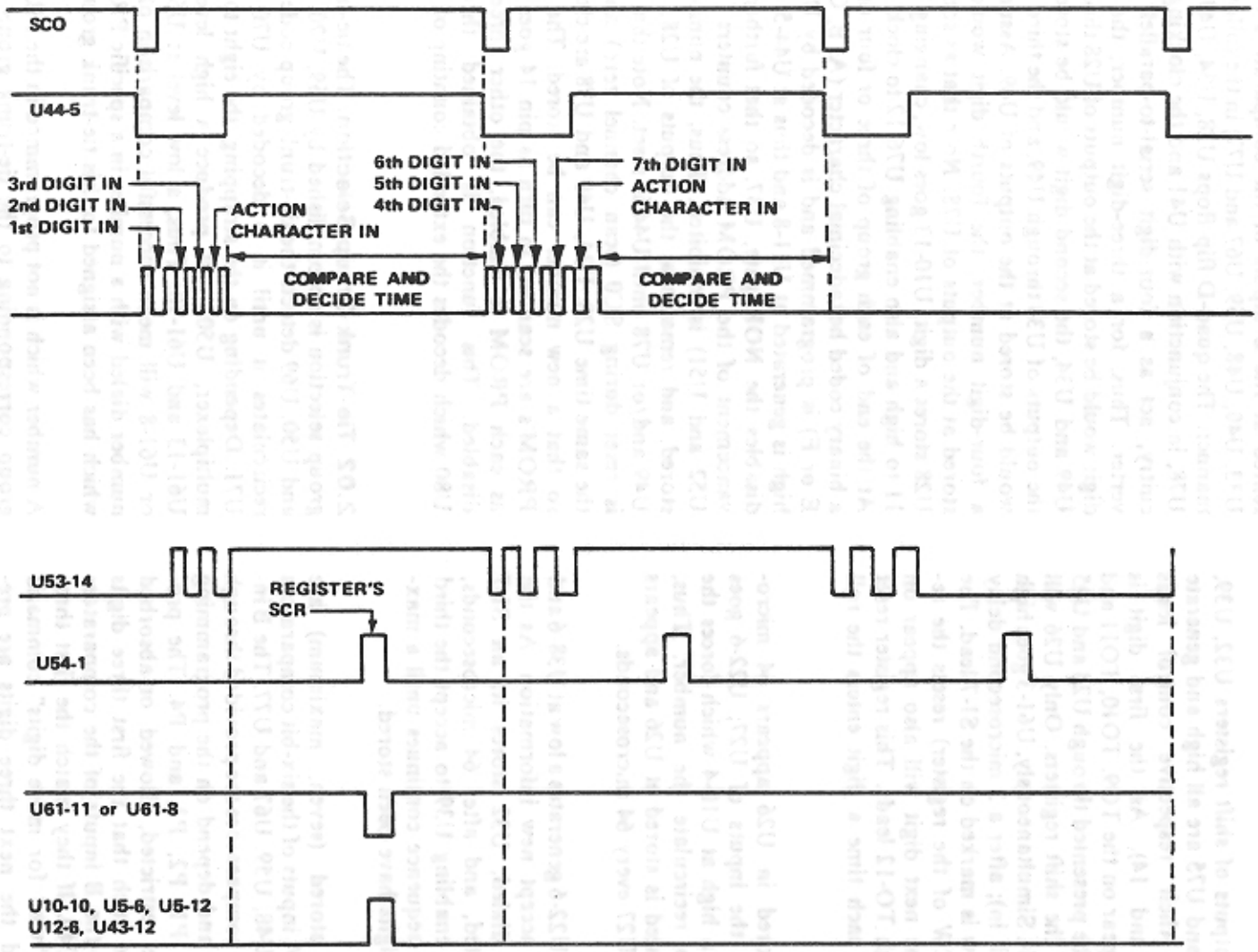

FIGURE 1.01 Toll Restrictor Timing Comparison Waveforms (from PROM read-out compared to a dialed number)

indication of START/END of the programming of each group. With the START of a group and the third digit in, a low is generated at U23-6 which appears at U21-1 after 64 microseconds. This low, at U5-9, generates a high at U5-8 which stores and recirculates the low level that previously appeared at U23-6. When the START/END pulse appears again at U76-9, coincidental with the tie-trunk group, U23-13 will go high and U23-3 low. This will generate a high at U55-11 and, depending on the A1-A4 to AD1-AD4 strapping, will either produce a deny or an allow code at leads TO-1 through TO-4. Complete strapping information for the toll restrictor PCB is contained in ITT practice OB-410-228.

In the case of six digits, the first three digits must match a programmed three-digit number which is followed by a "wait for more digits" code. This generates a low at U35-2; thus a high is generated at U14-12 which produces a low at U5-8 and resets the recirculation of the third digit in signal. As soon as the sixth digit is dialed, U23-8 goes low and U13-6 goes high to recirculate the low generated at U23-8. If the last three digits do not compare favorably, an allow or deny signal will be generated at the output depending on the A1-A4 to AD1-AD4 strapping. If all six digits compare and there is no seventh digit programmed, a high is generated at U37-1 which cancels the high at U13-6. Depending upon whether the code was programmed for allow or deny, a high appears at U79-8 or U63-6, respectively. This condition is stored at U36 and creates the final output condition. If a seventh digit is programmed, a high is generated at U22-3 for 64 microseconds which enables the three-input gate U20; U20-8 goes low to cancel the high at U13-6.

Notice that U37-1 is low in this case. As soon as the seventh digit has been dialed, U20-9 goes low disabling this gate. If there is a seventh digit comparison, U37-1 goes high and the sequence is as follows. If the seventh digit does not compare favorably, then after the START/END pulse of the group, U55-11 goes high and, again depending on the A1-A4 to AD1-AD4 strapping, an allow or deny code will be generated at the outputs.

The circuitry composed by U29, U30 and U9 provides a delay which depends on the strapping. At the beginning of each delay pulse (DL1 to DL5), a high for 64 microseconds is generated at U31-6 which feeds the carry-in input of the 4-bit full adder, U9. After eight of these pulses, the carry-out lead, U9-14, goes high, and U18-2 goes high so that it recirculates the high levels of U1 pins 4, 7 and 13 of the 64 x 4 bit shift register. After 64 microseconds, U9-11 goes high and adds one to the A1, A2, A3 and A4 inputs of the adder (which are all high), thus keeping the carry-out lead at a high level. The delay is initiated by the TR signal at the register's time slot and the ST signal from processor 2 at the tie-trunk's time slot. Figure 1.02 shows this delay waveform.

During the delay time, an IDT (inhibit decode terminator) signal is applied to the memory which inhibits the central office dial tone. At the same time, an SI-3 signal is generated which provides a nonrelease condition for the trunk. If a digit is dialed during this delay time, U19-6 goes low and U63-6 goes high, thus generating a deny condition at the output.

Note that U13-8 provides a signal which enables the restrictor to make decisions at any digit. Note also that U54-10 provides an absorb signal which is actually a forced reset of the restrictor.

3.00 PROM CODE ASSIGNMENTS

3.01 General. Each PROM is divided into two groups; the first group, A, is considered to be from address "00" to "7F" and the second group, B, from "80" to "FF." Thus, four PROM's provide eight groups; P1A and P1B for PROM 1, P2A and P2B for PROM 2, P3A and P3B for PROM 3, and P4A and P4B for PROM 4. These half-PROM groups can be combined to create a larger group depending on the number of codes which are to be programmed for a specific trunk group. Notice that in each half-PROM group, a maximum of 64 different three-digit numbers can be programmed; since each number is followed by an action character, two addresses are required. For example, assume that a system has toll restricted trunk groups TK1, TK3, TK6 and TL2. Assume also that 150 three-digit numbers are required for TK1, 100 for TK3, 120 for TK6 and 30 for TL1. This means that one and one-half PROM's must be devoted to TK1, one PROM to TK3, one to TK6 and one-half for TL1.

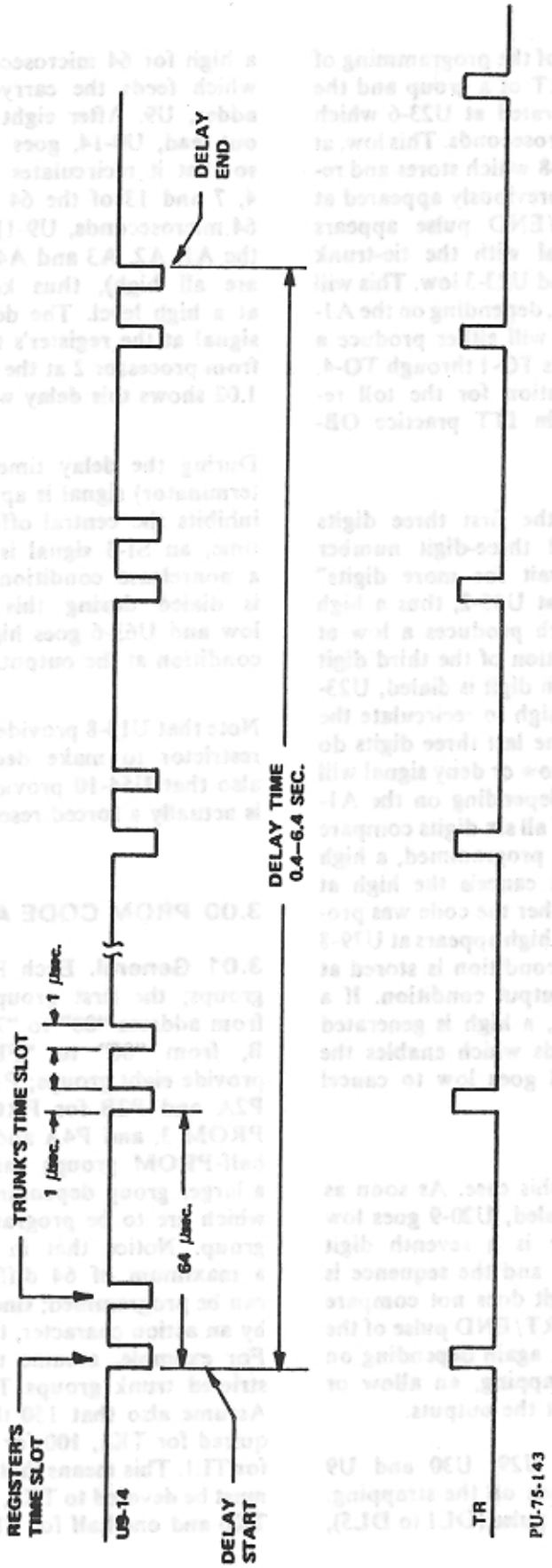

FIGURE 1.02 Toll Restrictor Delay Waveforms

The maximum capacity of all PROM's is 511 three-digit codes each followed by an action character. Thus, the maximum number of codes that could be programmed for one trunk group per board is limited to 511 three-digit codes. As many as four boards may be used in parallel to increase the capacity to 2044 three-digit codes. However, for any given trunk group, toll restriction must be on one board. For example, if TK1 requires 450 codes, TK2 300 codes and TK3 250 codes, then three boards must be used (one for each trunk group).

Each action character following a code has a specific meaning. These characters and their meanings are listed in table 1.01. Complete programming and strapping information is contained in ITT practice OB-410-228.

TABLE 1.01 Action Characters

CHARACTER	MEANING
A	Allow
B	Begin Program
C	Absorb
D	Deny
E	More to Follow
F	Filler Character

QUAD TRANSFER AND ADD-ON LINKS
(410258)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with one quad transfer and add-on link printed circuit board (PCB). This PCB contains four link circuits that, in normal service, function as transfer links but are multiplexed so that upon request they function as add-on links. A transfer link allows a station connected to a trunk to transfer the trunk to another station; an add-on link allows a station connected to a trunk to add on another station, thus enabling a three-way conversation.

2.00 DETAILED DESCRIPTION

2.01 General. Operation of the quad transfer and add-on link PCB is similar to that of the transfer and add-on links PCB. (See OL-410-170.) Waveforms of the quad transfer and add-on link circuit are shown in figure 1.00a. The output multiplexers U51 and U52 are enabled only at the SCR (scan channel read) time slots; the SCR signal is generated at U26 pin 2. The inputs SI-1, SI-2, and SI-3 are clocked in by the DATA-IN pulses generated at U27-8. The LOAD signal at U33-3 enables the circuit to load information in parallel form and then clock it out in serial form.

2.02 Seizure. When the circuit is seized by the originator momentarily depressing the hookswitch, SI-1 and SI-2 signals are clocked into U8 an U2, respectively, in serial form; 61 microseconds later the output changes from idle ("3F") to ring tone enable ("37"). These outputs are binary coded hexadecimals, and table 1.00 lists hexadecimal and alphanumeric equivalents. This change occurs because U26-12 and U26-8 go high while a low at U32-2 turns on the appropriate busy LED (light emitting diode). The output of U8 is shown in figure 1.00 on the assumption that the seized link belongs to the first time slot. Note that the same waveforms are generated at the outputs of U2 and U1 when SI-2 and SI-3 signals are detected. Note also that, since the link is in the transfer mode, U44-3 is high. In the add-on mode, U44-3 would be low.

2.03 Transfer. When the originator, after momentarily depressing the hookswitch, dials the number of the station to which the trunk call is to be transferred (the terminator), and the terminator answers, an SI-3 signal is generated. U26-4 goes high; U32-11 goes low and the output changes to busy transfer link ("33"). When the originator goes on-hook, the signal on lead SI-2 is removed and counters U22 and U23 are enabled. After 3.2 seconds, U32-8 goes low thus changing the status-out to transfer terminator to trunk ("30"). After the transfer, the circuit returns to idle.

2.04 Consultation Hold. After establishing a transfer as described in paragraph 2.03 above, and the terminator having answered, an SI-3 signal is generated. U26-4 goes high; U32-11 goes low and the output changes to busy transfer link ("33"). This enabled the talk path between the originating

station and the terminating station, but not the trunk party. After consultation between the two inside stations, the terminator goes on-hook. If this on-hook period exceeds 300 milliseconds, U27-11 goes low; U45-6 goes high generating a low at U44-11, which changes the output to transfer originator to trunk ("38"). After the transfer, the circuit returns to idle.

2.05 Add-On. When the originator, after momentarily depressing the hookswitch, dials the number of the station to which the trunk call is to be transferred (the terminator), and the terminator answers, an SI-3 signal is generated. U26-4 goes high; U32-11 goes low and the output changes to busy. When the originator depresses the hookswitch, the signal on lead SI-2 is removed and counters U22 and U23 are enabled. If the duration of the hookswitch flash is between 200 milliseconds and 1.6 seconds, a low is generated at U27-11 and U44-3. At the end of the hookswitch flash, the signal is reapplied on lead SI-2 causing U45-8 to go low and generate a high at U49-10.

With a high at the select input multiplexer, U51 and U52 enable the A inputs thus changing the output to busy add-on link. This output circulates through processor 2 and generates an AOE (add-on enable) signal. The AOE signal is gated with the low at U29-10. (The low was latched at U29-10 due to U44-3 going low and a high being generated at U38-10.) Through U37 and U25, the AOE signal generates a high at U19-3 and a low at U19-4; these are the signals necessary to enable the analog circuitry for three-way conversation.

2.06 Release from Add-On. If, during a three-way conversation, the terminator goes on-hook, the signal on lead SI-3 is removed and U30-6 goes low. This low is latched at U29-9 and counters U23 and U22 are enabled. If the duration of the on-hook period is greater than 300 milliseconds, U27-11 goes low, U39-10 goes high, and (since the signal is no longer present on lead SI-3) U44-9 goes low and U33-11 high. Under this condition, the output changes from busy add-on ("57") to transfer originator to trunk ("59"). After the transfer, the circuit releases and returns to idle.

If the originator, rather than the terminator, goes on-hook for more than 300 milliseconds, the same signals as described in the previous case are generated. The only difference is that the signal is removed from lead SI-2 rather than SI-3, thus changing the output to transfer terminator to trunk ("58"). After the transfer, the circuit returns to idle.

2.07 Timing. In figure 1.00b and 1.00c, the outputs of U8, U2, and U1 are tabulated so that the input/output timing can be determined. Each column corresponds to a specific SCW (scan channel write) and SCR (scan channel read) time slot as well as to a DATA-IN pulse. Thus, if link 1 is seized, signals are present on leads SI-1, SI-2, and/or SI-3 at SCW 1. This is denoted by a W/1 1 (write-in 1) designation; with the second pulse of DATA-IN, these signals are clocked to outputs A. At the third pulse, they are clocked at outputs B and so on to C and D. The signals remain at D for 61 microseconds and will generate an output which is enabled at SCR-1 (write-out 1). Three microseconds later, corresponding signals appear at the inputs and are clocked again at outputs A.

For the second link, the following sequence applies: WRITE-IN occurs at SCW-2 and the inputs are clocked to outputs A, then to B, and with the last DATA-IN pulse, to outputs C; 58 microseconds later the first pulse of DATA-IN occurs, clocking from outputs C to D. These signals generate an output which is enabled at (W/02) SCR-2, 61 microseconds after the W/12. Three microseconds later, the information is clocked back to A and the cycle continues. This same principle applies for all time slots.

TABLE 1.00 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

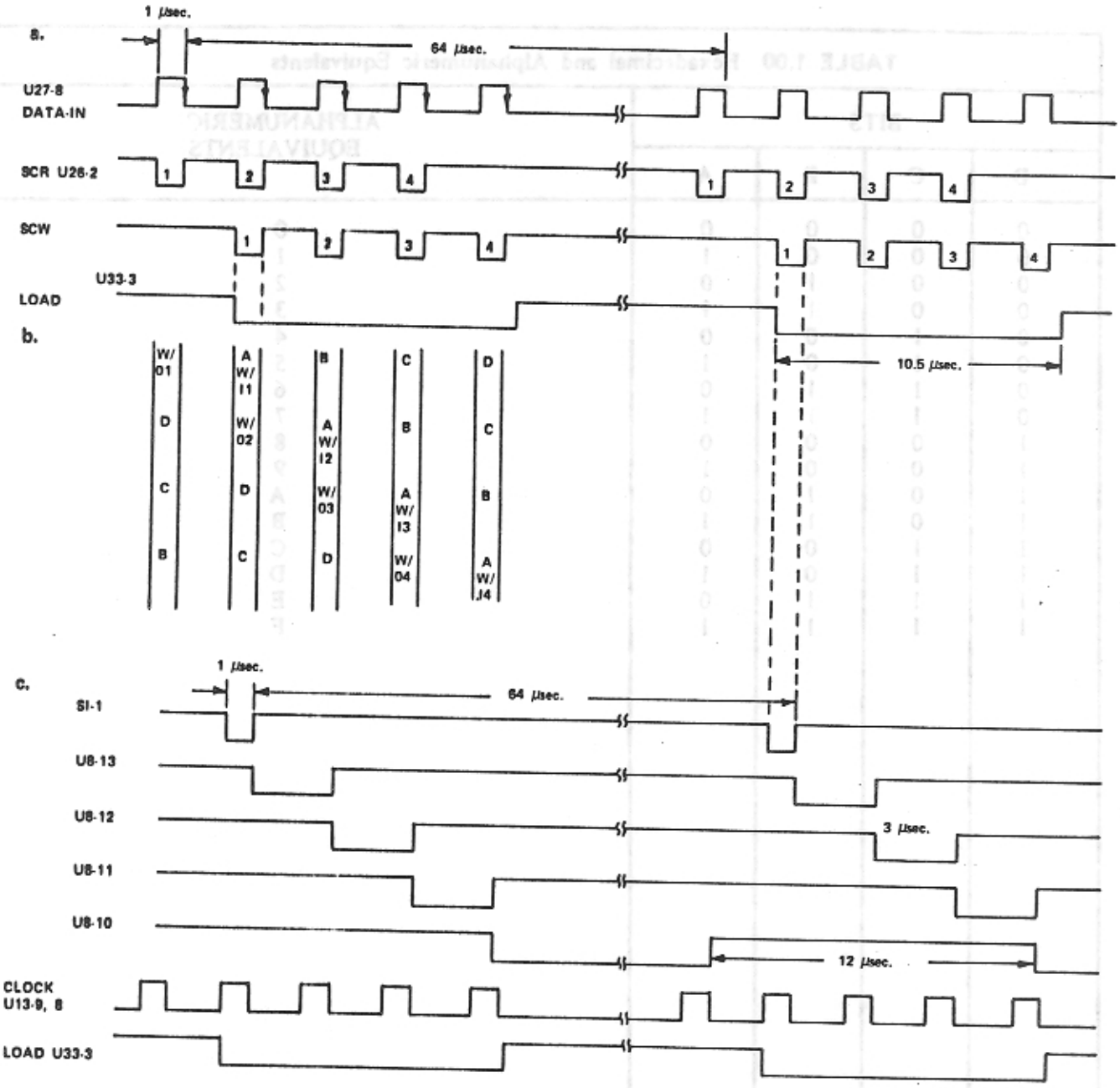

FIGURE 1.00 Quad Transfer and Add-On Waveforms

NUMBER TRANSLATOR
(410294)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 Binary and Hexadecimal Equivalents 2

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with a number translator printed circuit board (PCB) to be used in conjunction with the hotel/motel option package. This PCB plugs into the option 3 slot and has as its function the conversion of a hotel or motel room number into a TD-100 equipment number.

2.00 DETAILED DESCRIPTION

2.01 General. When using the TD-100 EPABX equipped with the hotel, motel package and a room number is dialed, the number appears on the TO leads of the register. These TO leads correspond to the TO leads on the room number translator.

For example, if the room number dialed is 410, then the number 4 is the hundreds digit and appears on leads TO-9 through TO-12. (Numbers are in binary coded hexadecimal form. Table 1.00 is a list of binary and hexadecimal equivalents.) This number produces a logic high on U3 pin 13 and a low on U3 pins 12, 14, and 15. The output of U3 (pin 5) is low and is extended to produce a low on U9 pin 4 and a high on U9 pin 6. With a high on U9 pin 6 and a high on U15 pin 13, the output of U5 (pin 12) is low which enables the programmable read only memory, PROM U11. Now U11 is enabled and U10 is disabled.

The number 1 is the tens digit and appears on leads TO-1 through TO-3. This number produces a high on U11 pin 20 and lows on U11, pins 19, 18, and 17.

The number 0 is the units digit and appears on leads TO-5 through TO-8. This number produces lows on U11, pins 3, 2, 1, and 21.

The necessary PROM has been enabled and the number 10 appears at its inputs. This number will produce any output that has been programmed into the PROM. Assume that this PROM has been programmed such that room number 410 corresponds with equipment number 222. The PROM will then recognize the 10 at its input and output the number 22 to the memory.

Single digit translation is also possible with proper programming and strapping. Dialing a pre-wired hundreds digit selects a PROM section and a specific address through U7 and U8. The accessed PROM then marks out the required tens and units digits (according to its programming) as described above.

Any selected hundreds digit (0-9) may be selected for translation bypass. Hundreds digits used for feature access should be strapped for bypass.

2.02 Strapping. Complete strapping information for the room number translator is contained in ITT publication OB-000-003, entitled TD-100 Feature Strapping.

TABLE 1.00 Binary and Hexidecimal Equivalents

BINARY BITS				HEXADECIMAL EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

RECORDER DISCONNECT
(410295)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION 1
General 1
2.00 DETAILED DESCRIPTION 1
General 1
Strapping 1

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be optionally equipped with one recorder disconnect printed circuit board (PCB) containing six recorder disconnect circuits. This PCB is used in the line option 2 position of the line subrack.

Each recorder disconnect circuit provides a positive disconnect signal to an Elgin Electronics Station Coupler, model ESC-20721 or equivalent. Since the line release of many station couplers is dependent on receipt of some period of silence, and since the TD-100 returns busy tone on calling station disconnect, the station coupler does not release. The recorder disconnect circuit provides an opening of the loop to force the station coupler from the line.

2.00 DETAILED DESCRIPTION

2.01 General. The tens and units digits of up to six TD-100 stations equipped with station couplers are strapped on the recorder disconnect PCB. When a coupler-equipped station is called and the calling station goes on-hook, busy tone is returned to the terminating station. This busy tone normally prevents the station coupler from disconnecting.

The recorder disconnect PCB decodes the units and tens digits of each terminating station and when the decoded number matches a strapped number, a pulse is clocked into flip-flop U17. Delayed by U17, U16, and U15 for a total of 3 microseconds, the pulse is then applied to one of six identical circuits as the enabling signal. (Since each circuit functions identically, only the first will be described.) When the first tri-state device is enabled and a BLO (busy lockout) signal is present, the BLO is applied to U4-5.

With customer provided switch S-1 in the operated position, the station coupler is enabled; in the normal position, the station coupler is disabled. With the station coupler enabled and the loop closed, transistors Q2 and Q3 are turned on via CRZ1 thus removing the reset from U4.

When the calling station goes on-hook, the BLO signal is gated through once (during the write scan). This clocks U4 which turns on Q1 and operates relay K1. The operation of K1 opens the tip side of the line to the station coupler, allowing it to release immediately; reset time of U4 will be about 1 second.

The switch which is installed at the station location to allow calls to be routed to the station coupler or the station instrument should be a double pole-double throw (2 form C) to switch both the tip and ring.

2.02 Strapping. Full strapping information is contained in ITT Practice OB-000-003, entitled Feature Strapping, TD-100 EPABX.

BUSY TRUNK/BUSY LINE CALL BACK
(TD-4102967 - ISS A)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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Line Call Back 3
Changing Call Back Reservations . 4
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1.00 Busy Trunk/Busy Line Call Back Block Diagram 2

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with one Busy Trunk/Busy Line Call Back PCB (printed circuit board) assembly. It is used in position 27 of the channel subrack and provides call back operation when a line or trunk becomes available.

1.02 Operation. The BT/BL CB (busy trunk/busy line call back) circuit allows a TD-100 station user, after dialing the number of a busy station or the access code of a busy trunk, to request call back operation when the station or trunk becomes idle. The originating station user makes this call back reservation automatically by remaining off-hook for 4 to 8 seconds after receiving busy tone. When the reservation is accepted, the busy tone will change to reorder tone (120 ipm), at which time the originating station should go on-hook. (Figure 1.00 is a block diagram of the BT/BL CB circuit and may be consulted as required.)

The TD-100 circuitry will then periodically scan the lines of the originator and the busy terminator once each 4 seconds. When both lines are idle, the BT/BL CB circuit will cause both lines to ring. The originator must answer within 8 seconds (two rings) or the call will be released; the terminator's line will continue to ring for as long as the originator remains off-hook.

The busy trunk/busy line call back circuit is equipped to accommodate six groups of trunks and/or tie trunks and one station group. Each group will accommodate seven reservations simultaneously. When reservation storage for a particular trunk group or the station group is full, and another originator attempts to place a reservation in that group, reorder tone is not returned. This continuation of busy tone serves to advise the originator that all seven reservation storage positions are full, and that new call back reservations are denied.

Each originator may have one station and one trunk reservation simultaneously. A station user desiring to change a call back reservation may do so by following the previously described procedure for new call back reservations; new reservations simply override old reservations.

The circuitry may be initialized (reset) in one of three ways, each of which result in complete eradication of reservation storage. A reset switch is located on the PCB and may be operated from the front of the equipment cabinet. The board may also be withdrawn and reinserted in the cabinet, in which case power on reset circuitry is enabled. Additionally, if the PCB is strapped for night service, operation of the NIGHT switch on the console will reset the BT/BL CB circuitry.

The BT/BL CB PCB may be ordered equipped for one station group and from zero to six CO trunk groups and the balance (to a total of six) in tie trunk groups. Strapping information for the various options of the busy trunk/busy line call back PCB is contained in ITT publication OB-410-296.

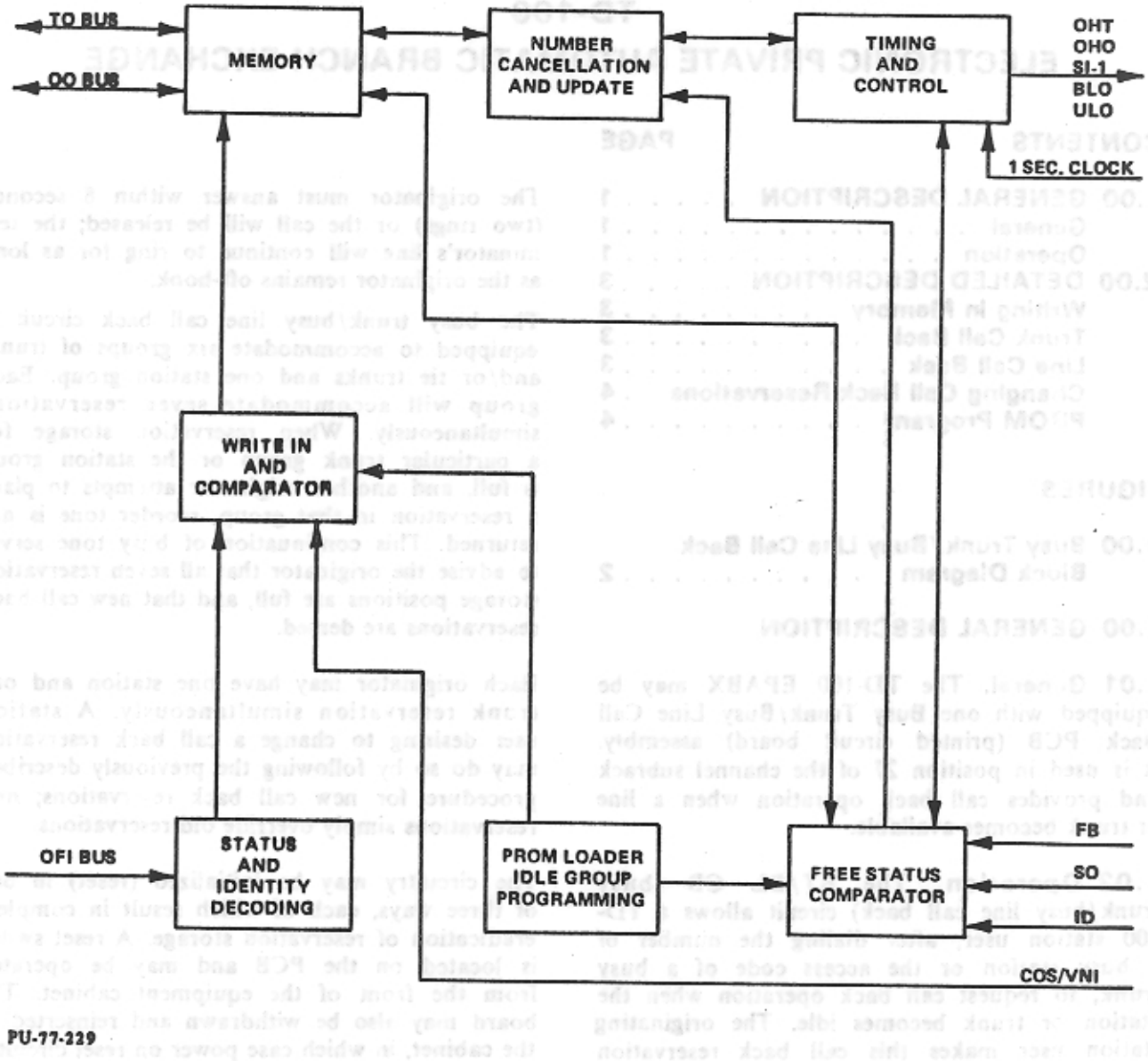

FIGURE 1.00 Busy Trunk/Busy Line Call Back Block Diagram

2.00 DETAILED DESCRIPTION

2.01 Writing in Memory. When a station user dials a busy trunk group, the originating number appears on the 00 bus and the identity and status-out of the busy trunk group appears on the OFI bus. If the BT/BL CB circuit is strapped for this trunk group, the output of the I and SO decoders will produce a pulse which is against a COS signal. If the station is allowed this trunk group, then the pulse will latch the I and SO into temporary storage and set the write-in latch. The write-in latch clocks the originating number into memory and requests a comparison to the trunk group location. The comparison enables the write-in latch to match a free slot in memory to the trunk group location. The write-in latch also advances the fast/slow clock. This clock normally runs the BT/BL CB at an idle speed of one pulse each 64 microseconds (with SC59) then changes to the fast clock mode and operates at T4 speed (1 microsecond).

The match then produces a 1-microsecond pulse which enters the originator's number into the 64-bit shift registers. The match also starts an 8-second timing interval and a 1-second scan. Once each second the originator's number is gated out on the leads during scan channel 60. If the originator goes on-hook within 8 seconds, the reservations are cancelled. A cancellation pulse is generated within 1 second, which removes the originator's number from memory in this time slot. (See paragraph 2.02.) If, at the end of 8 seconds, the originator is off-hook the FB lead is high during scan 63 indicating the originator's request for call back reservations. BLO and ULO are both gated out during scan 63 to send reorder tone to the station. At the same time, a comparator in the memory system is enabled to search for a duplicate number in the trunk groups. If a duplicate number appears in any trunk group, a cancellation pulse is generated to remove the previous number. The originator's number is latched into memory and a check is made each 4 seconds to determine when both the originator and terminator are free.

2.02 Trunk Call Back. When an originating station has a call back reservation for a trunk group in memory, the call back (originator's) number is gated out on the TO bus every 4 seconds during SC60. If the F/B lead goes low during SC63, a latch is set to enable the free status comparators to look for an idle trunk in the desired group. When a successful comparison is made, the originator's number is gated out on the TO bus in the time slot of the idle trunk. At the same time, SI-1 and OHT signals are marked to the processors in the trunk's time slot, and loaded into a 64-bit recirculating shift register, which continues to send the pulses for 8 seconds. Once each second, an SI-1 is inhibited, and a check is made for an SI-3 signal. Receipt of the SI-3 signal indicates that the originating party is off-hook and is ready to dial; it also indicates that the BT/BL CB circuit has transferred control of the call to the originating station. The reservation for that particular call back is cancelled, and if the originating station does not come off-hook within 8 seconds, ringing ceases.

When the cancellation latch is set, the BT/BL CB circuitry shifts to fast clock and a pulse is marked into the updating 64-bit recirculating shift registers. There is a 64 microsecond delay to allow the originating number to be presented at the beginning of memory. At this time, the multiplexers are disabled, allowing all TO and 00 leads to float high, thus writing a hexadecimal "FF" into the memory in place of the originator's station number. At the same time in the updating shift register, a latch is set to remove one clock pulse from the last shift registers in the memory. The beginning of the trunk group mark is fed into a 8-bit counter. The output of the counter (delayed by 8 microseconds) is fed into a 3-input nand gate with T3, and into the latch which was set when the number was removed. This generates a new clock pulse at the end of the group to replace the one removed at the beginning, thus the total count of 8 remains. This moves all reserved numbers in that group closer to the beginning of the group. The second output of the updating shift register sets the update latch and is routed through the shift register again. The output of the third cycle through resets the cancellation latch and the update latch; when the cancellation latch is reset, the system returns to slow clock and the operation is complete.

2.03 Line Call Back. The busy line call back operates similar to the trunk with the following exceptions. A busy station will cause the register

to output a hexadecimal "75" on the identity and status-out leads. This "75" is decoded and generates a pulse to the write-in latch instead of the trunk group decoding circuitry. The originator's station number and the terminator's station number are loaded into memory in a similar manner as the originator's number was loaded for trunk call back. The originator's number is gated out during scan channel 60 on the TO bus; the terminator's number is gated out during scan 62 on the TO bus.

Idle lines are detected by monitoring the F/B (free/busy) lead; F/B is detected during scan channel 63 and scan channel 01. The indication in scan 63 is delayed and compared with the one in scan 01 to determine when both parties are on-hook. If both parties are on-hook, the BT/BL CB looks for an idle link. The originator's number is sent on the 00 bus, and the terminator's number is sent on the TO bus. A series of OHT and OHO signals are sent for 8 seconds to hold the stations during the 8 second ringing period. Subsequent operation is identical to busy trunk call back operation.

NOTE: Non-equipped station numbers must be strapped to produce a VNI output and thus prevent the station group from being accidentally loaded by originating calls to non-equipped station.

2.04 Changing Call Back Reservations. An originator may change a reserved call back number to a new number. The originator dials the new number and when busy tone is received, waits 8 seconds for reorder tone. At the end of the 8 second period, the originator's number will be checked by the duplicate number comparator. If a reservation is already made, the old terminator number will be replaced with the new terminator number. If the reservation group is full (7 numbers), no reorder tone will be returned, and the continuance of busy tone indicates that the originating party's reservation is not changed.

2.05 PROM Program. The type and number of trunk groups that may be served by BT/BL CB circuitry is dependent upon programming contained in a Programmable Read Only Memory (PROM). Each PROM contains seven groups of reservations with seven reservations possible in each group. The PROM may be programmed with from one to six tie trunk groups and the remaining (up to a total of six) groups accommodating CO trunks. These six groups are in addition to one station group in all PROM programs.

DIAL CALL/DIRECTED CALL PICKUP
(TD-4103117 - ISS H)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 Dial Call/Directed Call Pickup
Block Diagram 3

1.00 GENERAL DESCRIPTION

1.01 General. The TD-100 EPABX may be equipped with one Dial Call/Directed Call Pickup PCB (printed circuit board) assembly. It is used in the feature 3 position on the channel subrack. This assembly consists of a feature 3 PCB (TD-4103226-001) equipped with the dial call/directed call pickup PCB (4103116-001) and the programmable read only memory PCB (4102756-002). Access codes are strappable on the feature 3 PCB to provide dial call pickup, or directed call pickup, or both.

1.02 Dial Call Pickup. This feature enables a station user in a pre-assigned group to dial a two-digit access code in order to answer a ringing station in the same group. All stations within the TD-100 system may be within a single group or may be divided into as many as 62 groups; each station may appear in only one group. Station grouping information must be supplied by the customer prior to shipment of the PCB.

1.03 Directed Call Pickup. This feature allows a station user to dial a two-digit access code, again receive dial tone, and then dial and answer any ringing station in the system. It may be necessary to provide a separate busy lamp field in order for the station user desiring directed call pickup to know which, if any, station is ringing.

2.00 DETAILED DESCRIPTION

2.01 General. The two types of service provided by the dial call/directed call PCB necessitate that a description of its operation be divided into separate parts. The following paragraphs provide that description; figure 1.00 is a block diagram of the call pickup assembly.

2.02 Dial Call Pickup Operation. In dial call pickup, stations are grouped according to the programming of P1, a programmable read only memory (PROM). When a station, 246 for example, within the group is ringing, and a station user at another group station, 248 for example, wishes to answer 246, station user 248 dials the access code for dial call pickup. The number 248 appears on the 001-008 leads from memory during the SCR of the register.

Upon an enable signal (also at the SCR of the register) from U4 that the dial call pickup access code has been dialed, 248 is stored in U6 and U7. One microsecond later, when U12-8 goes low to enable U10 and U11, 248 is fed to the input of P1, causing a group identity output which is stored at latch U30. At the same time U14-2 goes low to reset the input of U33.

U13, U32, and U33 monitor the I and SO leads in a search for an identity and status code which indicates a ringing station (B7, 37, E3, or 93). When a ringing station is identified, U23-6 goes low. When U23-6 goes low at SCR + 3 and U23-12 is low, U13-8 goes low to enable U15 and U16. This clocks the ringing number (246) from the TOC leads to the input of P1. When the number 246 is taken from the TOC 1 - TOC 8 leads and is applied to the input of P1, P1 outputs another group identity

The two group identities from P1 are compared by U31; when a match occurs, a high signal is generated at U31-9; 64 1/2 microseconds after the successful comparison, U22-11 goes low coincident with the last half of the SCR of the ringing channel. This low enables U1 and U2 to place the originating number (248) on the TO leads to the terminating side of the memory in place of 246. Lead TROR (transfer) is marked to the memory to inhibit an SI-7 signal from Processor 2.

2.03 Directed Call Pickup Operation. Directed call pickup does not require PROM programming since stations are not grouped. Any station may answer any ringing station by dialing an access code followed by the number of the ringing station.

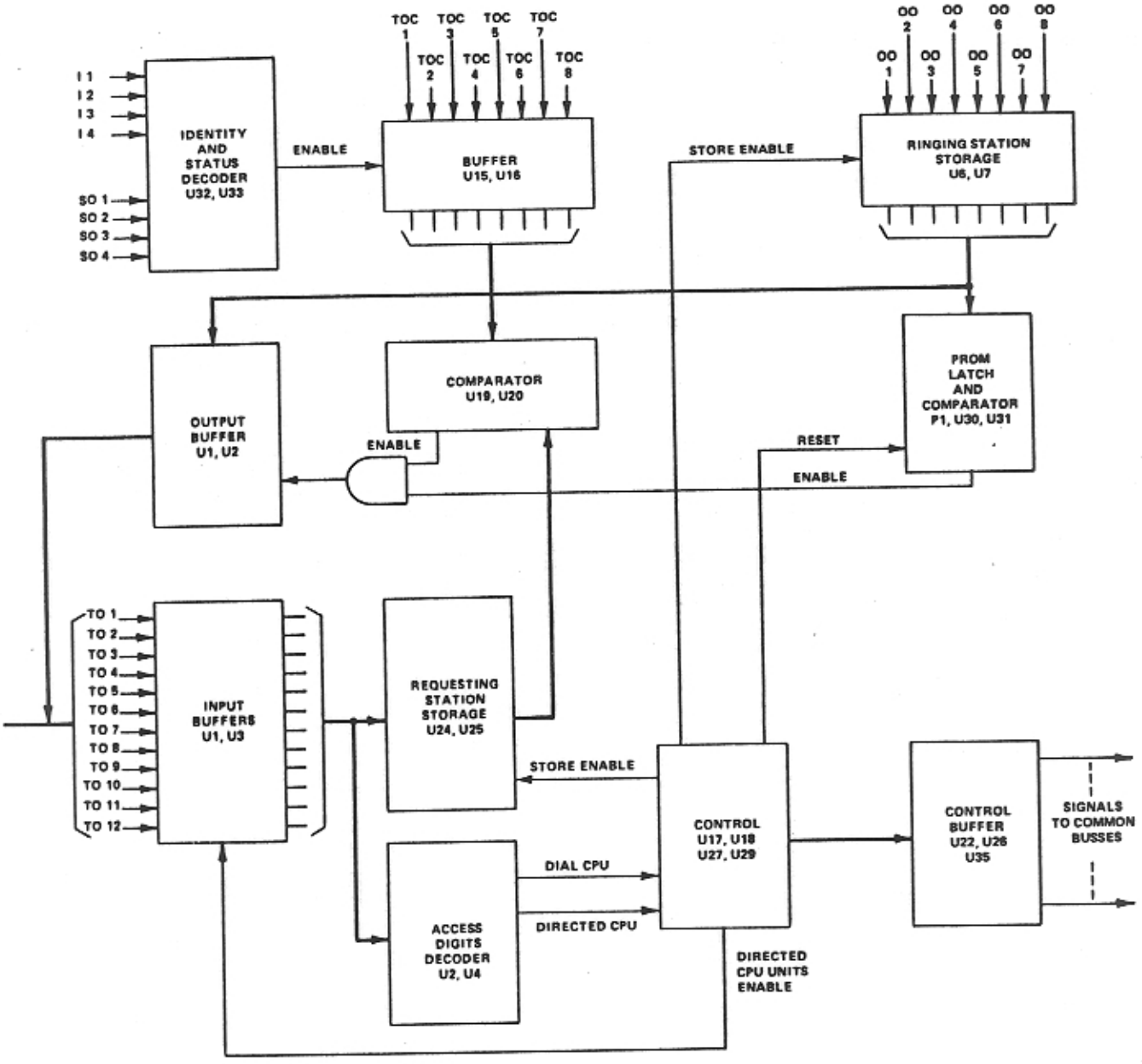
For example, if station 246 is ringing and the station user at 248 wishes to answer, station user 248 must dial the preassigned access code. U2 and U4 decode the access digits causing U5-4 to go high at the SCR of the registers and begin the directed call pickup sequence. The high is fed through U27 and emerges 131 microseconds later at U22-8. This occurs at the SCW of the register and marks the SI-7 lead to reset the register.

Station user 248 begins receiving dial tone again and dials 246. This number is marked on the TO 1 - TO 12 leads, and when the units leads are marked, signifying completion of dialing, U12-3 goes high. This high causes 246 to be stored in U24 and U25.

At this time, the outputs of U24 and U25 are compared with the terminating number gated from the TOC 1-8 leads by U15 and U16. The comparision occurs at U19 and U20. If the match is successful the output buffers. U1 and U2 are enabled to place the contents of U6 and U7 on the TO 1 - TO 12 leads to the memory. Thus 248 replaces 246 as the terminating number in the memory.

If the match is not successful, and a tranfer of terminating numbers does not occur, a BLO signal is generated to place the station desiring call pickup in lockout.

2.04 Strapping. Certain strapping must be applied to the dial call/directed call pickup PCB. ITT publication OB-410-311, entitled Feature Straping, TD-100 Dial Call/Directed Call Pickup contains full details.



PU-77-017

FIGURE 1.00 Dial Call/Directed Call Pickup Block Diagram

ACCESS TEST SET
(410320 INCLUDING 410306, 410327)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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FIGURES

1.00 Access Test Set 2
1.01 Channel Selection Timing Chart . . 6

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1.01 Channel Allocations 5

1.00 GENERAL DESCRIPTION

1.01 General. The access test set is a maintenance aid available for the TD-100 EPABX to enable test calls to be made from the TD-100 cabinet. Any pre-selected channel (0 through 63) may be accessed by a test call and thus test the circuit to which that channel is assigned.

The access test set permits maintenance personnel to perform system tests and initiate test calls from the front of the TD-100 cabinet. The test set operator may choose line 295, 296, 297, 298, or 299 as an access test line to the system. When an access test line is selected at the test set, the station telephone set on that line is automatically disconnected from the system. When the test set is not being used, the station telephone sets on line 295-299 are connected to the system in the normal manner.

The test set may be a portable unit or mounted at the top of the TD-100 cabinet, above the printed circuit boards. Figure 1.00 shows the layout of the test set controls and indicators, and table 1.00 lists the function of each.

2.00 DETAILED DESCRIPTION

2.01 General. The test set basic operating procedure is as follows:

a. Determine the circuit to be tested (register, link, trunk, etc.).

b. Obtain the channel (time slot) number of the circuit from table 1.01.

c. Set the UNITS and TENS switches on the test set to the channel number.

d. Access the system by operating one of the five LINE push buttons.

e. Momentarily operate the BUSY push button. This allows the test calls to be routed to the selected channel.

The previous steps provide only the sequence of operation for originating a test call from the test set. Detailed procedures for receiving calls and originating different types of test calls from the test set are given in paragraphs 2.03 through 2.08.

Note that even though the desired channel is selected with the UNITS and TENS switches, there may be instances when the channel cannot be obtained when the BUSY push button is pressed. Even if the channel is free when the tester gains access to the system, any regular station user originating or receiving a call may seize the channel selected for test if the call is processed between the time the tester gains access to the system and the time the BUSY push button is operated.

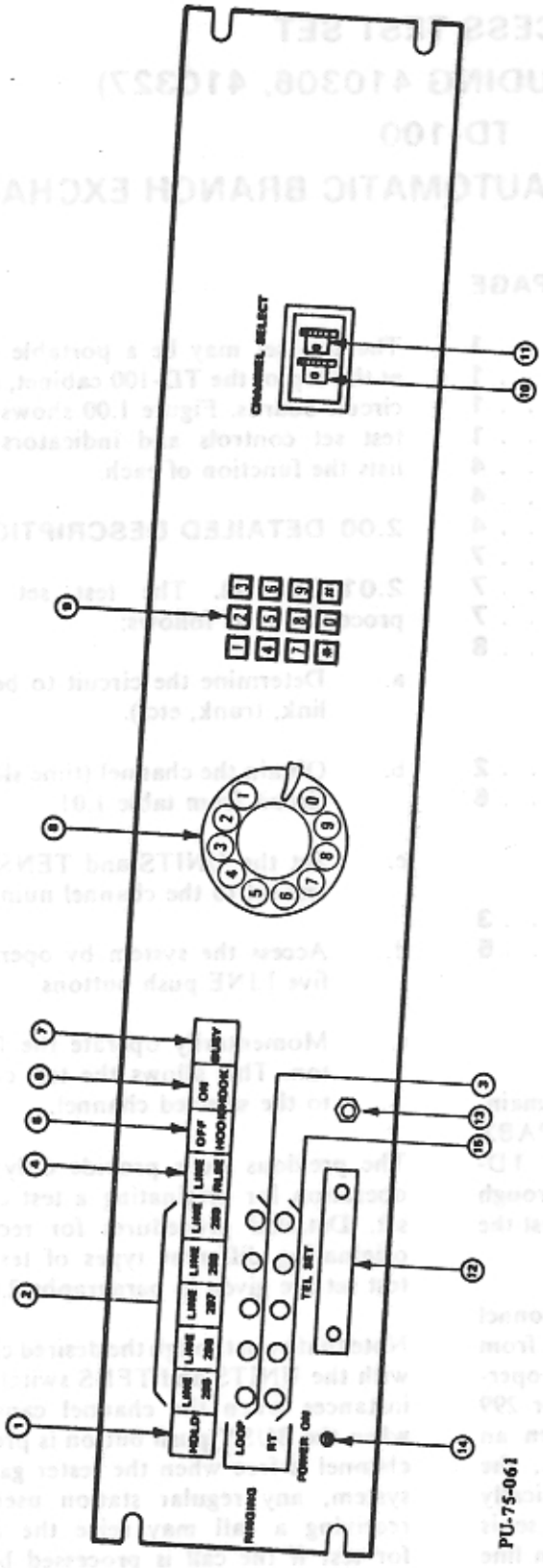

FIGURE 1.00 Access Test Set (Cabinet Mounted)

TABLE 1.00 Indicators and Controls

ITEM	DESIGNATION	DESCRIPTION
1.	HOLD	Used to place station on "hold."
2.	LINE 295 to LINE 299	Provide access to lines 295, 296, 297, 298, and 299. The integral lamps flash on incoming calls and light steady when the line is busy.
3.	LOOP 1-5	Will light when ringing generator is applied to the corresponding line.
4.	LINE RELEASE	Nonlocking push button releases LINE push buttons.
5.	OFF-HOOK	Nonlocking push button simulates off-hook condition when receiving or originating calls. This push button must be used to simulate the off-hook condition normally supplied by the station telephone set. The integral lamp will light when the push button is operated.
6.	ON-HOOK	Nonlocking push button simulates an on-hook condition. This push button must be used to simulate the on-hook condition normally supplied by the station telephone set. Operating this push button also extinguishes the OFF-HOOK lamps.
7.	BUSY	Nonlocking push button connects the test set to the channel selected with the UNITS and TENS switches.
8.	Rotary Dial	Provides dial pulses for calls originated from the test set.
9.	Push-Button Dial	Provides multifrequency TEL-TOUCH® tones for calls originated from the test set.
10.	TENS	Rotary switch selects the tens number of the desired channel.
11.	UNITS	Rotary switch selects the units number of the desired channel.
12.	TEL SET	Stand-off terminals provide points for connecting the two-wire telephone set or the hand test telephone to the access test set.

TABLE 1.00 Indicators and Controls (Cont.)

ITEM	DESIGNATION	DESCRIPTION
13.	Jack	Jack wired in parallel with stand-off terminals allows insertion of plug-equipped telephone set or hand test telephone.
14.	POWER ON	Light-emitting diode lights to indicate power is applied to the test set. Note that the test set does not have a power switch; power is on continuously.
15.	RT 1-5	Lamp RT 1-5 lights to indicate ringing generator on corresponding RT- lead.

2.02 Circuit Operation. Most access test set circuitry is mounted on one of two PCB's. The line access relays are contained on TD-4103066; the channel decoding logic is on TD-4103076. These two PCB's along with the front panel indicators comprise one complete access test set.

Each of the five lines (295 through 299) has a separate relay and the desired line circuit is accessed by pushing the correct line button along with the OFF-HK (off hook) button and thus lighting the OFF-HK lamp. Operating the ON-HK (on hook) button releases the OH relay. The LINE RLSE (line release) button releases the operated line button and restores the circuit to normal.

Solid state circuitry controls channel selection. Decade counters U1 and U3 are clocked by signal T4. The carry output of U1 is used as an enable pulse for U3 and SC1 (scan channel one) signal is used as a clear pulse for both counters. The outputs of U1 and U3 are connected to the binary to decimal decoders, U2 and U4. The outputs of U2 and U4 are fed to the units and tens switches of the channel selector. Figure 1.01 is a channel selector timing chart.

Channel selection is dependent upon making all circuits of a type busy during one 64 microsecond scan period, except the one to be seized. The ES (enable seizure) lead is held low for all time slots except the one selected. This is done automatically by the access test set.

Calls made to and from the access test set are established through a telephone network provided on the set. The network is connected to the tip and ring of the selected line (295 through 299) through relay contacts on each line.

2.03 Test Preparation. The only preparation required is to connect a two-wire telephone set or a hand test telephone to the stand-off terminals on the front of the test set.

2.04 General Procedures. The access test set may be used to conduct system tests using line 295, 296, 297, 298, or 299. Calls may be originated to local stations or outgoing trunks at the test set or received at the test set from local stations and incoming trunks. Paragraphs 5.02 through 5.05 give detailed procedures for different call types. In addition, the following general procedures must be followed to successfully complete test calls.

a. The two-wire station instrument or hand test telephone connected to the stand-off terminals or jack at the front of the test set is used mainly for transmission testing. The off-hook and on-hook conditions normally provided by the telephone sets must be simulated by using the OFF-HOOK and ON-HOOK push buttons on the test set. Also, the test set rotary dial or Tel-Touch pad must be used when dialing.

b. Prior to originating or receiving a test call the LINE push button (295 - 299) on which the test is to be completed should be operated (depressed). This disables the station

TABLE 1.01 Channel Allocations

CIRCUIT	CHANNEL	CIRCUIT	CHANNEL
Trunk 1	50	Local Link 9	51
Trunk 2	53	Local Link 10	54
Trunk 3	56	Local Link 11	57
Trunk 4	59	Local Link 12	47
Trunk 5	58		
Trunk 6	1	Option 1	0
Trunk 7	4	Option 2	3
Trunk 8	7	Option 3	6
Trunk 9	10	Option 4	9
Trunk 10	13	Option 5	12
Trunk 11	16		
Trunk 12	19	Spare 2-1	41
Trunk 13	22	Spare 2-2	44
Trunk 14	25		
Trunk 15 or Tie Line 1	28	Transfer Link 1	2
Trunk 16 or Tie Line 2	31	Transfer Link 2	5
Trunk 17 or Tie Line 3	34	Transfer Link 3	8
Trunk 18 or Tie Line 4	37	Add-On Link	63
Trunk 19 or Tie Line 5	40		
Trunk 20 or Tie Line 6	43	Conference Link 1	11
Trunk 21 or Tie Line 7	46	Conference Link 2	14
Trunk 22 or Tie Line 8	49	Conference Link 3	17
Trunk 23 or Tie Line 9	52	Conference Link 4	20
Trunk 24 or Tie Line 10	55		
Register 1	15	Attendant Link 1	23
Register 2	18	Attendant Link 2	26
Register 3	21	Attendant Register 1	29
Register 4	24	Spare 1-1	32
		Spare 1-2	35
		Spare 1-3	38
Local Link 1	27		
Local Link 2	30		
Local Link 3	33		
Local Link 4	36	Vacant	60
Local Link 5	39	Vacant	61
Local Link 6	42	Vacant	62
Local Link 7	45		
Local Link 8	48		

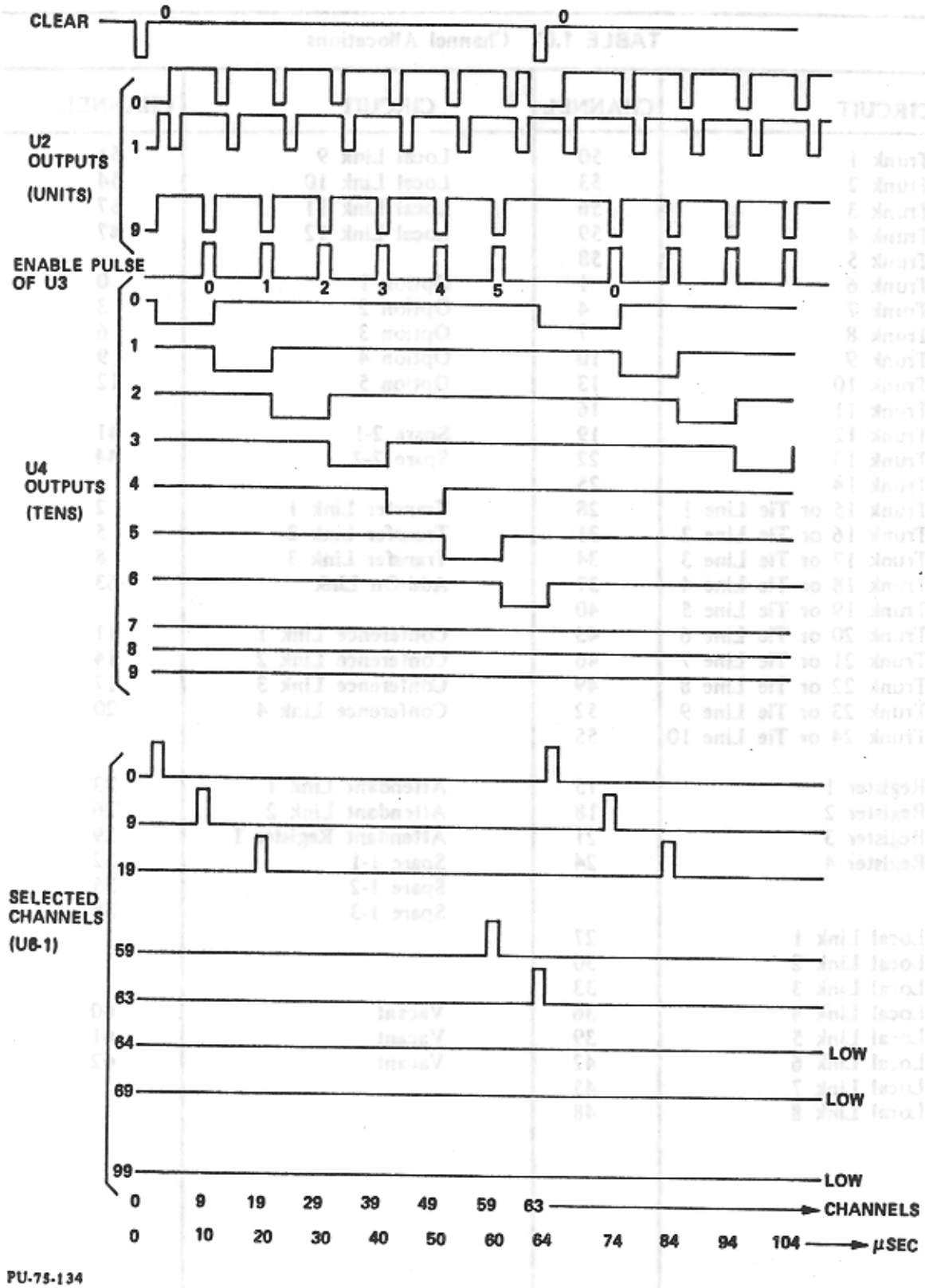

FIGURE 1.01 Channel Selector Timing Chart

elephone and lights the line lamp if a key set s provided. Should a nonoperated LINE ush button (intergral) lamp light or flash t indicates the station user is using the line r is being called. Operation of the LINE ush button at this time would disable the tation telephone and transfer the line cir- uit connection to the test set.

c. Calls between the test set and stations 295 - 299 can be made. To call station 295 from the est set, for example, access the system over one of lines 296 - 299 and then dial 295. Operate the HOLD push button to place the originating station on hold and then operate the 295 push button. Lamps associated with line 295 flash in response to ringing.

d. If, after operating the BUSY push button, reorder tone is received, this indicates that the channel selected for testing (TENS, UNITS switches) has been allocated to another call. The call should be released until the channel becomes idle.

2.05 Calls to Test Set. Calls may be made to the test set from a station telephone set, a trunk line, or from the attendant's console. The calls may be received over lines 295, 296, 297, 298, or 299.

a. To receive an incoming call, depress the LINE push button assigned to the line on which the call is to be received. The incoming call is visually indicated by the LINE lamp flashing and the appropriate LOOP and RT lamps responding to the interrupted ringing.

b. To answer the call, operate the OFF-HOOK push button. The OFF-HOOK and the LINE lamps light. The associated LOOP and RT lamps extinguish.

c. To verify transmission, talk and listen using the two-wire station instrument or the hand test telephone.

d. To release the call, operate the ON-HOOK push button. The LINE lamp and the OFF-HOOK lamp extinguish. To release the LINE, momentarily operate the LINE RELEASE push button.

2.06 Register Selection. To test a specific register, proceed as follows:

a. Determine the channel number of the register to be tested from table 1.01, and set the UNITS and TENS switches to the channel number.

b. Depress the BUSY push button; the BUSY lamp lights.

c. Depress the BUSY push button; the BUSY lamp lights.

d. Operate the OFF-HOOK push button. The OFF-HOOK and the LINE lamps light. The test set should now be connected to the desired register. Dial tone is heard on the two-wire telephone set or the hand test telephone. The BUSY LED (light-emitting diode) on the front of the register board lights. After eight or 16 seconds (strapping option), the register times out and busy tone is heard. The BUSY LED on the register board extinguishes.

e. Terminate the call by operating the ON-HOOK push button. The LINE and the OFF-HOOK lamps extinguish.

f. Operate the LINE RELEASE push button to release the LINE push button.

2.07 Link Selection. To check a specific link, proceed as follows:

a. Determine the channel number of the link to be tested from table 1.01 and set the UNITS and TENS switches to the channel number.

b. Depress a LINE push button.

c. Depress the BUSY push button; the BUSY lamp lights.

d. Operate the OFF-HOOK push button. The OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

e. Dial the first two digits of a station telephone set using the rotary dial or Tel-Touch pad on the test set.

f. After dialing the second digit, operate the BUSY push button.

g. Dial the third digit. The BUSY LED of the selected link (on the link board) lights.

h. The call to the dialed station is completed in the normal manner.

i. Terminate the call by operating the ON-HOOK push button. The LINE and OFF-HOOK lamps extinguish. The BUSY LED on the link board also extinguishes.

j. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

2.08 Trunk Selection. When it is desired to check a specific trunk, proceed as follows:

a. Determine the channel number from table 1.01 and set the UNITS and TENS switches to correspond to the channel number.

b. Depress a LINE push button.

c. Operate the OFF-HOOK push button. The OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

d. Operate the BUSY push button.

e. Dial the digit(s) to access the selected trunk (use the rotary dial or Tel-Touch pad on the test set panel.)

f. The BUSY LED on the selected trunk board lights.

g. A test call over the trunk may now be completed to test the transmission.

h. Terminate the call by operating the ON-HOOK push button. The LINE and OFF-HOOK lamps extinguish. The BUSY LED on the trunk board extinguishes.

i. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

REGISTER
(TD-4103437-ISS. A)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION

1.01 General. Each TD-100 EPABX is provided with four registers. Each register has as its function the acceptance of dialed information from the originating circuit. Registers accept dial pulses and, with the addition of an optional TEL-TOUCH® receiver, will accept multifrequency (MF) signals. Each register will accept and translate up to three digits to a binary code for presentation to the processor. Also transmitted is the register's identity and status; that is whether it is idle, busy or seized. Each register is equipped with a time-out feature that causes the calling line to be placed on lock-out and the register to release if the first digit is not received within 8 or 16 seconds (depending on strapping) after the register is seized.

Registers are normally used in position 15 through position 18 of the channel subrack. They may be optionally used in position 10 through position 14 of the channel subrack.

Each register printed circuit board (PCB) is equipped with a busy switch to remove the unit from service, a light emitting diode (LED) indicator to show whether the register is idle, busy or seized, and a power-on LED indicator. Table 1.00 gives some register abbreviations and their explanations.

2.00 DETAILED OPERATION

2.01 General. Operation of the registers may be divided into five basic functions for consideration; seizure, receipt of dial signals, trunk call transfer, consultation hold, toll restriction and register release. The following paragraphs describe each section. Figure 1.00 is a simplified block diagram of a TD-100 register and may be consulted during each description.

2.02 Seizure. When a station goes off-hook, the processor looks at the status of each register and, if an idle register is found, the OHO (off-hook originator) instruction (logic 0) is sent from the processor to the register on the SI-2 lead. The seize instruction (logic 0) is sent on the SI-1 lead at the same time and is latched at the output of the latch circuitry. The busy LED (CR1) lights and the status-out is changed to "77." The processor applies dial tone to the originating station and if there is no digit dialed from the station within 8/16 seconds of the off-hook condition, through the counter U7, the register times out.

Through U34 and U27, the lock-out status, "75," of

TABLE 1.00 Register Terms

ABBREVIATION	MEANING
I-1	Identity
RXEN	Receive enable
RXT	Receive terminate
SCR	Scan channel read (send info to processor)
SCW	Scan channel write (accept info from processor)
SI-1	Seize
SI-2	Off-hook originator
SI-4	Free
SI-5	From trunk
SI-7	Reset
SI-8	Busy
SI-9	Trunk reset
SO-1 thru SO-4	Information to processor
SPR	Status pulse record
TO-1 thru TO-4	Terminate out (tens digit)
TO-5 thru TO-8	Terminate out (units digit)
TO-9 thru TO-12	Terminate out (hundreds digit)
1S	One-second clock
1 thru 6	Information from Tel-Touch receiver

the register is sent to the processor which applies a lock-out condition to the station. The register releases while the processor removes all requests to the register which returns to the idle state.

Signaling within the TD-100 is in binary coded hexadecimal form. Table 1.01 gives binary and hexadecimal equivalents.

2.03 Receipt of Dial Signals. If the register is seized and the first digit is dialed with 8/16 seconds of the off-hook condition, the dial pulses come to the register on the SI-2 leads and, through U25, U8, U6 and U23, go to U4, the digit counter. "Digit in" information is sent through U22 to U34 and through U27 to the processor as the new status, "7B," of the register. Dial tone is then removed from the originating station.

If the first digit dialed came from a Tel-Touch phone, then the digit passes through the Tel-Touch receiver to the register (two inverters of U1 and two nand gates of U12). U16, U15, and U3 comprise the interface circuitry between the Tel-Touch receiver and the register. The binary output from the Tel-Touch receiver interface is nor-gated with the outputs of the dialed digit counter, U4, to send the first digit out to the processor on leads TO-9 through TO-12.

From the Tel-Touch receiver interface, the first "digit in" information is also sent out on the status-out leads through U23, U13, U22, U34, and U27. For the second digit from a Tel-Touch or rotary dial phone, a similar operation occurs except that U22 is clocked a second time and U19 is enabled to send the digit out on the TO-1 through TO-4 leads to the processor.

Timing circuitry, consisting of U8, U6, and associated components, determines the minimum inter-digital time (approximately 100-150 milliseconds). Each time a digit comes into the register, the time-out counter, U7, is reset. The status-out to the processor is sent from U27 to keep the processor informed about the "digit in" state of the register. When the second digit is in, the processor looks to see if it is strapped for two such digits (example 91, 92, etc.), indicating a request for special service. If the processor is strapped for the first two digits, it then performs the necessary operation according to the strapping by allotting a suitable time slot to the originating circuit and passing the necessary information from the "TO" leads to be stored in the memory.

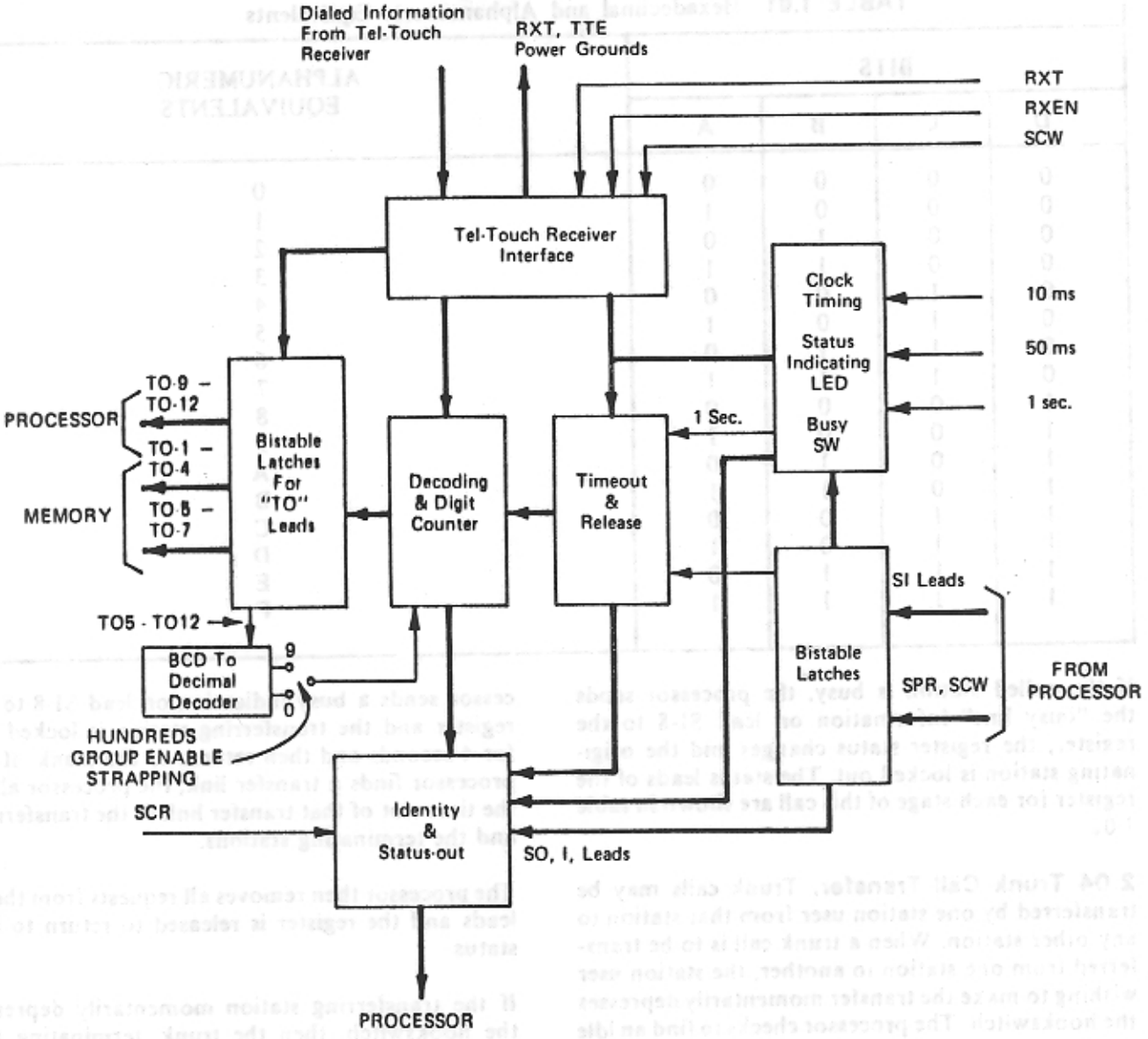

FIGURE 1.00 Register Block Diagram

If the processor does not find any strap for the first two digits indicating special service, then the processor recognizes a station number and the third digit is sent into the register in a similar manner as the first two, except that U22 is clocked again and the third digit is sent out on leads TO-5 through TO-8 to the memory through latch U20 and the surrounding circuitry. After the third digit is in, the processor checks the "free or busy" status of the terminating line circuit. If the terminating station is free, the processor sends a free indication on lead SI-4 to the register. Through U33, U17, U34, and U27, the new status of the register is sent out to the processor which allots a suitable time slot (e.g., the time slot of a free link) to the originator and terminator. After this transfer, the processor removes all input requests from the SI leads and the register returns to the idle status.

If the terminating station is idle, but the processor cannot find a free link, it removes all input requests from the SI leads and releases the register. The originating station is then locked out.

TABLE 1.01 Hexadecimal and Alphanumeric Equivalents

BITS				ALPHANUMERIC EQUIVALENTS
D	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

If the called station is busy, the processor sends the "busy line" information on lead SI-8 to the register, the register status changes and the originating station is locked out. The status leads of the register for each stage of this call are shown in table 1.02.

2.04 Trunk Call Transfer. Trunk calls may be transferred by one station user from that station to any other station. When a trunk call is to be transferred from one station to another, the station user wishing to make the transfer momentarily depresses the hookswitch. The processor checks to find an idle register and sends SI-1, SI-2, and SI-5 signals to the register. Transfer dial tone, status-out "76," is applied to the station that put the trunk on hold.

The transferring station user dials the number and the processor removes dial tone, status-out "7A," from the transferring station and puts the pulses on lead SI-2. If the dialed station is busy, the processor applies a busy indication on lead SI-8 to the register and the transferring station is locked out and returns to the trunk after 4 seconds. If the terminating station is not busy, the processor sends the free line indication on lead SI-4 and looks for a transfer link. If all transfer links are busy, the processor sends a busy indication on lead SI-8 to the register and the transferring station is locked out for 4 seconds and then returns to the trunk. If the processor finds a transfer link, the processor allots the time slot of that transfer link to the transferring and the terminating stations.

The processor then removes all requests from the SI leads and the register is released to return to idle status.

If the transferring station momentarily depresses the hookswitch, then the trunk, terminating and transferring stations are all connected through the add-on link and the transfer link is released. If one of the stations goes on-hook, the remaining station is connected to the trunk on the trunk's time slot and the add-on link is released. If the add-on link is busy when a station tries to add on, the transferring station returns to the trunk and the register releases. The status leads of the register for each stage of this call are shown in table 1.03.

2.05 Consultation Hold. Trunk calls may be put on permanent hold by the station user momentarily depressing the hookswitch and dialing the consultation hold code. On receipt of this signal, the processor sends SI-1, SI-2, and SI-5 signals to the reg-

TABLE 1.02 Register Status Leads* (when seized by station)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Idle	1	1	1	1	1	1	1	1	1	1	1
Seized from a station	0	0	1	1	1	1	1				
Dial tone to station								0	1	1	1
Station dials	0	0	1	1	1	1	1				
Digit in, dial tone removed								1	0	1	1
End of dialing, line idle	0	0	0	1	1	1	1				
Transfer to link								0	0	1	1
End of dialing, line busy	0	0	1	1	1	0	1				
Apply lock out to station								0	1	0	1
Call terminated (on hook, time out, ETC)	0	1	1	1	1	1	1				
Register released								0	0	0	1
Idle	1	1	1	1	1	1	1	1	1	1	1

* The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

TABLE 1.03 Register Status Leads* (when seized via station by a trunk)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Seized via station by a trunk	0	0	1	0	1	1	1				
Apply transfer dial tone								0	1	1	0
Station dials, trunk waiting	0	0	1	0	1	1	1				
Digit in, dial tone removed								1	0	1	0
End of dialing line idle	0	0	0	0	1	1	1				
Transfer to line								0	0	1	0
End of dialing line busy	0	0	1	0	1	0	1				
Apply lock out to station								0	1	0	0
Call terminated (on hook, time out, ETC)	0	1	1	0	1	1	1				
Register released								0	0	0	0
Idle	1	1	1	1	1	1	1	1	1	1	1

*The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

ister as in the case of a transfer. After the consultation hold code is sent into the register, the processor recognizes the code and sends an SI-7 signal to reset the register and removes the SI-5 signal. The station user can then accomplish station-to-station, station-to-trunk, or any other call as if there were no trunk waiting. The station will not return to the trunk until the re-access code to the trunk is dialed from the station.

2.06 Toll Restriction. If a trunk number is dialed from a station not toll restricted, then the requested trunk time slot is allotted to the originating line and the register is released. If an originating station is toll restricted and dials a toll trunk number, the processor checks the restriction; SI-1 and SI-2 signals sent originally to the register are followed by SI-9 and SI-5 signals. If a code disallowed by the COS toll restrictor is dialed, the processor removes all SI inputs, releases the register and sends a lockout tone to the originating station. If the dialed code was an allowed code, then the processor sends an SI-7 signal which resets the register to accept more digits and the requested trunk is seized.

The toll restrictor feature board places restrictions on digits dialed following the access code. When the next digit is dialed, it is sent to the processor on leads TO-9 through TO-12; when the processor recognizes the digit as an allowed digit, it sends an SI-7 signal to the register. The register is then reset to accept the next digit on leads TO-9 through TO-12. After every digit, an SI-7 signal is sent to reset the register and each succeeding digit is sent on the TO-9 through TO-12 leads until the trunk's slot is allotted to the originating station. The register is then released and returns to the idle state.

Ordinary COS toll restriction is dealt with by the processor differently from the toll restrictor feature board in that the SI-7 signal is only sent to the register once to reset it. The next digits are sent in exactly the same manner as an ordinary call from a station. The register would take up to three digits in to put the three digits on the TO-9 through TO-12 leads for the first, TO-1 through TO-4 leads for the second, and the TO-5 through TO-8 leads for third digit. The status leads of the register for each stage of this call are shown in table 1.04.

2.07 Register Release. If a station goes on-hook after being off-hook for less than 8/16 seconds, goes on-hook after dialing an incomplete number, or goes on-hook after dialing a complete code or number but before the register is reset, then U24 and its associated circuitry releases the register while the processor takes off all input requests from the SI leads. The register sends out a terminate status of "70," "71" or "7E" depending upon whether the register was seized by a trunk via a station, or seized by a toll restricted station. The register release could be due to an on-hook, inter-digit time-out, or register time-out.

2.08 Strapping. Full strapping information for the register PCB is available in OB-410-343, entitled Feature Strapping, TD-100 Register.

TABLE 1.04 Register Status Leads* (when seized by toll-restricted station)

CONDITION OF REGISTER	STATUS IN LEADS							STATUS OUT LEADS			
	SI-1	SI-2	SI-4	SI-5	SI-7	SI-8	SI-9	SO-1	SO-2	SO-3	SO-4
Seized by Toll Restricted Station	0	0	1	1	1	1	1				
Dial tone to station								0	1	1	1
Station dials	0	0	1	1	1	1	1				
Digit in, dial tone removed								1	0	1	1
End of code dialing, toll restriction checked	0	0	1	0	0	1	0				
Dialed circuit seized (trk) register reset								1	0	0	0
First digit in (SI-7 only for T.R. Feature BD after every digit in)	0	0	1	0	0	1	0				
Register reset (only when T.R. Feature BD in)								1	0	0	0
Final digit in (only when T.R. Feature BD in)	0	0	1	0	0	1	0				
Register reset (only when T.R. Feature BD in)								1	0	0	0
Terminate toll restriction	0	0	1	0	1	1	1				
Register released								1	1	1	0
Off hook removed	0	1	1	0	1	1	1				
Idle	1	1	1	1	1	1	1	1	1	1	1

*The identity of the register remains 7; I-1 = 0, I-2 = 1, I-3 = 1, I-4 = 1.

TO: USERS OF THIS MANUAL

This manual contains information concerning TD-100 maintenance. It includes all documents prefixed by the letters OC. A summary of the documents follows:

OC-000-001, GENERAL MAINTENANCE INFORMATION. Contains test procedures for checking system operation after cutover.

OC-000-002, ACCESS TEST SET. Describes the TD-100 access test set and gives instructions for using the test set.

OC-000-003, CONSOLE MAINTENANCE.

Console Assembly Numbers. . . . . .table 1.00
Functions of Controls and Indicators . . . . . .table 1.01
Replacement Parts List. . . . . .table 1.02 and 1.03
Procedures for Changing Keys, Lamps, etc.. . . . . .paragraphs 6.00 and 7.00
Pin Assignments – Console Cables . . . . . .table 1.04
Console Explosion Drawing. . . . . .figures 1.03 and 1.04

OC-000-004, MAINTENANCE GUIDE. Contains system trouble shooting ideas. Included are tables which list PCBs which may be responsible for particular types of system, console, or station failures.

OC-000-005, TROUBLE ANALYSIS GUIDE. This section serves as a trouble-shooting guide for the TD-100 EPABX. Appendix A is a series of detailed flow charts describing the operation of involved circuitry in various call sequences.
Notable items include,

Physical Layout and Theory of Operation . . . . . .paragraph 2.00
Flow Chart Interpretation. . . . . .paragraph 3.00
Analyzing and Isolating Troubles . . . . . .paragraph 4.00

OC-000-006, POWER SUPPLY MAINTENANCE TEST PROCEDURES. This section serves as a test and replacement procedure for the power supply and power supply control box for the TD-100 EPABX.
Notable items include,

Power Supply Testing and Replacement. . . . . .paragraph 2.00
Power Supply Control Box Testing and Replacement . . . . . .paragraph 3.00

OC-000-007, TD-100 PCB COMPATIBILITY. This section provides compatibility data for all TD-100 PCBs currently in use. It serves as a cross-reference between schematic and assembly generation numbers, lists the minimum recommended issue of each PCB, and explains all known areas of PCB and feature incompatibility.

OC-000-008, USING THE DATA MONITOR TEST SET. This section describes the testing capabilities and use of the data monitor test set. Notable items include,

Functions of Indicators and Controls . . . . . .paragraph 3.00
Operating Procedures. . . . . .paragraph 4.00
PROM Programming Data . . . . . .table 1.01

GENERAL MAINTENANCE INFORMATION
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides general maintenance information for the TD-100 Electronic Private Automatic Branch Exchange (EPABX).

1.02 Purpose of Equipment. The TD-100 EPABX is an electronic switching system suitable for private automatic exchange or private automatic branch exchange service. It is designed for use in installations where many extensions require the use of trunk circuits as well as local service. Any extension, with the appropriate class of service, can use the various special features.

1.03 System Subassemblies. The EPABX has a maximum capacity of 100 lines, 12 local links, and 24 trunks; it will provide many features, some integral and others optional. The maximum trunk capacity is 24, however, up to 10 of these may be substituted with tie trunks. For detailed descriptions of the functions performed by each subassembly, refer to Section OA-000-001, General Information, TD-100 EPABX.

The cabinet is shipped completely prewired; connections to external equipment, such as station telephone set lines and trunk lines, are made via plug-in cables at the cabinet.

The cabinet is equipped with three printed circuit board subracks. All features and services of the system are of the plug-in type. Thus, basic system requirements can be met at the time of the initial installation, and service may be expanded when required.

The plug-in boards fit into guides on a subrack and have connectors to mate to a motherboard at the rear of the subrack. Each board is equipped with two extractors, which are used when moving a board.

Circuit boards occupying time slots (trunks, links, registers, etc.) have BUSY switches located at the front of the board to busy-out the circuit, when required. In addition to power-on LED (light emitting diode) indicators, boards other than the common control circuitry have circuit busy LED's at the front of the boards. A lit LED indicates the circuit (line, trunk, register, etc.) is busy. Boards which have several strapping options available, such as the class of service and vacant number intercept board, must have the strapping done at the time of installation. Refer to the applicable strapping documents section for strapping required for the system features.

The system power supply is located at the bottom of the cabinet and requires 115V AC, 60 HZ source for operation.

1.04 Documents and Drawings. All drawings applicable to this section are listed in table 1.00.

2.00 MAINTENANCE AIDS

2.01 Console Indicators. Indicators provided on the console are MAJ ALM (major alarm), MIN ALM (minor alarm), PWR ON (power on), and STB PWR (standby power). These indicators provide an indication of system status to the attendant. Any minor alarm or major alarm is immediately displayed to the attendant.

> NOTE: A major alarm is caused by a failure which makes the system inoperative. Power failure transfer will occur with a major alarm. A minor alarm is caused by a deterioration in system operation that is not a complete system failure.

2.02 Alarm Panel. The TD-100 is equipped with an alarm panel mounted on a PCB and used in the extreme left position in the top subrack. Each alarm panel contains indicators and controls for fault identification. Alarm indicators are divided into two categories; major and minor, as explained in the preceding paragraph. For detailed information on the operation of the alarm board, see the alarm board narrative, ITT practice OL-410-178.

2.03 Maintenance Features. Some maintenance features deserving special attention by maintenance personnel are listed in the following paragraphs.

a. Boards may be removed or inserted without turning down power to the system.

b. Light emitting diodes (LED'S) are provided on most boards to indicate status of the circuit (idle, in-service busy, or made busy).

c. Switches are provided on circuit boards that occupy time slots (trunk, register, etc.) to make them busy. Removal of a board will also render the respective channel busy.

d. The POWER switch, a POWER-ON indicator, and a RESET push button are located at the lower right side of the cabinet.

2.04 Test Considerations. The following considerations apply to the tests in this section.

a. Tests in this section should be performed during the lightest possible traffic periods.

b. If possible, the EPABX station telephones used in the following tests should be located near the TD-100 console or equipment cabinet for convenience and test verification.

c. For these tests, all station telephone sets and interconnecting cables should be in good working condition.

d. Many of the tests in this section refer to the use of a headset at the console. This is for convenience only; either a headset or handset may be used.

e. In some of the tests, it is necessary to make calls into the EPABX from a distant office. When necessary, these test calls can be made by seizing an outgoing trunk and then dialing the EPABX listed number or the desired station number. If this alternative procedure is used, the same outgoing trunk should be used to perform successive tests over different incoming trunks.

2.05 Access Test Set. The access test set is an optional feature of the TD-100 EPABX. The access test set permits maintenance personnel to perform system tests from the front of the TD-100 cabinet. In performing such tests, the test set operator may choose any one of lines 295 through 299. When a line is selected at the test set, the station telephone set on that line is automatically disconnected from the system. When the test set is not being used, the station telephone sets on lines 295-299 will be connected to the system in the normal manner. For detailed operating procedures, refer to Section OC-000-002, Access Test Set.

2.06 Data Monitor Test Set. The data monitor test set is an optional feature of the TD-100 EPABX. This test set is a single plug-in PCB used in the dictation 2 position of the channel subrack. It is used to monitor the flow of data to and from the system processors. The data monitor test set may also be used to direct and respond to processor action. For detailed operating instructions, refer to Section OC-000-008, Using the Data Monitor Test Set.

3.00 ROUTINE MAINTENANCE TESTS

3.01 General. System maintenance should, for the most part, be limited to periodic inspections and cleaning, with special emphasis placed on cleaning the filters in the equipment cabinet. Instructions for cleaning the filters and step-by-step procedures for performing a variety of routine maintenance tests are provided in the following paragraphs.

Time tables for scheduling the necessary inspections and cleaning routines are not provided in this document, as such a schedule can best be determined by the operating company, taking into account environmental conditions such as humidity, dust, and temperature.

3.02 Cleaning Air Filters. It is imperative that the air filters in the TD-100 equipment cabinet be kept clean at all times. Clogged or dirty filters could result in damage to the equipment in the cabinet. Air filters are located on the inside of the front and rear cabinet panels and are removed and cleaned as follows:

a. Remove the front and rear cabinet panels.

b. Remove the two screws and flat washers that secure the front filter to the rear of the front door.

c. Slide the filter toward the side of the door and lift the filter up and out of the filter mounting slot.

d. Remove the front cabinet panel filter, then repeat steps a, b, and c to remove the rear cabinet panel filter.

e. Vacuum or wash the filters thoroughly. If the filters are disposable, discard them after making certain that replacements are available.

f. Reinstall the filters, taking care to center each over the door grill, and to properly replace the two screws and washers.

CAUTION: If the filters are washed, make certain they are thoroughly dry before they are reinstalled.

3.03 Timed Recall Test. The timed recall test, table 1.01, verifies that all trunks will recall the attendant in approximately 30 seconds if a called station is not answered.

3.04 Trunk Access Test. This test, table 1.02, verifies that all outgoing calls (per strapping in processor 2) will be routed to reorder tone when the TRUNK ACCESS switch on the console is set to the ATT position.

3.05 Manual Power Failure Transfer Test. This test, table 1.03, verifies that the console and all stations connected to the power failure transfer board will be put into the power failure transfer mode of operation when the POWER FAILURE TRANSFER switch on the console is set to the ON position.

3.06 Unassigned Night Answer (UNA) Test. To test the unassigned night answer feature, perform all steps in table 1.04. This test verifies that the TD-100 system will sound an audible signal to alert all personnel of an incoming call when the NIGHT switch on the console is set to the ON position. When the signal is heard, any unrestricted station must be able to answer the call by dialing the UNA answer code.

3.07 Tie Trunk Test. Perform all steps in table 1.05 to verify one-way or two-way operation of the tie trunks.

3.08 DID Trunk Tests. The DID tests, table 1.06, verify correct operation of all features of the DID trunk.

3.09 Trunk Reservation Test. This test, table 1.07, verifies that all trunks which have been strapped for trunk reservation will provide only incoming service when the TK RES ON push button has been depressed at the console.

3.10 Camp-on-Busy Test. The camp-on-busy test, table 1.08, verifies that all trunks will camp on a busy station and provide correct indications to the busy stations and the calling party.

3.11 Assigned Night Answer (ANA) Test. Perform all steps in table 1.09 to verify all stations assigned to night answer service receive incoming calls in the order they are assigned.

3.12 Class of Service and Vacant Number Intercept Test. This test, table 1.01, verifies that class of service strapping is correct and that stations are denied or allowed access to the assigned system services.

3.13 Alarms Test. The alarms test verifies correct operation of the switches and LED's on the alarm panel board. Refer to table 1.11 for detailed procedures to be followed.

3.14 Station Hunting Test. This test, table 1.12, verifies that the stations strapped at the station hunting board will be hunted in the sequence in which they are strapped.

3.15 Music On Hold Test. Perform all steps in table 1.13 to verify that all trunks will provide music to the distant office party when a call is placed on hold.

3.16 Automatic Recall Test. Test all incoming trunks, and where applicable, all outgoing-only trunks for automatic recall. A step-by-step procedure for testing this feature is provided in table 1.14.

3.17 Register Test. Perform the steps outlined in table 1.15 to verify proper operation of the registers. This test is arranged to check register time-out and the ability of a register to recognize dial pulses and/or TEL-TOUCH® tones.

3.18 Local Link Test. Test each local link as described in table 1.16.

3.19 Transfer and Add-on Link Test. Perform the steps outlined in table 1.17 to test each transfer and add-on link. This procedure is arranged to verify system consultation, transfer, and add-on conference features.

3.20 Conference Network and Link Test. Perform the steps outlined in table 1.18 to check operation of the conference network and conference links. The table provides procedures for checking the station and attendant controlled conference as well as the meet-me conference features.

3.21 DOD Trunk Test. Check the operation of the direct outward dial (DOD) trunks as described in table 1.19.

3.22 Dictation Access Test. Perform the steps in table 1.20 to verify proper operation of dictation access equipment.

3.23 Call Forward - Follow Me Test. Test the operation of the call forward - follow me feature per table 1.21.

3.24 Private Line (KTU) Test. Test each key telephone arranged for private line service as outlined in table 1.22.

3.25 Paging Circuit Test. Test the paging circuit as described in table 1.23.

3.26 Manual Intercom Test. Test all manual intercom circuits as outlined in table 1.24.

3.27 Executive Access Trunk Test. Perform the steps in table 1.25 to verify the operation of the executive access trunk.

3.28 CO to CO Conection Test. The steps in table 1.26 verify that the attendant can connect two trunks to the CO to CO connection.

3.29 Busy Trunk Call Back Test. Perform the steps in table 1.27 to verify the operation of the busy trunk call back equipment.

3.30 Busy Line Call Back Test. Perform the steps in table 1.28 to verify the operation of the busy line call back equipment.

4.00 REPAIR OF PRINTED CIRCUIT BOARDS

4.01 General. In general, field repair of the TD-100, plug-in cards or printed circuit boards (PCB's) is not recommended. In the event of a card failure, the card should be replaced and the faulty card returned to the factory for repair. Cards to be returned should be properly packed and then mailed to the following address, as applicable.

In USA:

Customer Repair Service
ITT Telecommunications
Telecom Drive
Milan, Tennessee 38358
Telephone: (901) 686-0307

In Canada:

Customer Service Department
ITT Telecommunications
175 Dawson Road
Guelph, Ontario N1H 1A1
Telephone: (519) 821-2000

TABLE 1.00 Documents and Drawings

TITLE	NUMBER
General Information	OA-000-001
General Installation	OB-000-001
Cabinet and Apparatus Installation	OB-000-002
Console Installation	OB-000-004
Cable Connections at Cross Connect Terminals	OB-000-005
Cabinet Tests and Inspections	OB-000-006
Console Operation Tests	OB-000-007
Station Operation Tests	OB-000-008
Feature Strapping	OB-410-XXX
General Maintenance	OC-000-001
Access Test Set	OC-000-002
Console Maintenance	OC-000-003
Maintenance Guide	OC-000-004
Trouble Analysis and PCB Replacement Guide	OC-000-005
Maintenance Flow Charts	OC-000-005, App. A
Power Supply Maintenance	OC-000-006
System Compatibility	OC-000-007
Using the Data Monitor Test Set	OC-000-008
Station User's Guide	OG-000-001
Console Operating Instructions	OG-000-002
Station User's Instruction Card	OG-000-003
Circuit Narratives	OL-410-XXX
Narrative Index	OL-401-601
Introduction to Narratives	OL-401-602
	CIRCUIT
Trunk Motherboard	TD-4101507
Line Circuit	TD-4101517
Attendant Line and Control	TD-4101527
CO Trunk	TD-4101537
Feature #2	TD-4101547
Assigned Night Answer	TD-4101557
Line Motherboard	TD-4101567
Conference Network	TD-4101577
Power Failure Transfer	TD-4101587
Common Services	TD-4101597
Class of Service and Vacant Number Intercept	TD-4101607
Memory	TD-4101617
Processor 1	TD-4101627
Processor 2	TD-4101637
Tie Trunk, Loop	TD-4101647
Station Hunt	TD-4101657

TABLE 1.00 Documents and Drawings (Cont.)

TITLE	NUMBER
	CIRCUIT
Register	TD-4101667
Tel-Touch Receiver	TD-4101677
Link (Conference and Local)	TD-4101687
Attendant Register and Links	TD-4101697
Transfer and Add-On Link	TD-4101707
Channel Motherboard	TD-4101717
Tie Trunk, E & M	TD-4101727
Power Supply Control Box	TD-4101767
DID Trunk	TD-4101777
Alarm Board	TD-4101787
Power Failure Transfer Extender	TD-4101797
Line Card Extender	TD-4101807
Trunk Card Extender	TD-4101817
Highway Amplifier	TD-4101857
Access Test Set (Early)	TD-4101867
Private Line and Manual Intercom	TD-4101917
Paging Access	TD-4101927
Dictation Access	TD-4101937
Data Monitor Test Set	TD-4102077
Call Forward Follow Me	TD-4102247
AIOD	TD-4102257
Message Register 1A	TD-4102267
Message Register 1B	TD-4102277
Toll Restrictor	TD-4102287
Quad Transfer/Add-On Link	TD-4102587
Number Translator	TD-4102947
Recorder Disconnect	TD-4102957
Busy Line/Trunk Call Back	TD-4102967
Call Forward Follow Me, BL, DA	TD-4103087
Dial/Directed Call Pickup	TD-4103117
Access Test Set (Late)	TD-4103207
Feature #3	TD-4103227
CO Trunk (LPS)	TD-4103257
2-Way Loop DID Trunk	TD-4103267
2-Way E & M DID Trunk	TD-4103277
Executive Access Trunk	TD-4103347
Translator, 2-Way DID Trunk	TD-4103457
Wiring Schematic	TD-4103507
Combined 2-Way DID Trunk and Number Translator	TD-4103547
ANA	TD-4104047
Dial/Directed Call Pickup	TD-4104307
North Electric Power Supply	TD-4200340
Powermate Power Supply	TD-4200341
Export Power Supply	TD-4200419
Attendant Console	316619( )68
Message Waiting Console	316623( )68

TABLE 1.01 Timed Recall Test

STEP	ACTION	VERIFICATION
1.	At the distant office, seize the desired trunk and dial the digits to access the TD-100 console.	The trunk push button at the console flashes and an audible signal is heard.
2.	Momentarily depress the flashing push button.	The audible signal stops. The trunk push button and associated lamp light. The transmission level is satisfactory.
3.	Momentarily depress the ATT LINE push button.	The ATT LINE push button lights, the trunk push button winks, and dial tone is heard in headset.
4.	Dial the number of an EPABX test station and momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights and the station rings. The distant office receives ringback tone. In approximately 30 seconds, the trunk push button and associated lamp will start flashing to indicate timed recall.
5.	Momentarily depress the flashing push button.	The trunk push button and associated lamp light. The distant office is reconnected to the console.
6.	Release the trunk at the distant office and momentarily depress the RELEASE bar at the console.	The trunk push button and associated lamp extinguish. The call is terminated.
7.	Repeat steps 1 through 6 for each trunk to be tested.	Same as steps 1 through 6.

TABLE 1.02 Trunk Access Test

STEP	ACTION	VERIFICATION
1.	Set the TRUNK ACCESS switch to the ATT position.	–
2.	Go off-hook at an EPABX test station and dial the digit(s) to access an outgoing trunk group assigned to trunk access deny.	Reorder tone is heard at the station.
3.	Go on-hook at test station.	–
4.	Repeat steps 2 and 3 for all applicable outgoing trunk groups.	Same as steps 2 and 3.
5.	At the completion of the tests, set the TRUNK ACCESS switch to the DIAL position.	–

TABLE 1.03 Manual Power Failure Transfer Test

STEP	ACTION	VERIFICATION
1.	Set the POWER FAILURE TRANSFER switch on the bottom of the console to the ON position.	The MAJ ALM lamp on the console lights.
2.	Go off-hook at an EPABX station that has been assigned for power failure transfer service. If necessary, depress the grounding push button on the station instrument. NOTE: Operation of the grounding push button is required if the assigned trunk is arranged for ground start.	CO dial tone is heard.
3.	Dial the number of a distant office test station.	Ringback tone is heard, followed by answer of the call at the distant office. The transmission level is satisfactory.
4.	Set the POWER FAILURE TRANSFER switch to the OFF position.	The transmission level is still satisfactory. The MAJ ALM lamp extinguishes at the console.
5.	Go on-hook at the distant office and power failure transfer station.	The call is terminated.
6.	Repeat steps 1 - 5 for transfer circuits 1 - 9, if applicable.	Same as steps 1 - 5.
7.	Set the POWER FAILURE TRANSFER switch to the ON position.	The MAJ ALM lamp on the console lights.
8.	At the console, depress the TK RES ON push button. If the assigned trunk is arranged for ground start, momentarily depress the CONNECT bar.	CO dial tone is heard in the headset.
9.	Dial the number of a distant office test station.	Ringback tone is heard, followed by answer of the call at the distant office. The transmission level is satisfactory.
10.	Set the POWER FAILURE TRANSFER switch to the OFF position.	The transmission level is still satisfactory. The MAJ ALM lamp extinguishes at the console.
11.	Go on-hook at the distant office. Depress the TK RES OFF push button on the console.	The call is terminated.

TABLE 1.03 Manual Power Failure Transfer Test (Cont.)

STEP	ACTION	VERIFICATION
12.	If the console is equipped with an auxiliary ringer, perform steps 13 - 16. If not, go to step 17.	–
13.	Set the POWER FAILURE TRANSFER switch to the ON position.	The MAJ ALM lamp on the console lights.
14.	At the distant office, seize the power failure transfer trunk assigned to the console. Dial the digits required to access the TD-100 EPABX.	The auxiliary console ringer rings.
15.	Depress the TK RES ON push button.	Ringing stops and the transmission level is satisfactory.
16.	Depress the TK RES OFF push button and at the distant office, release the trunk.	The call is terminated.
17.	At the distant office, seize the trunk assigned to an EPABX station. Dial the digits required to access the TD-100 EPABX.	The assigned EPABX station starts ringing.
18.	Go off-hook at the ringing EPABX station.	Ringing stops and the transmission level is satisfactory.
19.	Go on-hook at the distant office and the EPABX station.	The call is terminated.
20.	Repeat steps 17 - 19 for all trunks assigned power failure transfer capabilities. (10 maximum)	Same as steps 17 - 19.
21.	At the completion of the tests, set the POWER FAILURE TRANSFER switch to the OFF position.	The MAJ ALM lamp extinguishes.
22.	Momentarily lift the receiver at each power failure transfer station and listen for dial tone.	EPABX dial tone is heard, indicating that the power failure transfer circuitry has returned to normal.

TABLE 1.04 Unassigned Night Answer (UNA) Test

STEP	ACTION	VERIFICATION
1.	Set the NIGHT switch on the console to the ON position.	–
2.	Go off-hook at distant office and dial the digits required for the TD-100 EPABX.	The common audible signal for UNA is heard.
3.	Go off-hook at an unrestricted station, and dial the UNA answer code.	The common audible signal stops and the transmission level between the station and the distant office is satisfactory.
4.	Release from the test call at the distant office and the test station.	–
5.	Return the NIGHT switch to the OFF position.	–

TABLE 1.05 Tie Trunk Test

STEP	ACTION	VERIFICATION
1.	At the distant PABX, seize the desired tie trunk and dial the digits to access the TD-100 console.	The trunk push button flashes and the audible signal is heard at the console.
2.	Momentarily depress the flashing trunk push button at the console.	The trunk push button and associated lamp light, and the audible signal stops. The transmission level between the distant PABX and the console is satisfactory.
3.	Momentarily depress the ATT LINE push button at the console.	The ATT LINE push button lights, the trunk push button winks, and dial tone is heard in the headset.
4.	Dial the number of an EPABX test station and momentarily depress the CONNECT bar.	The ATT LINE push button and the lamp associated with the trunk extinguish. The trunk push button lights, and the test station rings. The distant PABX receives ringback tone.
5.	Go off-hook at the TD-100 station.	Ringing and ringback tone stop. The transmission level is satisfactory.
6.	Release the trunk at the distant PABX. Go on-hook at the test station. NOTE: If the tie trunk is not strapped for incoming dial operation, disregard steps 7 through 13.	The trunk push button extinguishes and the tie trunk releases.
7.	At the distant PABX, seize the tie trunk and dial the digits to access a TD-100 test station.	The trunk push button on the TD-100 console lights. The test station rings and the distant PABX receives ringback tone.
8.	Go off-hook at the test station.	Ringing and ringback tone stop. The transmission level is satisfactory.
9.	Release the trunk at the distant PABX. Go on-hook at the test station.	The trunk push button extinguishes and the tie trunk releases.
10.	Make all registers busy.	The busy LED lights on each register board.

TABLE 1.05 Tie Trunk Test (Cont.)

STEP	ACTION	VERIFICATION
11.	At the distant PABX, seize the tie trunk and dial the digits to access a TD-100 test station.	The trunk push button on the TD-100 console lights. In approximately 4.7 seconds, reorder tone is heard at the distant PABX, or the trunk push button and associated lamp on the console flash.
12.	At the distant PABX, release the tie trunk.	The trunk push button and associated lamp extinguish. The tie trunk releases.
13.	Restore all registers to service.	The busy LED extinguishes on each register board.
14.	Seize the tie trunk from an EPABX test station.	The trunk push button on the console lights. The distant PABX returns dial tone, if applicable.
15.	Dial the number of a station in the distant PABX.	Ringback tone is heard at the EPABX test station, followed by answer of the call at the distant PABX. The transmission level is satisfactory.
16.	At the distant PABX, go on-hook.	In 8, 16, or 32 seconds (depending on the option strapping), the trunk push button extinguishes and reorder tone is heard at the TD-100 test station.
17.	Go on-hook at the TD-100 station.	—
18.	At the distant PABX, seize the tie trunk.	The trunk push button on console lights and TD-100 dial tone is heard at the distant PABX.
19.	Dial the TD-100 CO trunk access code.	The associated trunk push button lights and CO dial tone is heard at the distant PABX.
20.	Dial the number of a central office test station.	At the distant PABX, ringback tone is heard, followed by answer of the call at the central office.

TABLE 1.05 Tie Trunk Test (Cont)

STEP	ACTION	VERIFICATION
21.	Go on-hook at the distant PABX and central office test stations.	At the TD-100 console, the tie trunk and CO trunk push buttons extinguish. The call is terminated.
22.	Repeat steps 1 - 21 for each applicable tie trunk.	Same as steps 1 - 21.

TABLE 1.06 DID Trunk Tests

STEP	ACTION	VERIFICATION
1.	At the distant office, seize the selected DID trunk and dial the number of EPABX test station A.	The trunk push button on the TD-100 console lights and test station A rings. The distant office receives ringback tone.
2.	Go off-hook at station A.	The transmission level is satisfactory.
3.	Release the trunk at the distant office and go on-hook at test station A.	The trunk push button extinguishes. The call is terminated.
4.	At the distant office, seize the DID trunk and dial the number of TD-100 test station A.	The trunk push button on the console lights and test station A rings. The distant office receives ringback tone. In approximately 30 seconds, the trunk push button and associated lamp flash indicating timed recall. Station A stops ringing.
5.	At the console, momentarily depress the flashing trunk push button.	The trunk push button and associated lamp light. The transmission level is satisfactory.
6.	Establish a call between TD-100 test stations A and B.	–
7.	Momentarily depress the ATT LINE push button at the console.	The ATT LINE push button lights and the trunk push button winks. Dial tone is heard in the headset.
8.	Dial the number of test station A, then momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights and the distant office receives music if music on hold is provided. Test stations A and B hear camp-on tone.
9.	Go on-hook at both test stations.	Station A rings and the distant office hears ringback tone.
10.	Go off-hook at station A.	Ringing and ringback tone stop. The transmission level is satisfactory between the distant office and station A.

TABLE 1.06 DID Trunk Test (Cont.)

STEP	ACTION	VERIFICATION
1.	If the trunk is not arranged for automatic recall, go on-hook at station A and release the trunk at the distant office. Omit steps 12 - 14.	The trunk push button extinguishes and the call is terminated.
2.	If the trunk is arranged for automatic recall, go on hook at station A.	In approximately eight seconds, the trunk push button and associated lamp flash.
3.	Momentarily depress the flashing trunk push button.	The trunk push button and associated lamp light. The transmission level between the distant office and the console is satisfactory.
4.	Release the trunk at the distant office and momentarily depress the RELEASE bar at the console.	The trunk push button and associated lamp extinguish and the call is terminated.
15.	If the DID trunk is strapped to route calls to busy stations to the console, omit steps 16 - 18 and test the trunk per steps 19 - 26.	–
16.	Go off hook at TD-100 test station A.	–
17.	At the distant office, seize the DID trunk and dial the number of test station A.	The trunk push button on the console lights and busy tone is heard at the distant office.
18.	Go on hook at test station A and release the DID trunk at the distant office.	The trunk push button extinguishes and the call is terminated. Go to step 27.
19.	Go off hook at test station A.	–
20.	At the distant office, seize the DID trunk and dial the number of test station A.	The trunk push button lights; after a short time, the trunk push button and associated lamp flash. Ringback tone is received at the distant office.
21.	Momentarily depress the flashing trunk push button.	The trunk push button and associated lamp light. The transmission level between the distant office and the console is satisfactory.
22.	Release the trunk at the distant office and momentarily depress the RELEASE bar on the console.	The trunk push button and associated lamp extinguish. The call is terminated.

TABLE 1.06 DID Trunk Tests (Cont.)

STEP	ACTION	VERIFICATION
23.	Place the NIGHT switch on the console in the ON position.	–
24.	At the distant office seize the DID trunk and dial the number of test station A.	The trunk push button on the console lights and the distant office receives busy tone.
25.	Release the DID trunk and go on-hook at test station A.	The trunk push button extinguishes and the call is terminated.
26.	Place the NIGHT switch on the console in the OFF position.	–
27.	At the distant office, seize the DID trunk and dial the number of EPABX test station A.	The trunk push button on console lights and test station A rings. The distant office receives ringback tone. In approximately 30 seconds, the trunk push button and associated lamp flash. Station A stops ringing.
28.	Momentarily depress the flashing trunk push button.	The trunk push button and associated lamp light. The transmission level is satisfactory.
29.	Momentarily depress the HOLD push button.	The trunk push button winks. The distant office receives music, if music on hold is provided.
30.	Momentarily depress the RELEASE bar.	No change.
31.	Momentarily depress the CONNECT bar.	The trunk lamp extinguishes.
32.	Momentarily depress the trunk push button.	The trunk push button and associated lamp light. The transmission level between the console and the distant office is satisfactory.
33.	Release the trunk at the distant office and momentarily depress the RELEASE bar at the console.	The trunk push button and associated lamp extinguish. The call is terminated.

TABLE 1.06 DID Trunk Tests (Cont.)

STEP	ACTION	VERIFICATION
34.	If the DID trunk is strapped to route calls directly to the TD-100 console, perform steps 35 - 37. If not, go to step 38.	–
35.	At the distant office, seize the DID trunk and dial the number to access the TD-100 console.	The trunk push button flashes and the audible signal sounds. The distant office receives ringback tone.
36.	Momentarily depress the flashing trunk push button.	The trunk push button and associated lamp light, and the audible signal stops. The transmission level between the console and the distant office is satisfactory.
37.	Release the trunk at the distant office and momentarily depress the RELEASE bar on the console.	The trunk push button and associated lamp extinguish. The call is terminated.
38.	If 2-way DID trunks are equipped, perform steps 39 - 45. If 1-way DID trunks are equipped, go to step 46.	–
39.	Make all the TD-100 registers busy.	The busy LED on each register board lights.
40.	At the distant office, seize the DID trunk.	In approximately ½ second, reorder tone is heard. The trunk push button on the console lights.
41.	Release the trunk at the distant office.	The trunk push button extinguishes.
42.	Restore all registers to service.	The busy LED on each register board extinguishes.
43.	At TD-100 test station A, go off-hook and dial the DID trunk access code.	The trunk push button on the console lights.
44.	Dial the digits of the distant office test termination.	The test termination responds.
45.	Go on-hook at both test stations.	The trunk push button extinguishes.
46.	Repeats steps 1 - 44 for all DID trunks.	Same as steps 1 - 44.

TABLE 1.07 Trunk Reservation Test

STEP	ACTION	VERIFICATION
1.	In a selected trunk group, make each standard two-way trunk, that has not been strapped for trunk reservation, busy.	The trunk LED's flash or light.
2.	Depress the TK RES ON push button at the console.	–
3.	Go off-hook at a TD-100 test station and dial the access digits for the outgoing trunk group being tested.	Busy tone is heard in the handset.
4.	Go on-hook at the test station, and repeat steps 2 and 3 for all applicable trunk groups.	Same as steps 2 and 3.
5.	At the distant office, seize a trunk and dial the digits required to access the TD-100 EPABX through the trunk group under test.	The Associated TD-100 trunk push button flashes and an audible signal is heard at the console.
6.	Momentarily depress the flashing push button.	The audible signal stops. The trunk push button and associated lamp light, and the transmission level is satisfactory.
7.	Release the trunk at the distant office. Momentarily depress the RELEASE bar at the console.	The trunk push button and associated lamp extinguish.
8.	Repeat steps 5 through 7 for the remaining trunks associated with trunk group under test.	Same as steps 5 through 7.
9.	Repeat steps 5 through 8 for all applicable trunk groups.	Same as steps 5 through 8.
10.	Restore all trunks to service.	The associated LED's extinguish.
11.	Depress the TK RES OFF push button on the console.	–

TABLE 1.08 Camp-on-Busy Test

STEP	ACTION	VERIFICATION
1.	Establish a call between TD-100 EPABX test stations A and B.	—
2.	At the console, momentarily depress the push button associated with a trunk which has outgoing capabilities.	The trunk push button and associated lamp light. CO dial tone is heard in headset.
3.	Dial the digits of a distant office test station.	Ringback tone is heard in headset followed by an answer of call. Transmission level is satisfactory.
4.	Momentarily depress the ATT LINE push button.	The ATT LINE push button lights, and the trunk push button winks. Dial tone is heard in the headset.
5.	At the console, dial the number of EPABX test station A, and then momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights and camp-on tone is heard at both inside stations. The Distant office receives music, if music on hold is provided.
6.	Maintain this condition.	In approximately 30 seconds, the trunk push button and associated lamp flash.
7.	Momentarily depress the flashing push button.	The trunk push button and associated lamp light. The trunk and console are reconnected.
8.	Momentarily depress the ATT LINE push button.	The ATT LINE push button lights and the trunk push button winks. Dial tone is heard in the headset.
9.	Dial the number of test station A, and then momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights and camp-on tone is heard at both inside stations. The distant office receives music, if music on hold is provided.
10.	Go on-hook at test stations A and B.	Station A rings and the distant office receives ringback tone.

TABLE 1.08 Camp-on-Busy Test (Cont.)

STEP	ACTION	VERIFICATION
11.	Go off-hook at test station A.	Ringing and ringback tone stop. The transmission level is satisfactory.
12.	Go on-hook at the distant office	The trunk push button extinguishes and test station A receives busy tone.
13.	Go on-hook at test station A.	The call is terminated.
14.	Repeat steps 1 - 13 for all applicable trunks.	—

TABLE 1.09 Assigned Night Answer (ANA) Test

STEP	ACTION	VERIFICATION
1.	Set the NIGHT switch on the console to the ON position.	–
2.	At the distant office, seize the desired trunk and dial the digits to access the TD-100 EPABX.	The assigned night answer station rings.
3.	Go off-hook at the ANA station.	The ringing stops and the transmission level is satisfactory.
4.	Go on-hook at the ANA station and at the distant office, release the trunk.	The call is terminated.
5.	Establish a call between the ANA station and another EPABX test station.	–
6.	At the distant office, reseize the trunk and dial the digits to access the TD-100 EPABX.	Both inside stations receive camp-on tone and the distant office receives ringback tone. In approximately 40 seconds, the above indication still exists. NOTE: If the ANA station is also assigned to the master position in a station hunt group, and hunting is allowed during ANA service, the next station in the group will ring. When this condition exists, go off-hook at the ringing station, verify the transmission level, and advance to step 9.
7.	Go on-hook at both stations.	The ANA station rings.
8.	Go off-hook at the ANA station.	The transmission level is satisfactory.
9.	Go on-hook at the ANA station. At the distant office, release the trunk.	The call is terminated.
10.	Repeat steps 2 through 9 for all trunks used for ANA service.	Same as steps 2 through 9.
11.	At the completion of the tests, set the NIGHT switch to the OFF position.	–

TABLE 1.10 Class of Service and Vacant Number Intercept Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at TD-100 station strapped to class of service 1.	EPABX dial tone is heard.
2.	Dial the digit(s) associated with the assigned service offering. (I.e., trunk access code, paging access code, dictation access code, etc.)	Reorder tone is heard, indicating that access was denied.
3.	Go on-hook at the EPABX station.	The call is terminated.
4.	Go off-hook at an EPABX station not strapped to class of service 1.	EPABX dial tone is heard.
5.	Dial the digit(s) associated with the assigned service offering.	Access is allowed.
6.	Go on-hook at the EPABX station.	The call is terminated.
	NOTE: In steps 2 and 5 above, and in some of the following steps, it may be necessary to dial some additional digits to determine whether the test call will be denied or allowed.	
7.	Repeat steps 1 - 6 for class of service assignments 2 - 6.	Same as steps 1 - 6.
8.	Go off-hook at an EPABX station strapped to class of service 7.	EPABX dial tone is heard.
9.	Dial the digit(s) associated with the assigned service offering.	Access is allowed.
10.	Go on-hook at the EPABX station.	The call is terminated.
11.	Go off-hook at an EPABX station not strapped to class of service 7.	EPABX dial tone is heard.
12.	Dial the digit(s) associated with the assigned service offering.	Reorder tone is heard, indicating that access is denied.
13.	Go on-hook at the EPABX station.	The call is terminated.
14.	Repeat steps 8 - 13 for class of service assignments 8 - 14.	Same as steps 8 - 13.

TABLE 1.10 Class of Service and Vacant Number Intercept Test (Cont.)

STEP	ACTION	VERIFICATION
15.	Go off-hook at an EPABX station strapped to class of service 15.	EPABX dial tone is heard.
16.	Dial the C.O. trunk access digit(s), listen for C.O. dial tone, and then dial a restricted central office number.	Reorder tone is heard, indicating that the toll call was denied.
17.	Go on-hook at the EPABX station.	The call is terminated.
18.	Go off-hook at an EPABX station not strapped to class of service 15.	EPABX dial tone is heard.
19.	Dial the C.O. trunk access digit(s), listen for C.O. dial tone and then dial the restricted central office number.	Ringback tone is heard followed by answer of call at the central office. The transmission level is satisfactory.
20.	Go on-hook at the EPABX station and central office station.	The call is terminated.
21.	Go off-hook at any EPABX station, listen for EPABX dial tone, then dial the number of an EPABX station strapped to vacant number intercept.	Reorder tone or recorded announcement is heard, whichever is applicable.
22.	Go on-hook at the EPABX station.	–
23.	Go off-hook at an EPABX station strapped to vacant number intercept.	Reorder tone is heard.
24.	Go on-hook at the EPABX station.	–

TABLE 1.11 Alarms Test

STEP	ACTION	VERIFICATION
1.	At the TD-100 cabinet, momentarily place the TEST/RESET switch on the alarm panel in the upper (TEST SW) position.	All LED's on the alarm panel light while the switch is operated.
2.	Momentarily place the TEST/RESET switch in the lower (RESET SW) position.	All LED's extinguish except the PS LED.
3.	Place the XFER switch in the upper position.	Stations assigned to the power failure transfer circuitry are put into the power failure transfer mode of operation. The MAJ ALM and XFER LED's light and the audible alarm is enabled, if equipped.
4.	Restore the XFER switch.	All LED's extinguish except the MAJ ALM and PS LED's.
5.	If the system is equipped with an audible alarm, momentarily set the ACO switch to the upper position.	The ACO LED lights momentarily and the audible alarm stops.

TABLE 1.12 Station Hunting Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at an EPABX station assigned at the master position of the first hunting group.	–
2.	Go off-hook at an EPABX station not assigned to a hunting group. Listen for dial tone, then dial the number of the station in step 1.	Ringback tone is heard and the station assigned to the next position in the hunting group rings.
3.	Go off-hook at called station.	Ringing and ringback tone stop. The transmission level is satisfactory.
4.	Go on-hook at the originating station.	Reorder tone is heard at called station.
5.	Repeat steps 2 through 4 for the remaining stations in the hunt group.	Same as steps 2 through 4.
6.	Go on-hook at all stations.	–
7.	Repeat steps 1 through 6 for all station hunting groups.	Same as steps 1 through 6.

TABLE 1.13 Music On Hold Test

STEP	ACTION	VERIFICATION
1.	At the distant office, seize the desired trunk and dial the digits required to access the TD-100 console.	The trunk push button flashes and the audible signal sounds.
2.	Momentarily depress the flashing push button.	The trunk push button and associated lamp light. The audible signal stops and the transmission level is satisfactory.
3.	Momentarily depress the HOLD push button.	The trunk push button winks and the distant office receives music.
4.	Momentarily depress the flashing trunk push button.	The trunk push button lights.
5.	Momentarily depress the ATT LINE push button.	The ATT LINE push button lights, the trunk push button winks, and dial tone is heard in headset. The distant office receives silence.
6.	Dial the number of an EPABX station, and then momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights, the EPABX station rings, and ringback tone is heard at the distant office.
7.	Go off-hook at the ringing EPABX station.	Ringing and ringback tone stop. The transmission level is satisfactory.
8.	At the EPABX station, momentarily depress the hookswitch.	The EPABX station receives transfer dial tone and the distant office receives music. After 8 or 16 seconds (strapping option), the transfer dial tone and music stop, and both stations receive 4 seconds of busy tone.
9.	Go on-hook at the test station and release the trunk at the distant office.	The trunk push button extinguishes. The call is terminated.
10.	Repeat steps 1 through 9 for all trunks with incoming capabilities. NOTE: If the EPABX includes one-way outgoing trunks, proceed to step 11; if not this concludes the test.	Same as steps 1 through 9.
11.	At an unrestricted EPABX station, go off-hook and dial the number of a central office test station.	Ringback tone is heard, followed by answer of call at central office. The transmission level is satisfactory.

TABLE 1.13 Music On Hold Test (Cont.)

STEP	ACTION	VERIFICATION
12.	Momentarily depress the hookswitch at the EPABX station.	The EPABX station receives dial tone and the central office station receives music.
13.	Momentarily depress the hookswitch at the EPABX station.	The station is reconnected to the central office.
14.	Repeat steps 11 through 13 for all applicable trunks.	Same as steps 11 through 13.

TABLE 1.14 Automatic Recall Test

STEP	ACTION	VERIFICATION
	INCOMING AND TWO-WAY TRUNKS	
1.	At the central office, seize the desired trunk and dial the digits to access the TD-100 console.	The trunk push button flashes and the audible signal sounds.
2.	Momentarily depress the flashing push button.	The trunk push button and associated lamp light. The audible signal stops and the transmission level is satisfactory.
3.	Momentarily depress the ATT LINE push button.	The ATT LINE push button lights, the trunk push button winks and dial tone is heard in headset.
4.	Dial the number of an EPABX station, and then momentarily depress the CONNECT bar.	The ATT LINE push button and trunk lamp extinguish. The trunk push button lights and the test station rings.
5.	Go off-hook at EPABX station.	The ringing stops. The transmission level between the test station and the distant office is satisfactory.
6.	Go on-hook at EPABX station.	In approximately 2 or 8 seconds, the trunk push button and associated lamp flash, indicating automatic recall.
7.	Momentarily depress the flashing push button.	The trunk push button and associated lamp light. The transmission level is satisfactory.
8.	Release the trunk at the central office and momentarily depress the RELEASE bar at the console.	The trunk push button and associated lamp extinguish.
9.	Repeat steps 1 through 8 for all applicable trunks.	Same as steps 1 through 8.
	ONE-WAY OUTGOING TRUNKS	
10.	At an unrestricted EPABX station go off-hook and dial the number of a central office test station.	The trunk push button on the console lights. Ringback tone is heard followed by answer of the call at the central office. The transmission level is satisfactory.

TABLE 1.14 Automatic Recall Test (Cont.)

STEP	ACTION	VERIFICATION
11.	Go on-hook at the EPABX station.	In approximately 2 or 8 seconds, the trunk push button and associated lamp flash, indicating automatic recall.
12.	Momentarily depress the flashing push button at the console.	The trunk push button and associated lamp light. The transmission level is satisfactory between the distant office and the console.
13.	Momentarily depress the RELEASE bar at the console and go on-hook at the central office.	The trunk push button and associated lamp extinguish.
14.	Make the trunk tested busy.	The busy LED flashes on the trunk card.
15.	Repeat steps 10 through 14 for all one-way outgoing trunks.	Same as steps 10 through 14.
16.	Restore all trunks to service at the completion of testing. NOTE: The automatic recall is effective only if the central office maintains the connection for longer than 2 or 8 seconds after the EPABX station has released.	All LED's extinguish.

TABLE 1.15 Register Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at an EPABX station equipped with a rotary dial telephone.	Dial tone is heard and the busy LED associated with register 1 lights. In approximately 8 or 16 seconds, busy tone is heard and the register LED extinguishes, indicating register release.
2.	Go on-hook at the EPABX station.	—
3.	Go off-hook at the station and, upon receipt of dial tone, dial the number of another EPABX station.	The Busy LED associated with register 1 lights until dialing is completed. Ringback tone is heard and the called test station rings.
4.	Go off-hook at the called station.	Ringing and ringback tone stop. The transmission level is satisfactory.
5.	Go on-hook at both stations.	—
6.	If applicable, repeat steps 3 through 5 using a Tel-Touch telephone for the originating station.	Same as steps 3 through 5.
7.	Make register 1 busy.	The Busy LED flashes.
8.	Repeat steps 1 through 7 for all registers.	Same as steps 1 through 7.
9.	At the completion of testing, restore all registers to service. NOTE: If a system has no rotary dial telephones, register release (steps 1 and 2) can be checked using a Tel-Touch telephone.	The Busy LED's extinguish.

TABLE 1.16 Local Link Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at EPABX test station A and, upon receipt of dial tone, dial the number of EPABX test station B.	Ringback tone is heard and station B rings. The Busy LED for local link 1 lights.
2.	Go off-hook at station B.	Ringing and ringback tone stop. The transmission level is satisfactory.
3.	Go on-hook at station A.	The Busy LED extinguishes and station B receives busy tone.
4.	Go on-hook at station B.	—
5.	Make local link 1 busy.	The Busy LED flashes.
6.	Repeat steps 1 through 5 for all local links.	Same as steps 1 through 5.
7.	At the completion of testing, restore all local links to service.	—

TABLE 1.17 Transfer and Add-on Link Test

STEP	ACTION	VERIFICATION
1.	At the distant office, seize an EPABX trunk and dial the number of the TD-100 console.	The TD-100 trunk push button flashes and the audible signal sounds.
2.	Answer the call at the console and extend it to EPABX test station A.	Station A rings and ringback tone is received at the distant office.
3.	Go off-hook at test station A.	Ringback tone and ringing stop. The transmission level is satisfactory.
4.	Momentarily depress the hookswitch at station A.	Transfer dial tone is heard at station A. The trunk is put on hold.
5.	Dial the number of EPABX station B.	Ringback tone is heard at station A. Station B rings. The Busy LED on the associated transfer link lights.
6.	Go off-hook at station B.	Ringing and ringback tone stop. The transmission level is satisfactory between stations A and B.
7.	Go on-hook at station A.	Station B and the distant office are connected. The transfer link LED extinguishes and the transmission level is satisfactory.
8.	Momentarily depress the hookswitch at station B.	Transfer dial tone is heard. The trunk is put on hold.
9.	Dial the number of station A.	Ringback tone is heard at station B. Station A rings. The LED on the seized transfer link lights.
10.	Go off-hook at station A.	Ringing and ringback tone stop. The transmission level is satisfactory between stations A and B.
11.	Momenatrily depress the hookswitch at station B.	The transfer link LED extinguishes. The Busy LED associated with the add-on link lights. All three stations are now connected. The transmission level is satisfactory.

TABLE 1.17 Transfer and Add-on Link Test (Cont.)

STEP	ACTION	VERIFICATION
12.	Go on-hook at station A.	Station B is now connected to the central office.
13.	Go off-hook at station A.	Dial tone is heard.
14.	Momentarily depress the hookswitch at station B, and dial the number of station A.	The trunk is put on hold. Both EPABX stations receive busy tone for approximately four seconds. Station B is then reconnected to the central office.
15.	Go on-hook at station A.	–
16.	Momentarily depress the hookswitch at station B, and dial the number of station A.	The trunk is placed on hold, station A rings, and ringback tone is heard at station B.
17.	Momentarily depress the hookswitch at station B.	Station B is again connected to the central office.
18.	At the central office, release the trunk. Go on-hook at EPABX station B.	The trunk Busy LED extinguishes and the call is terminated.
19.	Make the tested transfer link busy.	The transfer link LED flashes.
20.	Repeat steps 1 through 19 for all transfer links.	Same as steps 1 through 19.
21.	At the completion of testing, restore all transfer links to service.	The Busy LED's extinguish.

TABLE 1.18 Conference Network and Link Test

STEP	ACTION	VERIFICATION
	ATTENDANT CONTROLLED CONFERENCE	
1.	Momentarily depress the ATT LINE push button at the TD-100 console.	The ATT LINE push button lights and dial tone is heard in the headset.
2.	Key the three-digit number of an EPABX test station, station A.	Station A rings and ringback tone is heard in the headset.
3.	Go off-hook at station A.	Ringing and ringback tone stop. The transmission level is satisfactory.
4.	Momentarily depress the CONF push button.	The CONF push button lights and dial tone is heard in the headset. Station A is connected to the conference circuit.
5.	Repeat steps 2 through 4 for EPABX test stations B, C, and D.	Same as steps 2 through 4.
6.	Momentarily depress the RELEASE bar at the console.	The ATT LINE push button extinguishes.
7.	Momentarily depress a push button assigned to a trunk which has outgoing capabilities.	The trunk push button and associated lamp light. Dial tone is heard in the headset.
8.	Dial the number of a distant office test station.	Ringback tone is heard in the headset followed by answer of the call at the distant office. Ringback tone stops.
9.	Momentarily depress the CONF push button.	The trunk lamp extinguishes, indicating that the test station is now connected to the conference circuit.
10.	Repeat steps 7 through 9 for a second distant office test station.	Same as steps 7 through 9. NOTE: When the second distant office test station (sixth conferee) is connected, the CONF lamp winks, indicating that the conference network has reached its maximum capacity.
11.	Go on-hook at the EPABX and distant office test stations.	The CONF and trunk push buttons extinguish.

TABLE 1.18 Conference Network and Link Test (Cont.)

STEP	ACTION	VERIFICATION
	MEET-ME CONFERENCE	
12.	Go off-hook at EPABX test station A, and dial the meet-me conference access code.	The CONF push button on the console lights. The LED for the conference network and the LED for a conference link light. Station A is connected to the conference network.
13.	Repeat step 12 for EPABX test stations B and C.	As each station accesses the conference, an LED on the conference link lights.
14.	Add a trunk to the conference as in steps 7 - 9.	Same as steps 7 through 9.
15.	Dial the meet-me conference access code from EPABX test station D.	The station hears busy tone verifying the conference security feature.
16.	Go on-hook at all TD-100 stations.	In 30 or 60 seconds (strapping option), the CONF lamp extinguishes and the central office trunk releases or recalls the attendant (strapping option).
	STATION CONTROLLED CONFERENCE	
	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION.	

TABLE 1.19 Direct Outward Dialing (DOD) Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at an unrestricted EPABX station and dial the digit(s) required to access a central office trunk.	Central office dial tone is heard and the trunk LED lights.
2.	Dial the number of a central office test station.	Ringback tone is heard, followed by answer of call at central office.
3.	Release from the test call.	The trunk LED extinguishes.

TABLE 1.20 Dictation Access Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at an unrestricted EPABX station and dial the digits required to access customer provided dictation equipment.	Check the manufacturer's manual for indication provided upon seizure.
2.	Check the start, stop, record, playback, etc., operations per manufacturer's instruction manual.	Check the manufacturer's manual for verification of operation.
3.	Go on-hook at station.	The call is terminated.

TABLE 1.21 Call Forward-Follow Me Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at EPABX station A and on receipt of dial tone, dial the call forward access code.	Call forward-follow me dial tone is heard.
2.	Dial the number of the EPABX station to which subsequent calls are to be forwarded, station B.	Busy tone is heard.
3.	Go on-hook.	–
4.	Go off-hook at EPABX station C and dial the number of station A.	Ringback tone is heard and station B rings.
5.	Go off-hook at station B.	Ringing and ringback tone stop and the transmission is satisfactory.
6.	Go on-hook at stations B and C.	The call is terminated.
7.	Repeat steps 1 through 6 three times, to cause calls to stations D, E, and F to be forwarded to station B.	Same as steps 1 through 6.
8.	Repeat step 1 from a fifth station, station G.	Busy tone is heard indicating that all ports to the follow-me circuit are in use.
9.	Go on-hook at station G.	–
10.	Go off-hook at station A and dial the number of station A.	Busy tone is heard.
11.	Go on-hook at station A.	–
12.	Go off-hook at station C and dial the number of station A.	Station A rings, indicating that the follow me has been canceled.
13.	Go on-hook at stations A and C.	Ringing stops and the call is terminated.
14.	Repeat steps 10 through 13 to return stations D, E, and F to regular service.	Same as steps 10 through 14.

TABLE 1.22 Private Line (KTU) Test

STEP	ACTION	VERIFICATION
1.	Depress the line push button on the key telephone associated with a K.T.U. and go off-hook. Upon receipt of dial tone, dial the digits to access the TD-100 console.	The line push button lights and ringback tone is heard. An incoming trunk call indication appears on the console.
2.	Answer the call at the console.	The transmission level is satisfactory.
3.	Depress the HOLD push button on the key telephone.	The line push button winks. The call is placed on hold.
4.	Depress the winking line push button.	The line push button lights. The key telephone and console are reconnected.
5.	Release from the test call at the key telephone and console.	The line push button extinguishes and the call is terminated.
6.	Momentarily depress an idle central office trunk push button at the console. Upon receipt of central office dial tone, dial the digits required to access the key telephone used in step 1.	Ringback tone is heard at the console and the key telephone rings. The line push button flashes.
7.	Go off-hook at the key telephone.	Ringing and ringback tone stop and the line push button lights. The transmission level is satisfactory.
8.	Release from the test call at the key telephone and console.	The line push button extinguishes and the call is terminated.
9.	Repeat steps 1 through 8 for all key telephones connected to key telephone units.	Same as steps 1 through 8.

TABLE 1.23 Paging Circuit Test

STEP	ACTION	VERIFICATION
	STATION ACCESS	
1.	Go off-hook at test station A and dial the digits required to access the first paging circuit.	The PAGE push button on the console and the busy LED on the paging access circuit light. If applicable, one second of tone is heard at station A and over the paging system, strapping option. If music is normally heard over the paging system, it is removed.
2.	Announce your presence.	The announcement is heard over the paging system for the designated area.
3.	If answer back is provided, go to step 4. If answer back is not provided, go to step 5.	—
4.	Go off-hook at test station B and dial the paging answer code.	Station B can talk to station A.
5.	Go on-hook at the test station(s).	The PAGE push button on the console and the LED on the paging access board extinguish. If applicable, music is heard over the paging system.
6.	If applicable, repeat steps 1 - 5 for the next paging circuit.	The same as steps 1 - 5.
	ATTENDANT PUSH BUTTON ACCESS	
7.	Depress and hold the PAGE push button at the console.	The PAGE push button and the LED on the paging access circuit light. One second of tone is heard in the headset and, if applicable, over the paging system. If music is normally heard over the paging system, it is removed.
8.	Announce your presence.	The announcement is heard over the paging system in all designated areas.
9.	Release the PAGE push button.	The PAGE push button extinguishes. Music is heard over paging system if music is provided.

TABLE 1.23 Paging Circuit Test (Cont.)

STEP	ACTION	VERIFICATION
	ATTENDANT DIAL ACCESS	
10.	Depress the attendant line key and dial the digits required to access the first paging circuit.	The PAGE push button on the console and the LED on the paging access circuit light. One second of tone is heard in the headset and over the paging system (strapping option), if applicable. If music is normally heard over the paging system, it is removed.
11.	Announce your presence.	The announcement is heard over the paging system for the designated area.
12.	Depress the release bar and hold until the PAGE push button extinguishes.	The PAGE push button on the console and the LED on the paging access board extinguish. Music is heard over the paging system, if applicable.
13.	If applicable, repeat steps 10 through 12 for the next two paging circuits by dialing the appropriate access codes.	Same as steps 10 through 12.

TABLE 1.24 Manual Intercom Test

STEP	ACTION	VERIFICATION
1.	Go off-hook at the key telephone connected to the first manual intercom circuit.	—
2.	Depress the line push button for the first manual intercom circuit.	The LINE push button lights.
3.	Momentarily depress the SIGNAL push button at the originating key telephone.	All associated key telephones momentarily buzz.
4.	Go off-hook at one of the signaled key telephones.	The LINE push button lights. The transmission level is satisfactory.
5.	Go on-hook at both key telephones.	The LINE push buttons extinguish.
6.	Repeat steps 1 through 5 for all manual intercom circuits.	Same as steps 1 through 5.

TABLE 1.25 Executive Access Trunk Test

STEP	ACTION	VERIFICATION
1.	At the distant office, seize the executive access trunk to be tested.	The trunk push button on the TD-100 attendant console lights. The distant office receives TD-100 dial tone.
2.	At the distant office, using a Tel-Touch telephone, push button dial the number of a TD-100 test station.	Test station rings. The distant office receives ringback tone.
3.	Go off-hook at the test station.	The transmission level is satisfactory.
4.	Release the trunk at the distant office and go on-hook at the test station.	The trunk push button extinguishes. The call is terminated.
5.	At the distant office, seize the executive access trunk.	The trunk push button on the TD-100 attendant console lights. The distant office receives TD-100 dial tone.
6.	At the originating office, using a Tel-Touch telephone, push button dial a CO trunk access code.	The CO trunk push button on the attendant console lights. CO dial tone is heard at the distant office.
7.	Push button dial the digits of a CO test termination.	At the distant office, ringback tone is heard, followed by answer at the CO test termination.
8.	Release the call at the distant office.	At the TD-100 console the CO trunk and the executive access trunk push buttons extinguish.
9.	Repeat steps 1 - 8 for each executive access trunk.	Same as steps 1 - 8.

TABLE 1.26 CO to CO Connection Test

STEP	ACTION	VERIFICATION
1.	At the console, momentarily depress the push button associated with a trunk with outgoing capabilities.	The trunk push button and associated lamp light. CO dial tone is heard in headset.
2.	Dial the digits required to access a distant office test station.	Ringback tone is heard in headset followed by termination of the call. The transmission level is satisfactory.
3.	Momentarily depress the ATT LINE push button on the console.	The ATT LINE push button lights, and the trunk push button winks. TD-100 dial tone is heard in the headset.
4.	Dial three-digit station number of the CO to CO connection, then depress the CONNECT bar.	The ATT LINE push button extinguishes. The Trunk push button and associated lamp light steady.
5.	Repeat steps 1 - 3 using a different trunk and distant office test station.	Same as steps 1 - 3.
6.	Dial the second three-digit station number associated with the CO to CO connection, then depress the CONNECT bar.	The ATT LINE push button extinguishes. The trunk push button and associated lamp light steady. The two distant office terminations can now talk to verify that the transmission level is satisfactory.
7.	Go on-hook at both distant office terminations.	Both trunk push buttons and associated lamps extinguish.

TABLE 1.27 Busy Trunk Call Back Test

STEP	ACTION	VERIFICATION
1.	At the attendant's console, momentarily depress the trunk push button assigned to one of the trunks in the busy call back trunk group to be tested.	The trunk push button and associated lamp light.
2.	Momentarily depress the HOLD push button.	The trunk push button lamp starts winking.
3.	Repeat steps 1 and 2 for each trunk assigned to the trunk group being tested.	Same as steps 1 and 2.
4.	At a test station (test station A) that is allowed access to the trunk group that was made busy in steps 1 through 3, go off-hook and dial the trunk group access code.	Busy tone is heard for approximately eight seconds, then reorder tone is heard, indicating that the busy trunk call back is set.
5.	Go on-hook at test station A.	–
6.	Repeat steps 4 and 5 using six additional test stations (B, C, D, E, F, & G).	Same as steps 4 and 5.
7.	Repeat step 4 using test station H.	Reorder tone is heard indicating that all the access ports assigned to the trunk group being tested are busy.
8.	Go on-hook at test station H.	–
9.	At the attendant's console, momentarily depress one of the winking trunk push buttons.	The trunk push button and associated lamp lights steady.
10.	Momentarily operate the RELEASE bar.	The trunk push button and associated lamp extinguish. After a short delay, test station A starts ringing.
11.	After two rings (approximately eight seconds) test station A stops ringing.	After a short delay test station B starts ringing.
12.	In approximately eight seconds test station B stops ringing.	After a short delay test station C starts ringing.
13.	Go off-hook at station C and dial the digits required to terminate the call in the distant office.	The distant office test termination responds.

TABLE 1.27 Busy Trunk Call Back Test (Cont.)

STEP	ACTION	VERIFICATION
14.	Go off-hook at test station H and dial the access code of the trunk group being tested.	Busy tone is heard for approximately eight seconds, then reorder tone is heard.
15.	Go on-hook at test station H.	–
16.	Go off-hook at test station E.	EPABX dial tone is heard at test station E.
17.	Go on-hook at test station C.	After a short delay test station D starts ringing.
18.	In approximately eight seconds test station D stops ringing.	After a short delay test station F starts ringing. Note that test station E was skipped because it was off-hook.
19.	Go on-hook at test station E.	–
20.	After two rings (approximately eight seconds) test station F stops ringing.	After a short delay test station E starts ringing.
21.	In approximately eight seconds test station E stops ringing.	After a short delay test station H starts ringing.
22.	In approximately eight seconds test station H stops ringing.	
23.	Repeat steps 1 through 22 for each trunk group assigned for busy trunk call back.	

TABLE 1.28 Busy Line Call Back Test

STEP	ACTION	VERIFICATION
1.	At test station A, go off-hook and dial the digits required to access test station B.	Test station B starts ringing.
2.	At test station C, go off-hook and dial the digits required to access test station A.	Busy tone is heard at station C for approximately eight seconds and then reorder tone is heard, indicating that the busy line call back is set.
3.	Go on-hook at station C and go off-hook at station D and dial the digits required to access station A.	Busy tone is heard at station D for approximately eight seconds and the reorder tone is heard, indicating that the busy line call back is set.
4.	Go on-hook at station D.	–
5.	Go on-hook at station A.	After a short delay, stations A and C start ringing. In approximately eight seconds stations A and C stop ringing and stations A and D start ringing.
6.	Go off-hook at stations A and D and talk to verify transmission.	Transmission is satisfactory.
7.	Go on-hook at stations A and D.	–

ACCESS TEST SET
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 Access Test Set 2

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides general information and detailed operating instructions for the access test set. The test set is an optional unit for the TD-100 Electronic Private Automatic Branch Exchange (EPABX).

1.02 Purpose of Test Set. The access test set permits maintenance personnel to perform system tests and initiate test calls from the front of the TD-100 cabinet. The test set operator may choose any one of lines 295, 296, 297, 298, or 299 as an access test line to the system. When a line is selected at the test set, the station telephone set on that line is automatically disconnected from the system. When the test set is not being used, the station telephone sets on lines 295 - 299 will be connected to the system in the normal manner.

1.03 Auxiliary Equipment. The only additional equipment required is a standard two-wire telephone set (station instrument) or a linesman's test set (hand test telephone). The station instrument or hand test telephone is connected to the two stand-off terminals on the front of the test set.

2.00 DESCRIPTION

2.01 General. The optional access test set is mounted at the top of the TD-100 cabinet, above the printed circuit boards. Figure 1.00 shows the layout of the test set controls and indicators, and table 1.00 lists the function of each control and indicator.

3.00 OPERATING PROCEDURE

3.01 General. Basically, the test set operating procedure is as follows:

a. Determine the circuit to be tested (register, link, trunk, etc.).

b. Obtain the channel (time slot) number of the circuit from table 1.01.

c. Set the UNITS and TENS switches on the test set to the channel number.

d. Access the system by operating one of the five LINE pick-up push buttons.

e. Momentarily operate the BUSY push button. This allows the test set calls to be routed to the selected channel.

The previous steps provide only the sequence of operation for originating a test call from the test set. Detailed procedures for receiving calls and originating different types of test calls from the test set are given in paragraph 5.00.

Also, even though the desired channel is selected with the UNITS and TENS switches, there may be instances when the channel cannot be obtained

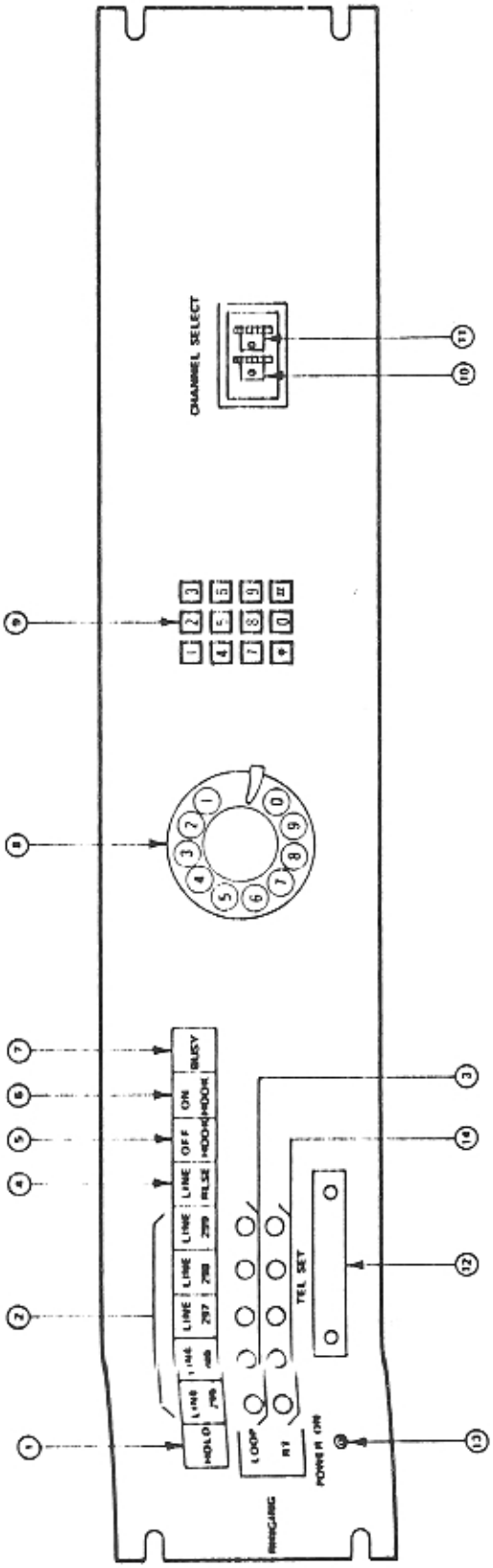

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FIGURE 1.00 Access Test Set

TABLE 1.00 Indicators and Controls

ITEM	DESIGNATION	DESCRIPTION
1.	HOLD	Used to place station on "Hold."
2.	LINE 295 to LINE 299	Provide access to lines 295, 296, 297, 298, and 299. The integral lamps will "flash" on incoming calls and will light steady when the line is busy.
3.	LOOP 1-5	Will light when ringing generator is applied to the corresponding line.
4.	LINE RELEASE	A nonlocking push button used to release LINE push buttons.
5.	OFF-HOOK	A nonlocking push button used to simulate a station line off-hook condition when receiving or originating calls. This push button must be used to simulate the off-hook condition normally supplied by the station telephone set. The integral lamp will light after the push button is operated.
6.	ON-HOOK	A nonlocking push button used to simulate a station line on-hook condition. This push button must be used to simulate the on-hook condition normally supplied by the station telephone set. Operating this push button also extinguishes the OFF-HOOK lamps.
7.	BUSY	A nonlocking push button used to connect the test set to the channel selected with the UNITS and TENS switches.
8.	Rotary Dial	Provides dial pulses for calls originated from the test set.
9.	Push-Button Dial	Provides multifrequency TEL-TOUCH® tones for calls originated from the test set.
10.	TENS	Rotary switch used to select the tens number of the desired channel.
11.	UNITS	Rotary switch used to select the units number of the desired channel.
12.	TEL SET	Stand-off terminals used to connect the two-wire telephone set or the hand test telephone to the access test set.

TABLE 1.00 Indicators and Controls (Cont.)

ITEM	DESIGNATION	DESCRIPTION
13.	POWER ON	Light-emitting diode lights to indicate power is applied to the test set. Note that the test set does not have a power switch – power is on continuously.
14.	RT 1-5	Light emitting diode RT 1-5 lights to indicate ringing generator on corresponding RT- lead.

TABLE 1.01 Channel Allocations

CIRCUIT	CHANNEL	CIRCUIT	CHANNEL
Trunk 1	50	Local Link 9	51
Trunk 2	53	Local Link 10	54
Trunk 3	56	Local Link 11	57
Trunk 4	59	Local Link 12	47
Trunk 5	58		
Trunk 6	1	Option 1	0
Trunk 7	4	Option 2	3
Trunk 8	7	Option 3	6
Trunk 9	10	Option 4	9
Trunk 10	13	Option 5	12
Trunk 11	16		
Trunk 12	19	Spare 2-1	41
Trunk 13	22	Spare 2-2	44
Trunk 14	25		
Trunk 15 or Tie Line 1	28	Transfer Link 1	2
Trunk 16 or Tie Line 2	31	Transfer Link 2	5
Trunk 17 or Tie Line 3	34	Transfer Link 3	8
Trunk 18 or Tie Line 4	37	Add-On Link	63
Trunk 19 or Tie Line 5	40		
Trunk 20 or Tie Line 6	43	Conference Link 1	11
Trunk 21 or Tie Line 7	46	Conference Link 2	14
Trunk 22 or Tie Line 8	49	Conference Link 3	17
Trunk 23 or Tie Line 9	52	Conference Link 4	20
Trunk 24 or Tie Line 10	55		
Register 1	15	Attendant Link 1	23
Register 2	18	Attendant Link 2	26
Register 3	21	Attendant Register 1	29
Register 4	24	Spare 1-1	32
		Spare 1-2	35
		Spare 1-3	38
Local Link 1	27		
Local Link 2	30		
Local Link 3	33		
Local Link 4	36	Vacant	60
Local Link 5	39	Vacant	61
Local Link 6	42	Vacant	62
Local Link 7	45		
Local Link 8	48		

when the BUSY push button is pressed. Even if the channel is free when the tester gains access to the system, any regular station user originating or receiving a call may seize the channel selected for test if the call is processed between the time the tester gains access to the system and the time the BUSY push button is operated.

4.00 TEST PREPARATION

4.01 General. The only preparations required is to connect a two-wire telephone set or a hand test telephone to the two stand-off terminals on the front of the test set. Note that even though the two-wire telephone set or the hand test telephone is equipped with a dial, any dialing required should be done with the rotary dial or the Tel-Touch pad on the test set.

5.00 TESTS

5.01 General. The access test set may be used to conduct system tests using one of lines 295, 296, 297, 298, or 299. Calls may be originated to local stations or outgoing trunks at the test set or received at the test set from local stations and incoming trunks. Paragraphs 5.02 through 5.05 give detailed procedures for different call types. In addition, the following general procedures must be followed to successfully complete test calls.

a. The two-wire station instrument or hand test telephone connected to the stand-off terminals at the front of the test set is used mainly for transmission testing. The off-hook and on-hook conditions normally provided by the telephone set must be simulated by using the OFF-HOOK and ON-HOOK push buttons on the test set. Also, the test set rotary dial or Tel-Touch pad must be used when dialing.

b. Prior to originating or receiving a test call, the LINE push button (295 - 299) on which the test is to be completed on should be operated (depressed). This disables the station telephone and lights the line lamp if a key set is provided. Should a nonoperated LINE push button integral lamp light or flash, it indicates the station user is using the line or being called. Operation of the LINE push button at this time would disable the station telephone and transfer the line circuit connection to the test set.

c. Calls between the test set and stations 295 - 299 can be made. For the test set operator to call station 295, for example, the test set operator would access the system over one of lines 296 - 299 and then dial 295. Operate the HOLD push button to place the originating station on hold and then operate 295 push button. Lamps associated with line 295 will flash in response to ringing.

d. If after operating the BUSY push button reorder is received, it indicates that the channel selected for testing (TENS, UNITS switches) has been allocated to another call. Release the call and retest when the channel becomes idle.

5.02 Calls to Test Set. Calls may be made to the test set from a station telephone set, a trunk line, or from the attendant's console. The calls may be received over lines 295, 296, 297, 298, or 299.

a. To receive an incoming call, depress the LINE push button assigned to the line on which the call is to be received. The incoming call is visually indicated by the LINE lamp flashing and the appropriate LOOP and RT lamps responding to the interrupted ringing.

b. To answer the call, operate the OFF-HOOK push button. The OFF-HOOK lamp and the LINE lamp light. The associated LOOP and RT lamps extinguish.

c. To verify transmission, talk and listen using the two-wire station instrument or the hand test telephone.

d. To release from the call, operate the ON-HOOK push button. The LINE lamp and the OFF-HOOK lamp extinguish. To release the LINE, momentarily operate the LINE RELEASE push button.

5.03 Register Selection. To test a specific register, proceed as follows:

a. Select the channel number of the register to be tested from table 1.01, and set the UNITS and TENS switches to the channel number.

b. Depress a LINE push button.

c. Operate the BUSY push button.

d. Operate the OFF-HOOK push button. The OFF-HOOK and the LINE lamps light. The test set should now be connected to the desired register. Dial tone will be heard on the two-wire telephone set or the hand test telephone. The BUSY LED (light-emitting diode) on the front of the register board lights. After eight or 16 seconds (strapping option), the register will time-out and busy tone will be heard. The BUSY LED on the register board extinguishes.

e. Terminate the call by operating the ON-HOOK push button. The LINE and the OFF-HOOK lamps extinguish.

f. Operate the LINE RELEASE push button to release the LINE push button.

5.04 Link Selection. To check a specific link, proceed as follows:

a. Select the channel number of the link to be tested from table 1.01 and rotate the UNITS and TENS switches to correspond to the channel number.

b. Depress a LINE push button.

c. Operate the OFF-HOOK push button. The integral OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

d. Dial the first two digits of a station telephone set using the rotary dial or Tel-Touch pad on the test set panel.

e. After dialing the second digit operate the BUSY push button.

f. Dial the third digit. The BUSY LED of the selected link (on front of links board) lights.

g. The call to the dialed station is completed in the normal manner.

h. Terminate the call by operating the ON-HOOK push button. The integral LINE lamp and the OFF-HOOK lamp extinguishes. The BUSY LED on the links board also extinguishes.

i. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

5.05 Trunk Selection. When it is desired to check a specific trunk, proceed as follows:

a. Select the channel number from table 1.01 and rotate the UNITS and TENS switches to correspond to the channel number.

b. Depress a LINE push button.

c. Operate the OFF-HOOK push button. The integral OFF-HOOK and LINE lamps light. Dial tone at the telephone set or hand test telephone indicates a register has been selected.

d. Operate the BUSY push button.

e. Dial the digit(s) to access the selected trunk (use the rotary dial or Tel-Touch pad on the test set panel).

f. The BUSY LED on the front of the selected trunk board lights.

g. A test call over the trunk may now be completed to test the transmission.

h. Terminate the call by operating the ON-HOOK push button. The integral LINE lamp and the OFF-HOOK lamp extinguish. The BUSY LED on the trunk board extinguishes.

i. Release the LINE push button by momentarily depressing the LINE RELEASE push button.

CONSOLE MAINTENANCE
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section contains maintenance information for the TD-100 Electronic Private Automatic Branch Exchange (EPABX) consoles.

1.02 Consoles. The TD-100 consoles provide an attendant operating position for the system. The attendant has the capability to connect stations to trunks and special features, plus the ability to monitor the status of the TD-100 EPABX. Refer to figure 1.00.

The attendant consoles are available in two basic styles, one console equipped with a 100-line busy lamp field and one without the busy lamp field, with variations of each. Refer to table 1.00.

The control functions for each console are identical with pushbutton keys provided to accommodate 24 trunk lines.

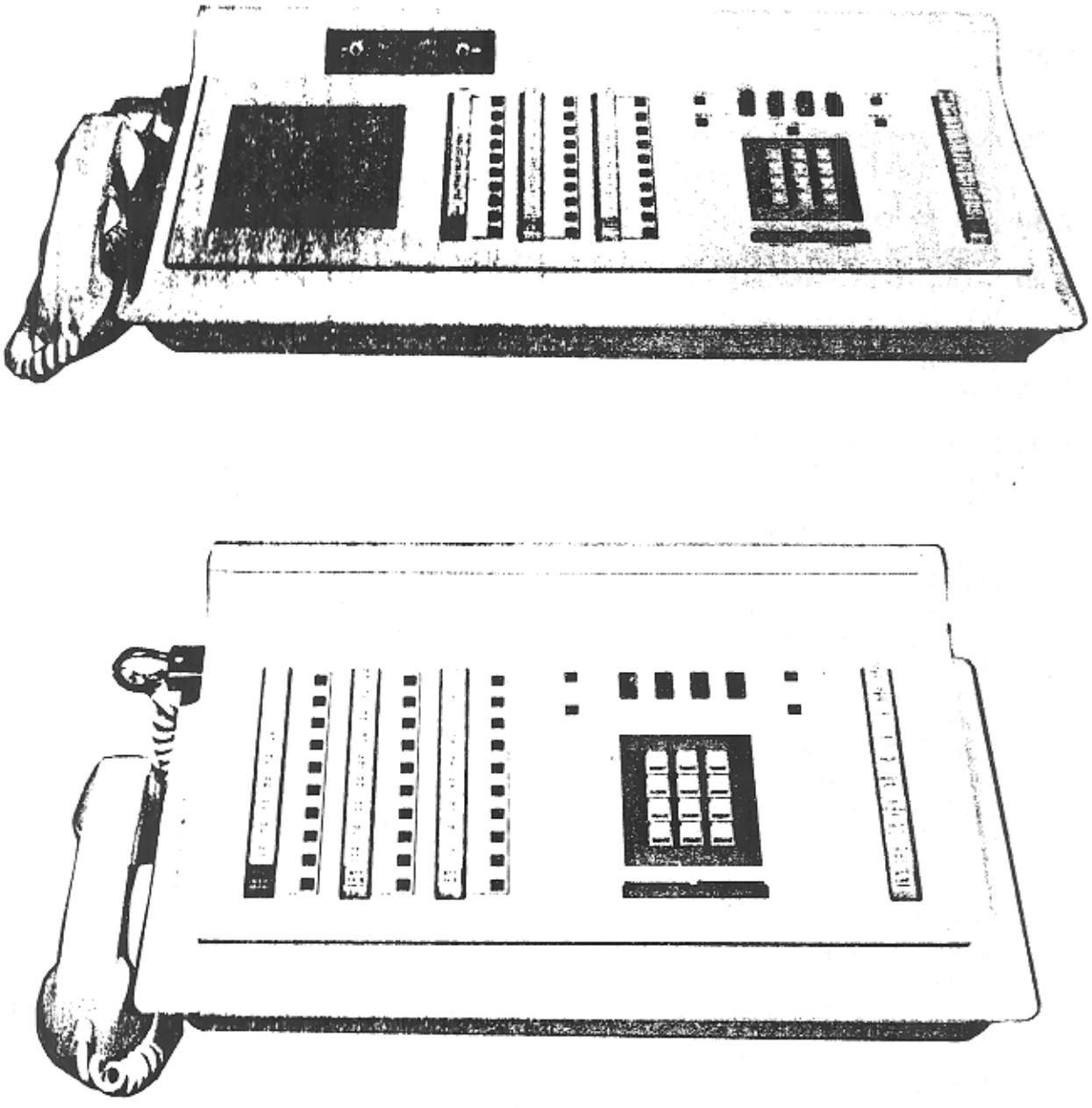


FIGURE 1.00 Consoles

TABLE 1.00 Console Configuration

ASSEMBLY NO.	DESCRIPTION
316619(1)122	Busy Lamp Field/Quick-Step Dial
316619(2)122	Busy Lamp Field/TEL-TOUCH® Dial
91670-1 (Mfg. Disc.)	Busy Lamp Field/Quick-Step Dial
91670-2 (Mfg. Disc.)	Busy Lamp Field/Tel-Touch Dial
316619(5)122	Busy Lamp Field/Quick-Step Dial/Digital Clock
316619(6)122	Busy Lamp Field/Tel-Touch Dial/Digitial Clock
316619(3)122	Without Busy Lamp Field/Quick-Step Dial
316619(4)122	Without Busy Lamp Field/Tel-Touch Dial
91660-1 (Mfg. Disc.)	Without Busy Lamp Field/Quick-Step Dial
91660-2 (Mfg. Disc.)	Without Busy Lamp Field/Tel-Touch Dial

2.00 PLANNING

2.01 Tools and Equipment. The minimum tools and equipment required for maintenance are:

a. A set of blade screwdrivers.

b. A soldering iron.

c. Lamp, extractor, P. K. Neuses, Inc., N533A, or equivalent.

d. Freon-type solution.

e. Pair of long-nose pliers.

3.00 CONTROLS AND INDICATORS

3.01 General. All console controls and indicators are shown in figures 1.01 and 1.02. The functions of each control and indicator are given in table 1.01.

4.00 DESIGNATION TABS

4.01 General. Designation tabs are furnished in strips for typing convenience and are easily broken out of the strips for installation.

To install a designation tab in a button cap, squeeze both sides of the cap and lift. Insert the designation tab in the cap and re-install the cap by depressing it down over the button.

5.00 LAMPS

5.01 General. To replace the lamps, the console faceplate must be removed (refer to paragraph 6.02). With the faceplate removed, the lamps for the busy lamp field, the power indicator, and the alarm indicator may be removed using a lamp extractor, P. K. Neuses, Inc., N553A, or equivalent.

To replace the lamps of a key assembly, remove the key assembly collar, then remove the appropriate button and cap assembly by squeezing both sides of the assembly and lifting. The lamp may then be removed using an appropriate lamp removal tool. Replace the button and cap assembly by pressing it down over the key assembly.

6.00 PARTS ASSEMBLY, CONSOLES 91660 and 91670

6.01 General. The following paragraphs provide detailed instructions for maintenance of consoles 91660 and 91670. Maintenance should normally be limited to the cleaning and replacement of the items listed in table 1.02. Figure 1.03 presents an exploded view of console 91670 equipped with a busy lamp field. Except for minor variations, the figure is applicable with all 91660 and 91670 consoles (see Table 1.00 Console Configuration).

6.02 Faceplate Assembly. To remove a faceplate assembly:

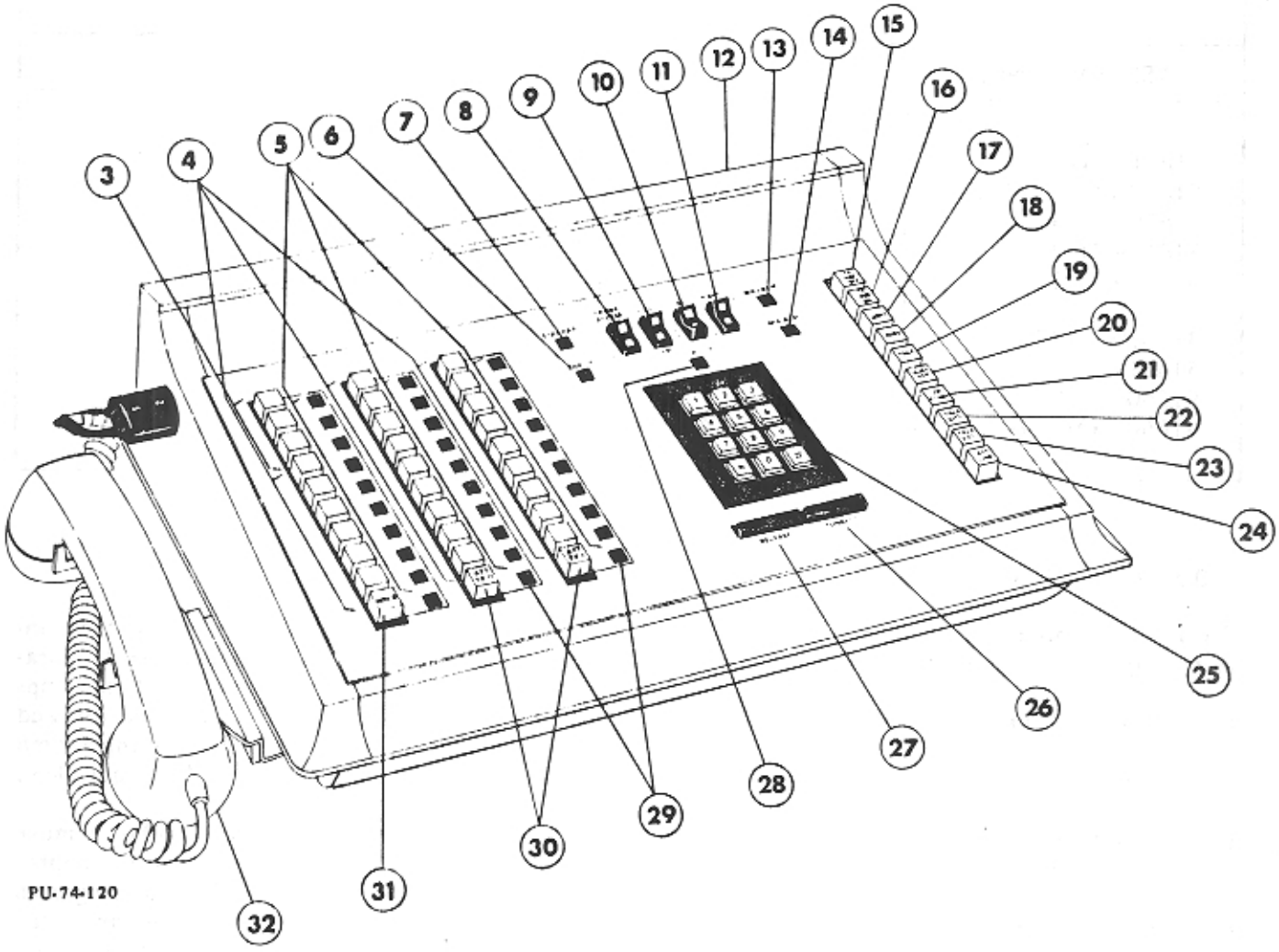


FIGURE 1.01 Layout of Controls and Indicators – 316619(3)122

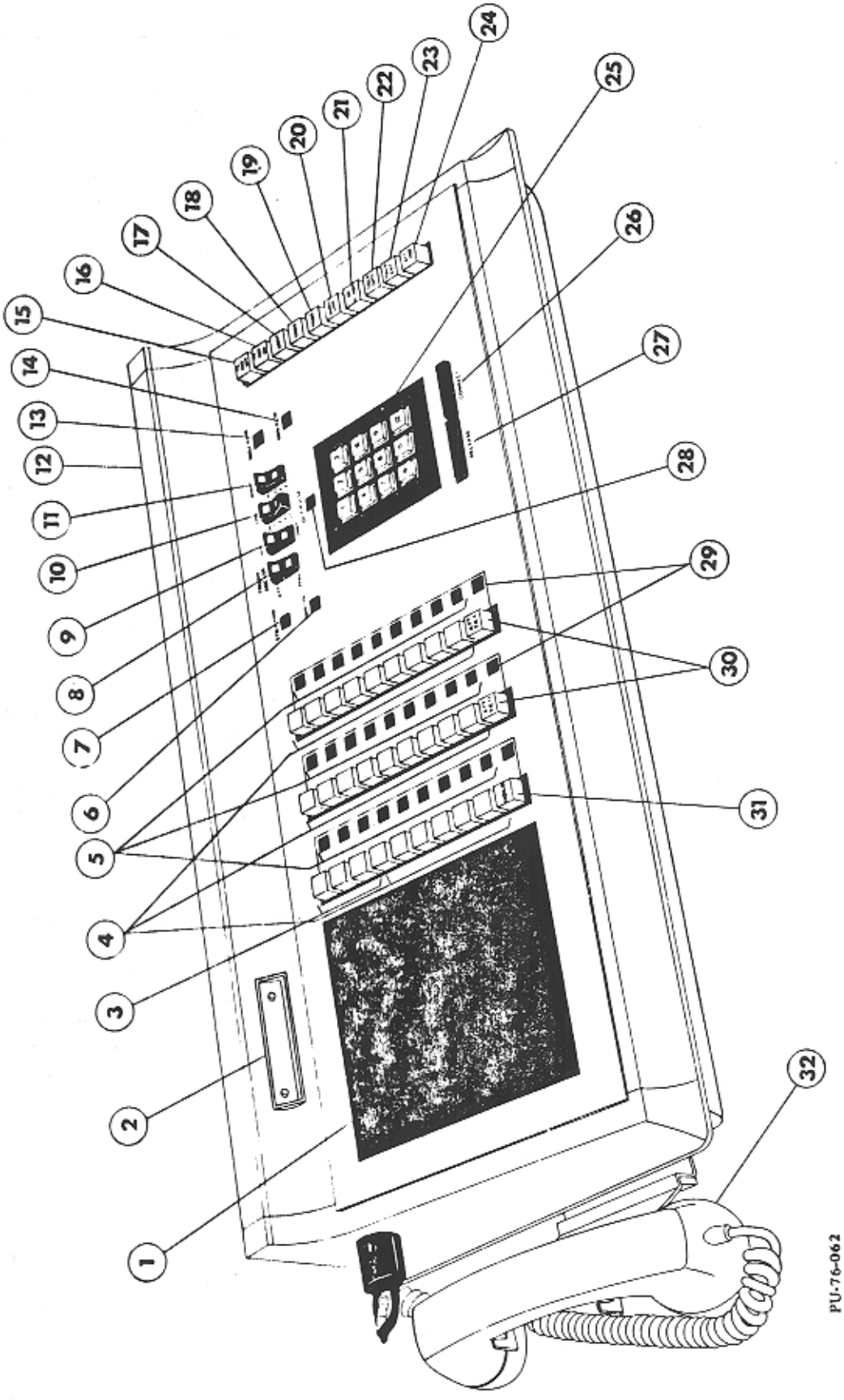


FIGURE 1.02 Layout of Controls and Indicators – 316619(5)122

TABLE 1.01 Controls and Indicators

ITEM	NAME	DESCRIPTION
1.	Busy Lamp Field	00-99. Lamps light to indicate status of stations.
2.	Digital Clock	Digital readout of correct time.
3.	Spare	Spare, not used.
4.	TA lamps (1-24)	Used to answer or initiate calls on trunks 1-24. Visual indications (refer to the operating instructions for each type of call).
5.	TB lamps	Visual indications (refer to the operating instructions for each type of call).
6.	PWR ON (power on)	When lit, it indicates the commercial power is applied to the system.
7.	STBY PWR (standby power)	When lit, it indicates that the system is operating on standby power.
8.	TRUNK ACCESS switch	When in the ATT position, predetermined trunk groups can be accessed only by the attendant. When in the DIAL position, stations with the appropriate class of service may access the outgoing trunk groups directly, by dialing the appropriate access code.
9.	HDST/HNST switch (headset/handset)	When in the HDST position, a headset may be used. When in the HNST position, a handset may be used.
10.	TONE switch	A three position switch to control the audible level of the buzzer or to turn off the buzzer. Positions are HI, OFF, and LO.
11.	NIGHT switch	When operated, this key causes the system to direct all incoming trunk calls to the night answer facility.
12.	TRANSFER	Allows the attendant to manually switch the system into the power failure transfer mode, if required (located on bottom rear of console).

TABLE 1.01 Controls and Indicators (Cont.)

ITEM	NAME	DESCRIPTION
13.	MAJ ALM (major alarm)	When lit, it indicates the system cannot complete calls in the normal manner. The system is in the power failure transfer mode.
14.	MIN ALM (minor alarm)	When lit, it indicates that system operation is degraded.
15.	TK RES OFF (trunk reservation off)	Disables the trunk reservation feature.
16.	TK RES ON (trunk reservation on)	Enables the trunk reservation feature by inhibiting outgoing calls on preselected two-way trunks; this makes the trunks incoming only.
17.	CONF (conference)	Used to set up an attendant controlled conference.
18.	CODE	Used to make a code call.
19.	PAGE	Used to make a paging call.
20.	BUSY VER (busy verification)	Used to establish a talking connection to an apparently busy station.
21.	OP FLASH (operator flash)	Used to flash an operator at the central office end (trunk calls).
22.	TALK CITY	Need to consult privately with the trunk party on a trunk/station call that is still under control of the console (the CONNECT bar has not been operated).
23.	TALK EXT (talk extension)	Used to consult privately with the station party on a trunk to station or a station to trunk call that is still under control of the console (the CONNECT bar has not been operated).
24.	ATT LINE (attendant line)	Used to make console-to-station calls.
25.	Pushbutton Dial	Used to dial all calls.
26.	CONNECT bar	Used to connect a station to a trunk on calls through the console.

TABLE 1.01 Controls and Indicators (Cont.)

ITEM	NAME	DESCRIPTION
27.	RELEASE bar	Used to release the attendant from a call.
28.	OUT PULSE lamp	Visual indication of digit outpulsing on Quick-Step dial operation.
29.	ATT TK lamps	Visual indications of local or tie trunk intercept calls.
30.	ATT TK I and ATT TK II (attendant trunks)	Used to answer incoming calls from stations.
31.	HOLD	Allows the attendant to place a trunk call on manual hold.
32.	Handset or Headset	Used by the attendant for all calls.

a. Grasp the upper corners of the faceplate with the forefingers.

b. Carefully lift the faceplate away from the console body.

To install a faceplate assembly:

a. Place the faceplate in position.

b. Carefully press the faceplate down until the faceplate edges are in contact with the console body.

CAUTION: Be careful not to scratch the top of the faceplate.

6.03 Key Assembly. To remove a key assembly

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove captive screw at each end of the key assembly.

c. Carefully lift out the key assembly and disconnect the 10 color-coded plugs on the bottom of the key assembly (note order of colored plugs). It may be necessary to disconnect the 50 pin connector on the console base to allow the key assembly to be moved enough to disconnect the color-coded plugs. Also for trunk key assemblies, the lamp strips adjacent to the key assembly must be removed to allow the key assembly to be completely removed.

To install a key assembly:

a. Connect the 10 color-coded plugs to the bottom of the key assembly (refer to previous paragraph 6.03, step c. or the wiring diagrams).

b. Carefully position the key assembly on the two mounting brackets.

c. Secure key assembly with two captive screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.04 Dial Assembly. To remove the dial assembly:

TABLE 1.02 Replacement Parts, Consoles 91660, 91670 (Reference Figure 1.03)

ITEM	DESCRIPTION	PART NUMBER
1.	Faceplate Assembly with Busy Lamp Field	97315-1
	without Busy Lamp Field	97314-1
2.	Key Assembly	97306-1
3.	Button Assembly (part of Item 2)	
4.	Cap (part of Item 2)	
5.	Designation Tab	91697-1
6.	Collar	97308-1
7.	Lamp	K51(A)745
8.	Dial Assembly	
	Tel-Touch	97316-1
	Quick-Step	*91716-1
9.	Connect/Release Switch	91676-1
10.	Network Assembly	**97310-1
11.	Horn Assembly	91696-1
12.	Printed Circuit Board (part of Quick-Step Dial Assembly)	
13.	Relays	97304-1
14.	Rocker Switch (two-position)	96903-1
15.	Rocker Switch (three-position)	96007-2
16.	Mounting Cords (control leads)	91700-1
17.	Mounting Cords (busy lamp leads)	91701-1
18.	Handset	91704-1
19.	Headset	***
20.	Busy Lamp Strip	95998-10
21.	Slide Switch	96245-1
22.	Amplifier Oscillator Assembly	90850-1
23.	Key Assembly	97305-1
24.	Double Plug	****
*	Superseded by:	Mod. 16086 (1) 79
	Quick-Step Dial w/mounting equip.	Mod. 16086 (2) 79
	Mounting equipment, only	750640-101
	Quick-Step Dial, only	
**	Superseded by Network Assembly	181427-101
	with Network Spacer	182175-101
***	Plantronics	Model MS-50/T55-002 or equivalent
****	Western Electric	Part No. 289B or equivalent
	Switchcraft	Part No. 412 or equivalent
	Trimm	Part No. 50E or equivalent

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Disconnect the connector for the dial assembly leads.

d. Remove two screws securing the dial assembly to the swing-out frame.

To install the dial assembly:

a. Secure the dial assembly to the swing-out frame with two screws.

b. Connect the connector for the dial assembly leads.

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.05 Connect/Release Switch. To remove the connect/release switch:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Unsolder the wires from the switch (note positions of wires).

d. Remove four screws securing the connect/release switch to the swing-out frame.

To install the connect/release switch:

a. Secure the connect/release switch to the swing-out frame with four screws.

b. Solder the wires to the connect/release switch terminals (refer to previous paragraph 6.05, step c. or the wiring diagrams).

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.06 Network Assembly. To remove the network assembly:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Disconnect the plug-in connctions from the network assembly (note locations of wires).

d. Release two plastic clips securing the network assembly to the console base.

To install the network assembly:

a. Position and secure the network assembly to the console base with two plastic clips.

b. Connect the plug-in connections to the network assembly (refer to pervious paragraph 6.06, step c. or the wiring diagrams).

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.07 Horn Assembly. To remove the horn assembly:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Remove two screws securing the horn assembly to the mounting bracket.

d. Remove two screws connecting the wires to the horn assembly.

To install the horn assembly:

a. Connect the wires to the horn assembly with two screws.

b. Secure the horn assembly to mounting bracket with two screws.

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.08 Printed Circuit Board. To remove the printed circuit board:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Unsolder the wires to the printed circuit board (note locations of wires).

d. Remove four screws securing the printed circuit board to the console base (the screws are on the underside of the console base).

To install the printed circuit board:

a. Position and secure the printed circuit board to the console base with four screws (screws are installed from under-side of the console base).

b. Solder the wires to the printed circuit board (refer to previous paragraph 6.08, step c. or the wiring diagrams).

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.09 Relays. To remove a relay:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Release the wire clip holding the relay and carefully pull the relay away from the connector.

To install a relay:

a. Carefully plug the relay into the connector and secure the relay with the wire clip.

b. Secure the swing-out frame with two screws.

c. Replace the faceplate assembly per paragraph 6.02.

6.10 Rocker Switches. To remove the rocker switch:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Unsolder the wires on the rocker switch (note locations of wires).

d. Remove two screws securing the rocker switch to the swing-out frame.

To install the rocker switch:

a. Secure the rocker switch to the swing-out frame with two screws.

b. Solder the wires to the rocker switch (refer to previous paragraph 6.10, step c. or the wiring diagrams).

c. Secure the swing-out frame with two screws.

d. Replace the faceplate assembly per paragraph 6.02.

6.11 Mounting Cords. The standard console is equipped with one 150 conductor cable; the console lamp field is equipped with two 150 conductor cables. Each cable is fitted with 3-50 pin connectors. In addition, a 3-conductor cord is provided on both consoles for connections of an external ringer. Lead assignments are shown in table 1.04.

To remove the mounting cords:

a. Remove the faceplate assembly per paragraph 6.02.

b. Remove two screws securing the top of the swing-out frame.

c. Carefully disconnect the mounting cord connectors inside the console (it may be necessary to disconnect the trunk key assemblies and the TB lamp assemblies to gain access to all connectors).

d. Unfasten the cord stay.

e. Carefully take the cables out through the cable holes at the rear of the console.

To install the mounting cords:

a. Carefully insert the cables through the cable holes at the rear of the console.

b. Fasten the cord stay.

c. Carefully connect the mounting cord connectors inside the console, ensuring they are mated with the appropriate connectors.

d. Secure the swing-out frame with two screws.

e. Replace the faceplate assembly per paragraph 6.02.

7.00 PARTS ASSEMBLY, CONSOLE 316619( )122.

7.01 General. The following paragraphs provide detailed instructions for the maintenance of consoles 316619( )122 with the new easy access swing-up mounting panel. Maintenance should be limited normally to the cleaning and replacement of items listed in table 1.03. Figure 1.04 presents an exploded view of console 316619(5)122 equipped with the busy lamp field and digital clock. Except for minor variations, the figure is applicable with all 316619( )122 consoles (see Table 1.00 Console Configuration).

7.02 Faceplate Assembly. To remove the faceplate assembly:

a. Grasp the upper corners of the faceplate with the forefingers.

b. Carefully lift the faceplate away from the console body.

To install the faceplate assembly:

a. Place the faceplate in position.

b. Carefully press the faceplate down until the faceplate edges are in contact with the console body.

CAUTION: Be careful not to scratch the top of the faceplate.

7.03 Key Assembly. To remove the key assembly:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove captive screw at each end of the key assembly.

c. Carefully lift out the key assembly and disconnect the 10 color-coded plugs on the bottom of the assembly. Beginning at the lower key (towards the front of console), the code is: blue, orange, green, brown, slate, white, red, black, yellow, violet.

d. When it is necessary to raise the swing-up mounting panel to facilitate maintenance, remove the two screws so designated on the top of the panel. Grasp the panel on each side and swing it up until the panel locks into the pivot brackets. The panel will be standing in an upright position.

To install a key assembly:

a. Connect the 10 color-coded plugs to the bottom of the key assembly. Refer to previous paragraph 7.03, step c. or the wiring diagram.

b. To lower the swing-up mounting panel, grasp each side of the panel, lift it straight up to unlock the pivot brackets, and lower the panel into position. Secure panel with the two screws.

c. Carefully position the key assembly on the mounting panel.

d. Secure key assembly with the two screws at each end.

TABLE 1.03 Replacement Parts, Consoles 316619( )122 (Reference Figure 1.04)

ITEM	DESCRIPTION	PART NUMBER
1.	Faceplate Assembly with Busy Lamp Field	97315-3
	without Busy Lamp Field	97314-3
2.	Key Assembly (Hold)	91720-1
3.	Button Assembly (part of Item 2)	
4.	Cap (part of Item 2)	
5.	Designation Tab	91697-1
6.	Collar	97308-1
7.	Lamp	K51(A)745
8.	Dial Assembly	
	Tel-Touch	97316-1
	Quick-Step	*91716-2
9.	Connect/Release Switch	91676-1
10.	Network Assembly	181427-101
11.	Network Spacer	182175-101
12.	Horn Assembly	91696-1
13.	Printed Circuit Board (part of Quick-Step Dial Assembly)	
14.	Rocker Switch (two-position)	96903-1
15.	Rocker Switch (three-position)	96007-2
16.	Mounting Cords (control leads)	91733-1
17.	Mounting Cords (busy lamp leads)	91701-1
18.	Handset	91704-1
19.	Headset	**
20.	Busy Lamp Strip	91729-1
21.	Slide Switch	97485-1
22.	Amplifier Oscillator Assembly	312337( )122
23.	Key Assembly (Trunk)	91721-1
24.	Double Plug	***
25.	Digital Clock Printed Circuit Board	312397( )122
*	Superseded by:	
	Quick-Step Dial w/mounting equip.	Mod. 16086 (1) 79
	Mounting equipment, only	Mod. 16086 (2) 79
	Quick-Step Dial, only	750640-101
**	Plantronics	Model MS-50/T55-002, or equivalent
***	Western Electric	Part No. 289B or equivalent
	Switchcraft	Part No. 412 or equivalent
	Trimm	Part No. 50E or equivalent

f. Replace the faceplate assembly per paragraph 7.02.

7.04 Dial Assembly. To remove the dial assembly:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Raise the swing-up mounting panel per paragraph 7.03, step d.

d. Remove the two screws securing the printed circuit board associated with the Quick-step dial assembly, when equipped, which are located on the underside of the console base.

e. Disconnect the connector for the dial assembly leads.

f. Remove two screws securing the dial assembly to the swing-up mounting panel.

To install the dial assembly:

a. Secure the dial assembly to the swing-up panel with two screws.

b. Connect the connector for the dial assembly leads.

c. Secure the printed circuit board associated with the Quick-step dial assembly, when equipped, with the screws installed from the underside of the console base.

d. Lower the swing-up mounting panel per paragraph 7.03 and secure with two screws as marked on the top of the panel.

e. Replace the faceplate assembly per paragraph 7.02.

7.05 Connect/Release Switch. To remove the connect/release switch:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Remove four screws from the underside of the console base which secure the mounting panel via two pivot brackets, to the console base.

d. Lift mounting panel up and tilt on one end.

e. Unsolder the wires from the switch (note positions of wires).

f. Remove four screws securing the connect/release switch to the swing-up panel.

To install the connect/release switch:

a. Secure the connect/release switch to the swing-up panel with four screws.

b. Solder the wires to the connect/release switch terminals (refer to previous paragraph 7.05, step e. or the wiring diagrams).

c. Secure the two pivot brackets holding the mounting panel with four screws, located on the underside of the console base.

d. Secure the mounting panel to the console per paragraph 7.03.

e. Replace the faceplate assembly per paragraph 7.02.

7.06 Network Assembly and Spacer. To remove the network assembly and spacer:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Raise the mounting panel into position per paragraph 7.03, step d.

d. Loosen screws and remove solderless connectors from the network assembly (note locations of wires).

e. Remove screws securing the network assembly and spacer to the console base (screws are installed from underside of console base).

To install the network assembly:

a. Position and secure the network assembly and spacer to the console base with screws (on the underside of the console base).

b. Connect solderless connectors to the network assembly (refer to pervious paragraph 7.06, step d.) and tighten screws.

c. Secure mounting panel to the console base per paragraph 7.03.

d. Replace the faceplate assembly per paragraph 7.02.

7.07 Horn Assembly. To remove the horn assembly:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Raise mounting panel per paragraph 7.03, step d.

d. Remove two screws securing the horn assembly to the mounting bracket.

e. Remove two screws connecting the wires to the horn assembly.

To install the horn assembly:

a. Connect the wires to the horn assembly with two screws.

b. Secure the horn assembly to mounting bracket with two screws.

c. Secure mounting panel with two screws.

d. Secure the swing-up mounting panel with two screws.

e. Replace the faceplate assembly per paragraph 7.02.

7.08 Printed Circuit Board. To remove the printed circuit board (PCB):

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Raise mounting panel per paragraph 7.03, step d.

d. Unsolder the wires on the printed circuit board (note locations of wires).

e. Disconnect the connector on the PCB.

f. Tilt console base upward to expose the tips of four plastic pins projecting through the base. Pinch the pin together, using long-nose pliers, and push pin inward to disconnect PCB from the console base.

To install the printed circuit board:

a. Position and secure the PCB to the base by the four plastic pins through the holes in the console base.

b. Solder the wires to the PCB (refer to paragraph 7.08, step d. or wiring diagram).

c. Connect the connector to the PCB.

d. Secure the mounting panel to the console base per paragraph 7.03.

e. Replace the faceplate assembly per paragraph 7.02.

7.09 Rocker Switches. To remove the rocker switch:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove two screws securing the top of the swing-up mounting panel.

c. Raise mounting panel per paragraph 7.03, step d.

d. Unsolder the wires on the rocker switch (note locations of wires).

e. Remove two screws securing the rocker switch to the swing-up mounting panel.

To install the rocker switch:

a. Secure the rocker switch to the swing-up mounting panel with two screws.

b. Solder the wires to the rocker switch (refer to previous paragraph 7.09, step d. or the wiring diagrams).

c. Secure the mounting panel per paragraph 7.03.

d. Replace the faceplate assembly per paragraph 7.02.

Mounting Cords. The standard console is equipped with one - 150 conductor cable; the console busy lamp field is also equipped with one - 150 conductor cable. Each cable is fitted with 3 - 50 pin connectors. In addition, a 3-conductor cord is provided on the consoles for connections of an external ringer. Lead assignments are shown in table 1.04.

To remove the mounting cords:

a. Remove the faceplate assembly per paragraph 7.02.

b. Remove the two screws securing the top of the swing-up mounting panel.

c. Raise the mounting panel into position per paragraph 7.03, step d.

d. Carefully disconnect the mounting cord inside the console.

e. Carefully take the cables out through the cable holes at the rear of the console.

To install the mounting cords:

a. Carefully insert the cables through the cable holes at the rear of the console.

b. Carefully connect the mounting cord inside the console.

c. Secure the mounting panel to the console base per paragraph 7.03.

d. Replace the faceplate assembly per paragraph 7.02.

8.00 CLEANING

8.01 Console. Maintenance of the console is limited to dusting with a clean cloth. In case of excessive dust accumulation, dampen the cloth with a mild cleaning solution before wiping the console.

8.02 Double Plug. The plug associated with the handset/headset may require periodic cleaning. Due to environmental conditions prevalent at the console location, the plug can become slightly tarnished.

To clean the plug:

a. Remove the plug from the jack.

b. Clean the plug with any Freon-type solution.

c. Polish with a clean cloth.

d. Replace the plug.

TABLE 1.04 Mounting Cord Assignments
CONSOLE MOUNTING CORD (Connector) 1
CONSOLE CONTROL LEADS

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	ALK	Attendant Line
R	1	BL-WH	ARK	Release
2T	27	WH-OR	CONK	Connect
R	2	OR-WH	TAC	Trunk Access
3T	28	WH-GN	24V	Power
R	3	GN-WH	AS-2	Trunk Restriction On
4T	29	WH-BN	TEK	Talk Extension
R	4	BN-WH	NS	Night Service
5T	30	WH-SL	POC	Power On Console
R	5	SL-WH	AS-1	Trunk Restriction On
6T	31	RD-BL	PC	Power
R	6	BL-RD	TEL	Talk Extension Lamp
7T	32	RD-OR	TCK	Talk City
R	7	OR-RD	DL-1	Dial Low 1
8T	33	RD-GN	24V	Power
R	8	GN-RD	24V	Power
9T	34	RD-BN	DL-2	Dial Low 2
R	9	BN-RD	TCL	Talk City Lamp
10T	35	RD-SL	AH	Attendant Flash
R	10	SL-RD	DL-4	Dial Low 4
11T	36	BK-BL	24V	Power
R	11	BL-BK	24V	Power
12T	37	BK-OR	DL-3	Dial Low 3
R	12	OR-BK	ALL	Attendant Line Lamp
13T	38	BK-GN	IRK	Busy Verification
R	13	GN-BK	24V	Power
14T	39	BK-BN	24V	Power
R	14	BN-BK	24V	Power
15T	40	BK-SL	DH-1	Dial High 1
R	15	SL-BK	DCP	Dial
16T	41	Y-BL	PK	Page
R	16	BL-Y	DH-3	Dial High 3
17T	42	Y-OR	GND	Ground
R	17	OR-Y	DH-2	Dial High 2
18T	43	Y-GN	OTR	Console Line Ring
R	18	GN-Y	OTT	Console Line Tip
19T	44	Y-BN	CCK	Code Call
R	19	BN-Y	L-MINOR	Minor Alarm Lamp
20T	45	Y-SL		Spare
R	20	SL-Y	L-MAJOR	Major Alarm Lamp
21T	46	VI-BL	PC	Power
R	21	BL-VI	CCL	Code Call Lamp
22T	47	VI-OR	CK	Conference
R	22	OR-VI	SBB	Standby Power On
23T	48	VI-GN	24V	Power
R	23	GN-VI	TRL	Trunk Restriction Lamp
24T	49	VI-BN	BUZ	Buzzer
R	24	BN-VI	CL	Conference Lamp
25T	50	VI-SL	TRK	Trunk Restriction
R	25	SL-VI	PL	Page Lamp

TABLE 1.04 Mounting Cord Assignments (Cont.)
CONSOLE MOUNTING CORD (Connector) 2
CONSOLE CONTROL LEADS

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	24V	Power
R	1	BL-WH	ATK-1	Attendant Trunk 1
2T	27	WH-OR	TSC	Trunk Switch Connect
R	2	OR-WH	TSW	Transfer Switch
3T	28	WH-GN	TS-24	Trunk Switch 24
R	3	GN-WH	ATL-1	Information Link 1 Lamp A
4T	29	WH-BN	TB-21	Trunk 21 Lamp B
R	4	BN-WH	TS-1	Trunk Switch
5T	30	WH-SL	TB-20	Trunk 20 Lamp B
R	5	SL-WH	GND	Ground
6T	31	RD-BL	TB-19	Trunk 19 Lamp B
R	6	BL-RD	TA-1	Trunk 1 Lamp A
7T	32	RD-OR	TB-9	Trunk 9 Lamp B
R	7	OR-RD	TS-2	Trunk Switch 2
8T	33	RD-GN	24V	Power
R	8	GN-RD	TB-24	Trunk 24 Lamp B
9T	34	RD-BN	TB-8	Trunk 8 Lamp B
R	9	BN-RD	TA-2	Trunk 2 Lamp A
10T	35	RD-SL	24V	Power
R	10	SL-RD	TS-3	Trunk Switch 3
11T	36	BK-BL	TB-7	Trunk 7 Lamp B
R	11	BL-BK	TB-23	Trunk 23 Lamp B
12T	37	BK-OR	24V	Power
R	12	OR-BK	TA-3	Trunk 3 Lamp A
13T	38	BK-GN	TB-6	Trunk 6 Lamp B
R	13	GN-BK	TS-4	Trunk Switch 4
14T	39	BK-BN	24V	Power
R	14	BN-BK	TB-22	Trunk 22 Lamp B
15T	40	BK-SL	TB-5	Trunk 5 Lamp B
R	15	SL-BK	TA-4	Trunk 4 Lamp A
16T	41	Y-BL	24V	Power
R	16	BL-Y	TS-5	Trunk Switch 5
17T	42	Y-OR	TB-4	Trunk 4 Lamp B
R	17	OR-Y	TA-9	Trunk 9 Lamp A
18T	43	Y-GN	24V	Power
R	18	GN-Y	TA-5	Trunk 5 Lamp A
19T	44	Y-BN	TB-3	Trunk 3 Lamp B
R	19	BN-Y	TS-6	Trunk Switch 6
20T	45	Y-SL	24V	Power
R	20	SL-Y	TS-9	Trunk Switch 9
21T	46	VI-BL	TB-2	Trunk 2 Lamp B
R	21	BL-VI	TA-6	Trunk 6 Lamp A
22T	47	VI-OR	24V	Power
R	22	OR-VI	TS-7	Trunk Switch 7
23T	48	VI-GN	TB-1	Trunk 1 Lamp B
R	23	GN-VI	TA-8	Trunk 8 Lamp A
24T	49	VI-BN	24V	Power
R	24	BN-VI	TA-7	Trunk 7 Lamp A
25T	50	VI-SL	IL-1	Information Link 1 Lamp B
R	25	SL-VI	TS-8	Trunk Switch 8

TABLE 1.04 Mounting Cord Assignments (Cont.)
CONSOLE MOUNTING CORD (Connector) 3
CONSOLE CONTROL LEADS

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	HLD	Hold
R	1	BL-WH	ATK-2	Attendant Link 2
2T	27	WH-OR	TA-21	Trunk 21 Lamp A
R	2	OR-WH	TA-23	Trunk 23 Lamp A
3T	28	WH-GN	TS-23	Trunk Switch 23
R	3	GN-WH	ATL-2	Information Link 2 Lamp A
4T	29	WH-BN	TS-19	Trunk Switch 19
R	4	BN-WH	TS-10	Trunk Switch 10
5T	30	WH-SL	TA-24	Trunk 24 Lamp A
R	5	SL-WH	TA-22	Trunk 22 Lamp A
6T	31	RD-BL	TA-19	Trunk 19 Lamp A
R	6	BL-RD	TA-10	Trunk 10 Lamp A
7T	32	RD-OR	TB-18	Trunk 18 Lamp B
R	7	OR-RD	TS-11	Trunk Switch 11
8T	33	RD-GN	24V	Power
R	8	GN-RD	TS-22	Trunk Switch 22
9T	34	RD-BN	TB-17	Trunk 17 Lamp B
R	9	BN-RD	TA-11	Trunk 11 Lamp A
10T	35	RD-SL	TS-21	Trunk Switch 21
R	10	SL-RD	TS-12	Trunk Switch 12
11T	36	BK-BL	TB-16	Trunk 16 Lamp B
R	11	BL-BK	TA-20	Trunk 20 Lamp A
12T	37	BK-OR	24V	Power
R	12	OR-BK	TA-12	Trunk 12 Lamp A
13T	38	BK-GN	TB-15	Trunk 15 Lamp B
R	13	GN-BK	TS-13	Trunk Switch 13
14T	39	BK-BN	24V	Power
R	14	BN-BK	TS-20	Trunk Switch 20
15T	40	BK-SL	TB-14	Trunk 14 Lamp B
R	15	SL-BK	TA-13	Trunk 13 Lamp A
16T	41	Y-BL	24V	Power
R	16	BL-Y	TS-14	Trunk Switch 14
17T	42	Y-OR	TB-13	Trunk 13 Lamp B
R	17	OR-Y	TA-18	Trunk 18 Lamp A
18T	43	Y-GN	24V	Power
R	18	GN-Y	TA-14	Trunk 14 Lamp A
19T	44	Y-BN	TB-12	Trunk 12 Lamp B
R	19	BN-Y	TS-15	Trunk Switch 15
20T	45	Y-SL	24V	Power
R	20	SL-Y	TS-18	Trunk Switch 18
21T	46	VI-BL	TB-11	Trunk 11 Lamp B
R	21	BL-VI	TA-15	Trunk 15 Lamp A
22T	47	VI-OR	24V	Power
R	22	OR-VI	TS-16	Trunk Switch 16
23T	48	VI-GN	TB-10	Trunk 10 Lamp B
R	23	GN-VI	TA-17	Trunk 17 Lamp A
24T	49	VI-BN	24V	Power
R	24	BN-VI	TA-16	Trunk 16 Lamp A
25T	50	VI-SL	IL-2	Information Link 2 Lamp B
R	25	SL-VI	TS-17	Trunk Switch 17

TABLE 1.04 Mounting Cord Assignments (Cont.)
CONSOLE MOUNTING CORD (Connector) 4
BUSY LAMP LEADS (00-39)

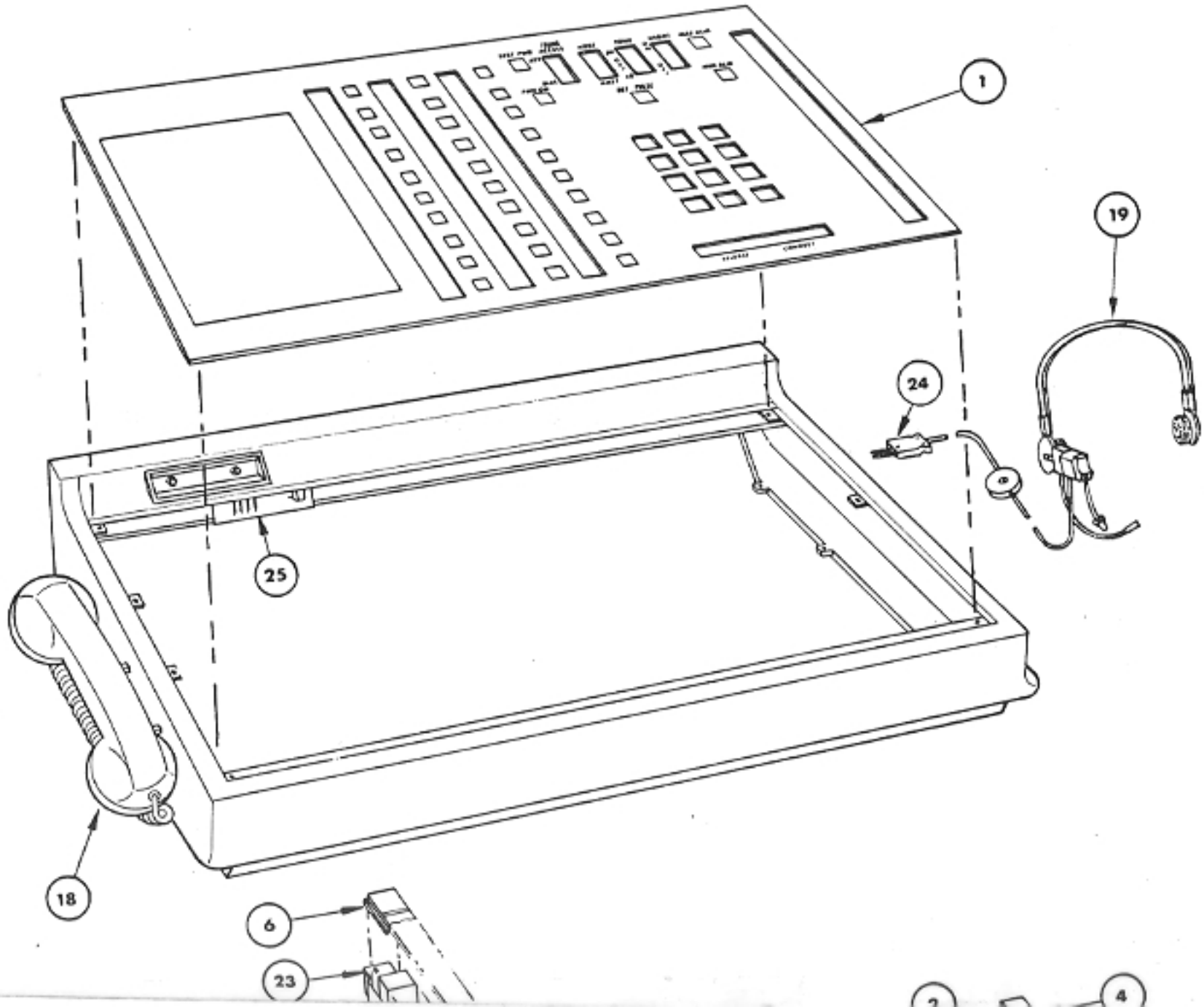
PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	GND	
R	1	BL-WH	GND	
2T	27	WH-OR	GND	
R	2	OR-WH	GND	
3T	28	WH-GN	GND	
R	3	GN-WH	GND	
4T	29	WH-BN	GND	
R	4	BN-WH	GND	
5T	30	WH-SL	BL-01	
R	5	SL-WH	BL-00	
6T	31	RD-BL	BL-03	
R	6	BL-RD	BL-02	
7T	32	RD-OR	BL-05	
R	7	OR-RD	BL-04	
8T	33	RD-GN	BL-07	
R	8	GN-RD	BL-06	
9T	34	RD-BN	BL-09	Busy Lamp
R	9	BN-RD	BL-08	—
10T	35	RD-SL	BL-11	Connections
R	10	SL-RD	BL-10	
11T	36	BK-BL	BL-13	
R	11	BL-BK	BL-12	
12T	37	BK-OR	BL-15	
R	12	OR-BK	BL-14	
13T	38	BK-GN	BL-17	
R	13	GN-BK	BL-16	
14T	39	BK-BN	BL-19	
R	14	BN-BK	BL-18	
15T	40	BK-SL	BL-21	
R	15	SL-BK	BL-20	
16T	41	Y-BL	BL-23	
R	16	BL-Y	BL-22	
17T	42	Y-OR	BL-25	
R	17	OR-Y	BL-24	
18T	43	Y-GN	BL-27	
R	18	GN-Y	BL-26	
19T	44	Y-BN	BL-29	
R	19	BN-Y	BL-28	
20T	45	Y-SL	BL-31	
R	20	SL-Y	BL-30	
21T	46	VI-BL	BL-33	
R	21	BL-VI	BL-32	
22T	47	VI-OR	BL-35	
R	22	OR-VI	BL-34	
23T	48	VI-GN	BL-37	
R	23	GN-VI	BL-36	
24T	49	VI-BN	BL-39	
R	24	BN-VI	BL-38	
25T	50	VI-SL		Spare
R	25	SL-VI		Spare

TABLE 1.04 Mounting Cord Assignments (Cont.)
CONSOLE MOUNTING CORD (Connector) 5
BUSY LAMP LEADS (40-79)

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	GND	
R	1	BL-WH	GND	
2T	27	WH-OR	GND	
R	2	OR-WH	GND	
3T	28	WH-GN	GND	
R	3	GN-WH	GND	
4T	29	WH-BN	GND	
R	4	BN-WH	GND	
5T	30	WH-SL	BL-41	
R	5	SL-WH	BL-40	
6T	31	RD-BL	BL-43	
R	6	BL-RD	BL-42	
7T	32	RD-OR	BL-45	
R	7	OR-RD	BL-44	
8T	33	RD-GN	BL-47	
R	8	GN-RD	BL-46	
9T	34	RD-BN	BL-49	
R	9	BN-RD	BL-48	
10T	35	RD-SL	BL-51	
R	10	SL-RD	BL-50	Busy Lamp
11T	36	BK-BL	BL-53	
R	11	BL-BK	BL-52	Connections
12T	37	BK-OR	BL-55	
R	12	OR-BK	BL-54	
13T	38	BK-GN	BL-57	
R	13	GN-BK	BL-56	
14T	39	BK-BN	BL-59	
R	14	BN-BK	BL-58	
15T	40	BK-SL	BL-61	
R	15	SL-BK	BL-60	
16T	41	Y-BL	BL-63	
R	16	BL-Y	BL-62	
17T	42	Y-OR	BL-65	
R	17	OR-Y	BL-64	
18T	43	Y-GN	BL-67	
R	18	GN-Y	BL-66	
19T	44	Y-BN	BL-69	
R	19	BN-Y	BL-68	
20T	45	Y-SL	BL-71	
R	20	SL-Y	BL-70	
21T	46	VI-BL	BL-73	
R	21	BL-VI	BL-72	
22T	47	VI-OR	BL-75	
R	22	OR-VI	BL-74	
23T	48	VI-GN	BL-77	
R	23	GN-VI	BL-76	
24T	49	VI-BN	BL-79	
R	24	BN-VI	BL-78	
25T	50	VI-SL		Spare
R	25	SL-VI		Spare

TABLE 1.04 Mounting Cord Assignments (Cont.)
CONSOLE MOUNTING CORD (Connector) 6
BUSY LAMP LEADS (80-99)

PAIR	PIN	COLOR	LEAD DESIGNATION	USAGE
1T	26	WH-BL	GND	
R	1	BL-WH	GND	
2T	27	WH-OR	GND	
R	2	OR-WH	GND	
3T	28	WH-GN	BL-81	
R	3	GN-WH	BL-80	
4T	29	WH-BN	BL-83	
R	4	BN-WH	BL-82	
5T	30	WH-SL	BL-85	
R	5	SL-WH	BL-84	Busy Lamp
6T	31	RD-BL	BL-87	
R	6	BL-RD	BL-86	Connections
7T	32	RD-OR	BL-89	
R	7	OR-RD	BL-88	
8T	33	RD-GN	BL-91	
R	8	GN-RD	BL-90	
9T	34	RD-BN	BL-93	
R	9	BN-RD	BL-92	
10T	35	RD-SL	BL-95	
R	10	SL-RD	BL-94	
11T	36	BK-BL	BL-97	
R	11	BL-BK	BL-96	
12T	37	BK-OR	BL-99	
R	12	OR-BK	BL-98	
13T	38	BK-GN	GND	
R	13	GN-BK	24V	
14T	39	BK-BN	GND	
R	14	BN-BK	24V	
15T	40	BK-SL	GND	
R	15	SL-BK	24V	Digital Clock
16T	41	Y-BL	GND	
R	16	BL-Y	24V	Connections
17T	42	Y-OR	GND	
R	17	OR-Y	24V	
18T	43	Y-GN	GND	
R	18	GN-Y	24V	
19T	44	Y-BN	GND	
R	19	BN-Y		
20T	45	Y-SL		
R	20	SL-Y		
21T	46	VI-BL		
R	21	BL-VI		
22T	47	VI-OR		Spare
R	22	OR-VI		
23T	48	VI-GN		
R	23	GN-VI		
24T	49	VI-BN		
R	24	BN-VI		
25T	50	VI-SL		
R	25	SL-VI		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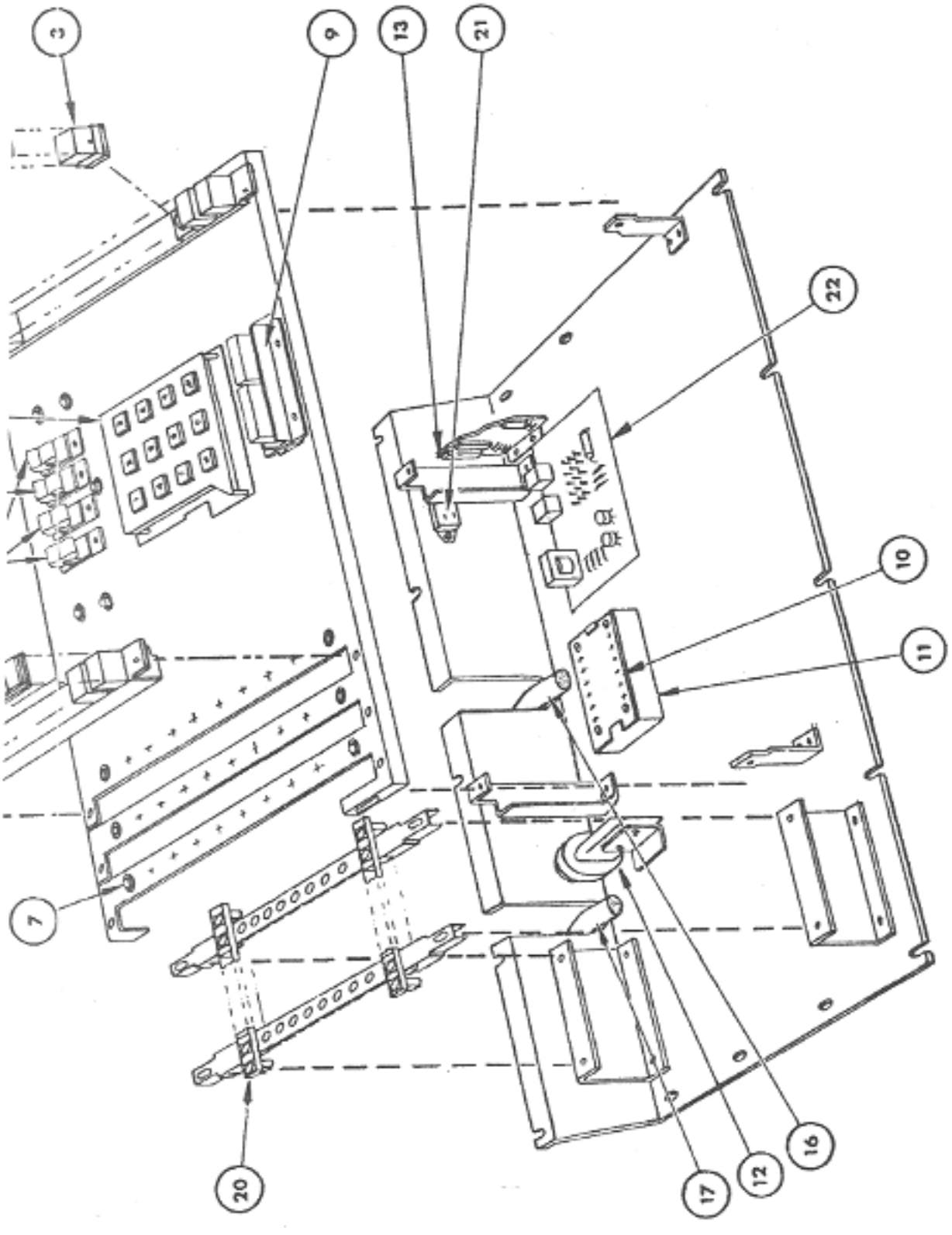
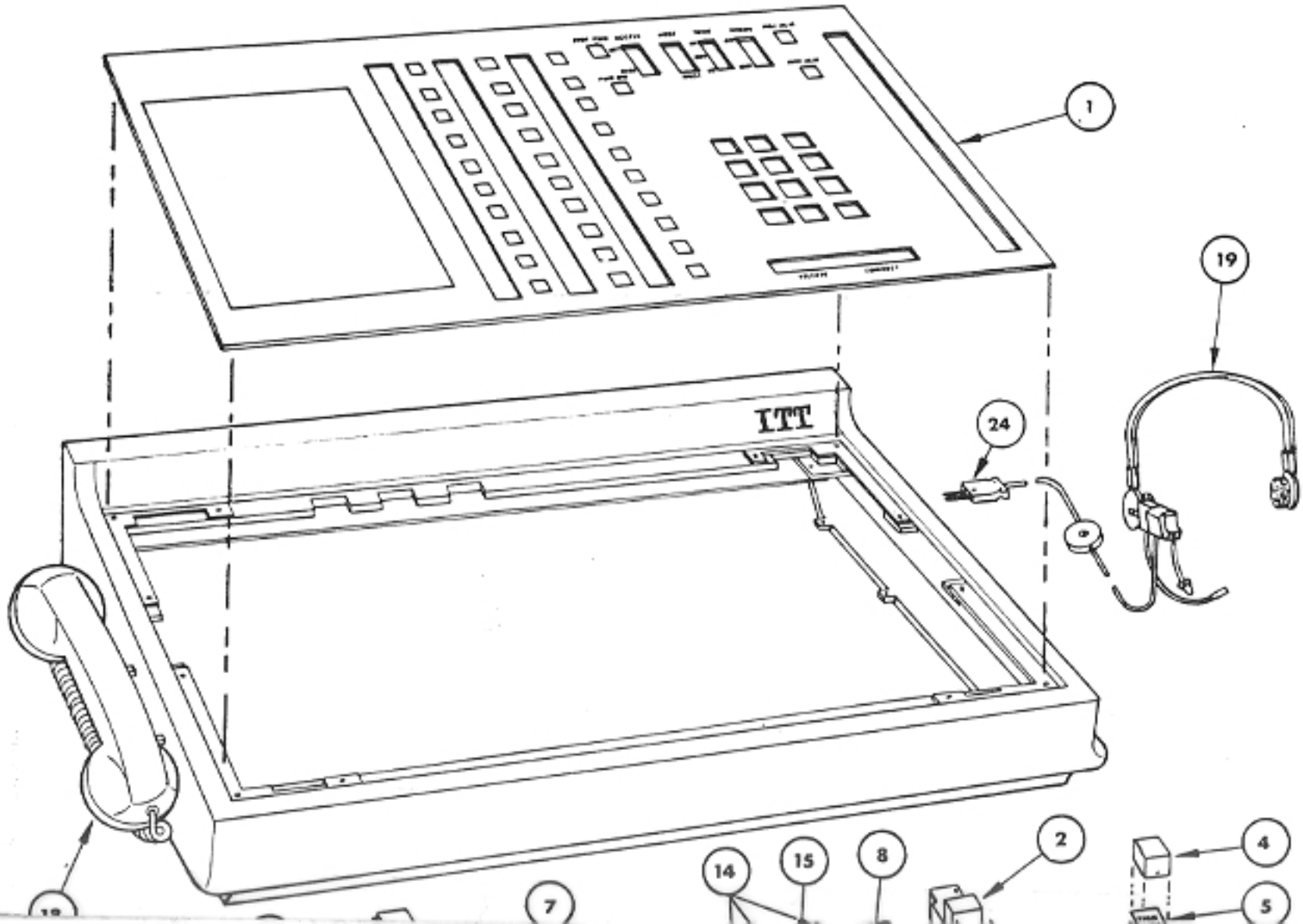


FIGURE 1.04 Console (316619) Exploded View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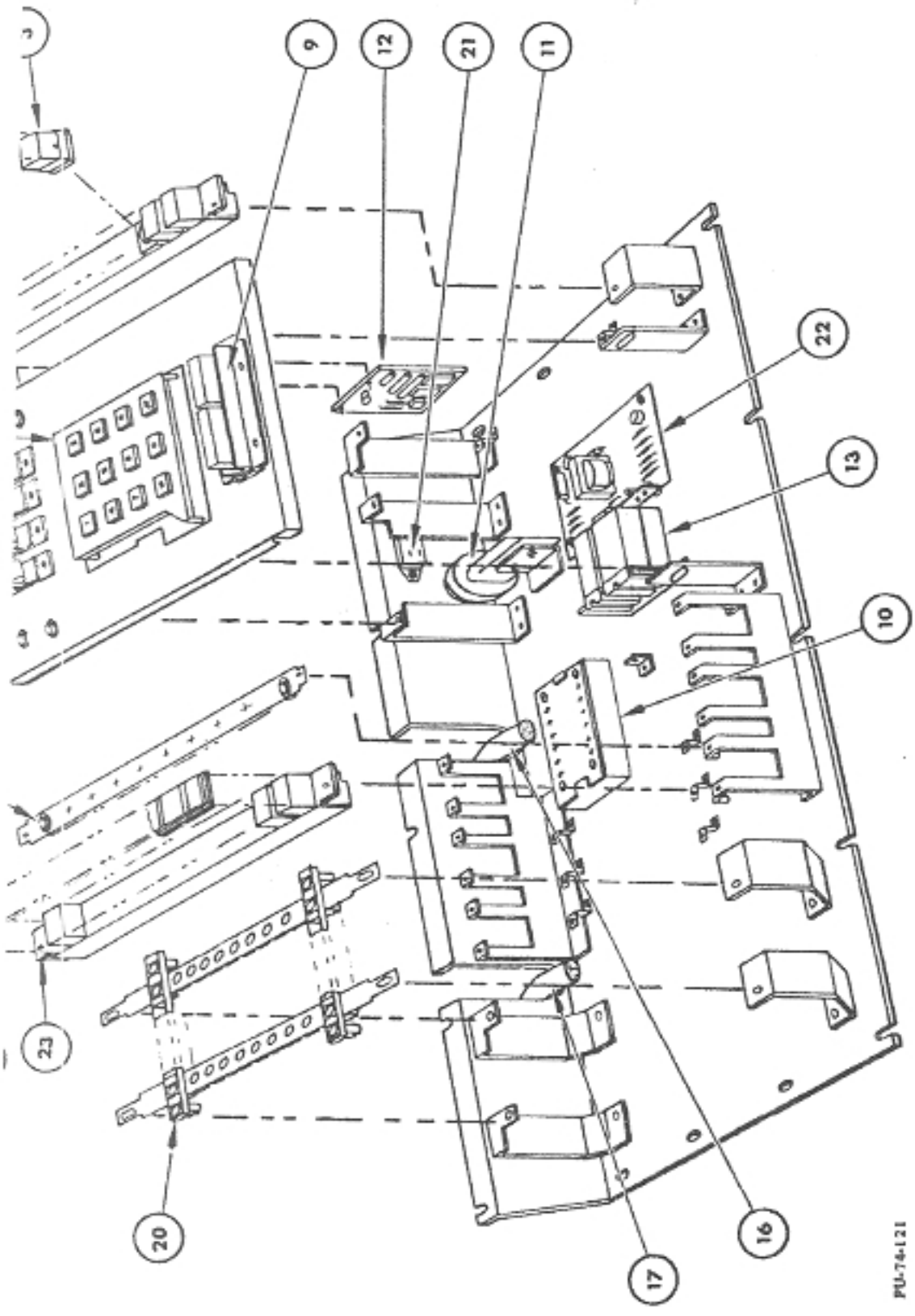

FIGURE 1.03 Console (91670) Exploded View

MAINTENANCE GUIDE
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides information concerning maintenance of the TD-100 electronic private automatic branch exchange (EPABX). It is intended as a general guide to be used by maintenance personnel in locating and correcting troubles in the TD-100 system.

The section is divided into two parts. The first part, paragraphs 2.00 through 2.03, describes the alarm panel board, explains the functions of the associated test jacks, indicators and switches, and discusses their use in analyzing system malfunctions. The second part, paragraphs 3.00 through 3.05, provides tables for narrowing a failure down to a replaceable printed circuit card assembly. The tables have been compiled from actual field service reports and reflect only problems which have occurred in working systems. The tables will be periodically revised to reflect the latest field service repair information.

While the probable causes and solutions in the trouble analysis tables are valid, they are by no means the only solutions to the stated troubles. Where the recommended solutions or card replacements do not correct a trouble, they should serve to direct the technician to the general area of concern.

To be able to diagnose, locate, and correct problems in the TD-100 EPABX, the technician should have a working knowledge of the components which make up the system, and a good understanding of the principals of TDM (time division multiplex) switching. It is the purpose then, of this document, to assist maintenance personnel in learning to diagnose and correct system malfunctions.

1.02 Related Documents and Drawings. The principal documents and drawings for the TD-100 EPABX are listed in Section OA-000-001, General Information - TD-100 EPABX. Included in the above document is a brief description of each of the systems printed circuit cards. Card quantities are indicated, and the basic functions of each card are summarized.

For system maintenance, the documents listed in paragraphs a through d below, should be consulted.

a. OC-000-001, General Maintenance Information, TD-100 EPABX. This document provides information concerning regular system maintenance. It includes test procedures for checking both standard and optional features.

b. OC-000-002, Access Test Set, TD-100 EPABX. This document provides general information concerning operation and use of the optional access test set.

c. OC-000-003, Console Maintenance, TD-100 EPABX. This document provides instructions for maintaining the TD-100 console. It includes a console parts explosion drawing and information concerning removal and replacement of the major components (push-button switches, lamps, etc.).

d. OB-000-003, Feature Strapping, TD-100 EPABX. This document provides information regarding how to strap the system for the required standard or optional service features.

2.00 ALARM PANEL BOARD

2.01 General. The alarm panel board, see figure 1.00, is a useful tool for analyzing system malfunctions. In the event of a failure, this board should be checked since, in most cases, it will indicate the cause of a failure or give the technician an indication of where to look for the trouble.

The alarm panel board is located on the left side of the top subrack in the equipment cabinet. It accommodates test jacks for measuring various power supply outputs, light emitting diodes (LED's) which provide visual indications of system alarms, and toggle switches for testing and/or resetting the TD-100 audible and visual alarm devices.

2.02 Test Jacks. Test jacks at the top of the alarm panel board permit the technician to measure the various outputs of the power supply. Table 1.00 lists each test jack, the voltage which should be measured at the test jack, and the actual points where the voltage should be measured. In the event of a system failure, these test jacks should be checked to be certain that power supply outputs are within their specified tolerances.

2.03 Indicators and Controls. In table 1.01, the functions of the indicators and controls on the alarm panel board are explained. All indicators on the board are light emitting diodes (LED's). The green PS LED is normally lighted; the others are normally extinguished. The LED's change state to indicate a failure.

The alarm panel board is arranged so that any LED which changes state (lights or extinguishes) to indicate a failure, will remain in the changed condition until the trouble is cleared and the TEST/RESET

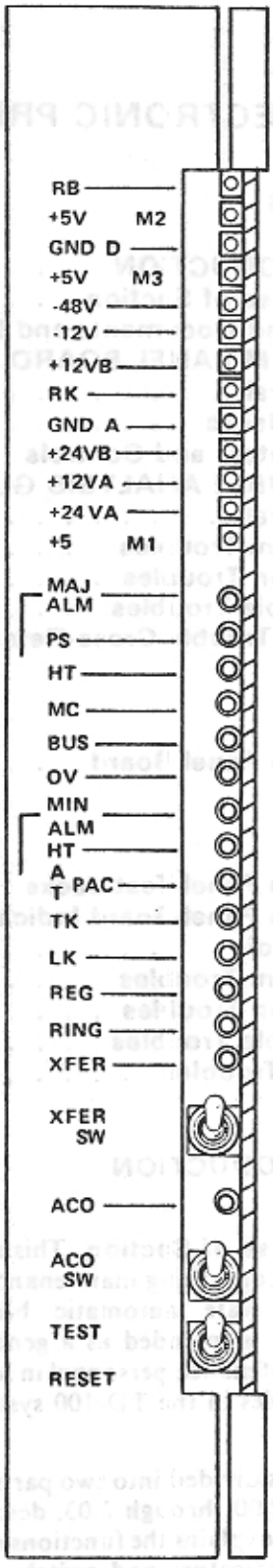

FIGURE 1.00 Alarm Panel Board

TABLE 1.00 Alarm Panel Test Jacks

DESIGNATION	FUNCTION	MEASURED POTENTIAL
RB	Ring battery for loop ringing on line cards.	85 to 120 V interrupted AC superimposed on -48 VDC. Measure between test jacks RB and GND D.
+5V M2	Logic voltage for middle subrack.	4.75 to 5.7 VDC Measure between test jacks +5V M2 and GND A.
GND D	Ground D.	
+5V M3	Logic voltage for bottom subrack.	4.75 to 5.7 VDC Measure between test jacks +5V M3 and GND A.
-48V	Talk battery for line and trunk circuits.	-48 ± 6 VDC Measure between test jack -48V and GND C on the upper and lower mother boards.
-12V	Logic voltage for processor and memory boards.	-12 ± 0.6 VDC Measure between test jacks -12V and GND D.
+12VB	Lamp voltage for key telephones.	+12 ± 3 VDC Measure between test jacks +12VB and GND D.
RK	Ringing voltage for common audible ringer.	85 to 120 VAC Measure between test jacks RK and GND D.
GND A	Ground A.	
+24VB	Voltage for various console lamps and controls	+24 ± 2.4 VDC Measure between test jack +24VB and GND B on the mother board.

TABLE 1.00 Alarm Panel Test Jacks (Cont.)

DESIGNATION	FUNCTION	MEASURED POTENTIAL
+12VA	Bias voltage for speech common highway.	+12 ± 1.2 VDC Measure between test jacks +12VA and GND A.
+24VA	Voltage for operational amplifiers.	+24 ± 2.4 VDC Measure between test jacks +24VA and GND A.
+5 M1	Logic voltage for top subrack.	4.75 to 5.7 VDC Measure between test jacks +5V M1 and GND A.

switch at the bottom of the alarm panel is operated to reset the alarm circuitry.

The five LED's directly under the MAJ ALM indicator (PS, HT, MC, BUS, and OV) serve to indicate various types of major alarms. Should one of these LED's change state, a major alarm will occur and the MAJ ALM LED will light. In this way, the type of failure will be apparent. Similarly, the six LED's directly under the MIN ALM indicator (HT, AT PAC, TK, LK, REG, and RING) serve to identify various types of minor alarms. Should one of these LED's light, the MIN ALM LED will also light.

Functions of the switches at the bottom of the alarm panel board are outlined in table 1.01. As shown in figure 1.00, the switches designated XFER and ACO have LED's associated with them. The functions of these LED's are described in the table.

3.00 TROUBLE ANALYSIS GUIDE

3.01 General. Lists of system, station, and console malfunctions, their probable causes (where applicable), and suggested remedies are given in tables 1.02, 1.03, and 1.04. These tables have been prepared from actual field service reports; therefore, only troubles which have occurred in working systems are listed. As more data becomes available, these tables will be revised and reissued to keep them current.

3.02 System Troubles. Table 1.02 includes a list of troubles most closely associated with system operation. These are general type troubles and do not apply to a particular EPABX station or to console operation. To make the table as useful as possible, troubles are grouped into four categories. These are: trunk related failures, station related failures, feature related failures, and other (miscellaneous) failures. Where a failure is similar to one in another category on the same table, or to a failure listed on another table, the other category or table entry is referenced in the column designated SYMPTOM.

3.03 Station Troubles. Table 1.03 includes a list of troubles which would normally be reported by EPABX station users. The table is broken up into five categories. These are: dial tone failures, transmission failures, ringing failures, signaling and control failures, and miscellaneous failures. As in tables 1.02 and 1.04, where a failure is similar to one in another category on the same table, or to a failure listed on another table, it is noted in the column designated SYMPTOM.

3.04 Console Troubles. A list of troubles unique to console operation is provided in table 1.04. These troubles are the types which would normally be

TABLE 1.01 Alarm Panel Board Indicators and Controls

PANEL DESIGNATION	DESCRIPTION	FUNCTION
MAJ ALM	Red LED	The MAJ ALM (major alarm) LED lights to indicate a major system alarm. It lights when the PS LED extinguishes, or when the HT, MC, BUS, or OV LED's light. When a major alarm occurs, the power failure transfer circuit is enabled to connect selected EPABX stations and/or the console to the C.O. via predetermined trunks.
PS	Green LED	The PS (power supply) LED monitors the TD-100 power supply. It is normally lit. It extinguishes when an output of the power supply exhibits an incorrect tolerance.
MC	Red LED	The MC (master clock) LED lights to indicate failure of the master clock on the common services PCB.
BUS	Red LED	The BUS LED lights to indicate a failure of the common bus.
OV	Red LED	The OV (overvoltage) LED lights to indicate a power supply overvoltage.
MIN ALM	Red LED	The MIN ALM (minor alarm) LED lights to indicate a minor system failure. It lights whenever the HT, AT PAC, LK, TK, REG, or RING LED's light. When such an alarm occurs, the system is still capable of completing calls; however, there is a slight deterioration of service.
HT	Red LED	The HT (high temperature) LED lights to indicate the temperature of the TD-100 equipment cabinet has exceeded the specified operating limits.
AT PAC	Red LED	The AT PAC (attendant package) LED lights to indicate a failure in an attendant circuit.
TK	Red LED	The TK (trunk) LED lights to indicate a failure in one or more trunk boards.
LK	Red LED	The LK (link) LED lights to indicate a failure in one or more link boards.

TABLE 1.01 Alarm Panel Board Indicators and Controls (Cont.)

PANEL DESIGNATION	DESCRIPTION	FUNCTION
REG	Red LED	The REG (register) LED lights to indicate a failure in one or more register boards.
RING	Red LED	Not used.
XFER	Red LED	The XFER (transfer) LED lights to indicate the TD-100 EPABX has transferred to the power failure transfer mode of operation. It lights when automatic transfer occurs, or when the transfer switch on the console or the XFER switch on the alarm panel board is used to affect manual transfer.
XFER	2-Position Toggle Switch	The XFER switch is used to manually transfer the system to the power failure transfer mode of operation.
AC0	Red LED	The AC0 (alarm cutoff) LED lights whenever the AC0 switch is operated.
AC0	2-Position Toggle Switch	The AC0 switch is used to cut off (disable) any audible alarms in the event of a major or minor alarm.
TEST/RESET	3-Position Toggle Switch	This switch is used to test the LED's on the alarm panel and the alarm lamps on the attendant console, or to reset the alarm panel circuitry. When placed in the TEST position, the LED's on the alarm panel and the alarm lamps on the attendant console light. When operated to the RESET position, the console alarm lamps and any lighted alarm panel LED's extinguish.

reported by a console attendant. The troubles on this table are arranged in five categories. These are: call completing failures, call holding failures, trunk related failures, transmission failures, and miscellaneous failures. Where a trouble is similar to one in another part of the same table, or to a trouble in table 1.02 or 1.03, the proper cross-reference is noted in the SYMPTOM column.

3.05 PCB/Trouble Cross-Reference. In table 1.05, the troubles in tables 1.02, 1.03, and 1.04 are grouped according to printed circuit board (PCB). The table lists the troubles which can be associated with a particular printed circuit board. Each entry is cross-referenced to one or more entries in tables 1.02, 1.03, or 1.04.

TABLE 1.02 System Troubles

SYMPTOM	PROBABLE CAUSE	REMEDY
I. Trunk Related Failures		
a. Trunk dropping calls	Improper strapping.	Correct strapping on trunk PCB.
	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
	Telephone company trunk trouble.	Check trunk facility, repair as necessary.
	Defective processor card.	Replace processor II PCB, TD-4101636.
	Misoperation on transfer.	See item Ib.
b. Trunk drops when transferred.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
	Defective processor card.	Check and if necessary, replace processor I and/or processor II PCB's, TD-4101626 and TD-4101636.
	Defective transfer link.	Replace transfer and add-on links PCB, TD-4101706.
c. Trunk drops when transferred to busy station.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
	Defective processor card.	Check and if necessary, replace processor I and/or processor II PCB's, TD-4101626 and TD-4101636.
d. Local stations hear camp-on busy tone when attendant extends call to odd numbered station.	Defective memory.	Replace memory PCB, TD-4101616.
e. Dropping calls; blast of camp-on-busy tone to station when call is connected by attendant.	Defective attendant register and links card.	Replace attendant register and links PCB, TD-4101696.

TABLE 1.02 System Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
I. Trunk Related Failures (Cont.)		
f. CO trunk won't release.	Faulty CO trunk.	Replace CO trunk PCB, TD-4101536.
	Central office trunk trouble.	Check trunk facility, repair as necessary.
	Defective transfer link.	Replace transfer and add-on links PCB, TD-4101706.
	Defective processor card.	Replace processor I, PCB TD-4101626.
g. No talk path or intermittant talk path on trunk.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
h. Ground start trunk does not work on ANA or UNA.	CO ringing to wrong side of line.	Correct trunk wiring.
i. Can't dial out on trunk.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
II. Station Related Failures		
a. Ring tone hard to hear.	Defective common services card.	Replace common services PCB, TD-4101596.
b. Cannot complete calls to certain EPABX stations.	Defective memory.	Replace memory PCB, TD-4101616.
	Defective station hunt card.	Replace station hunt PCB, TD-4101656.
c. Call dropped when transferred to busy station. (Also see Ib and c.)	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
	Defective processor card.	Check and if necessary, replace processor I and/or processor II PCB's. TD-4101626 and TD-4101636.

TABLE 1.02 System Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
II. Station Related Failures (Cont.)		
d. Local calls not going to proper stations.	Station hunt card blocks digits from register to memory.	Replace station hunt PCB, TD-4101656.
	Defective class of service card.	Replace class of service PCB, TD-4101606.
	Number changed in memory.	Replace memory PCB, TD-4101616.
	Defective register.	Replace register PCB, TD-4101666.
e. All stations receive busy tone.	Defective processor card.	Replace processor I PCB, TD-4101626.
f. Stations do not ring when dialed.	Faulty power supply.	Repair or replace power supply, TD-4200237 or TD-4200341.
g. Stations receive reorder tone when they go off-hook.	Defective common control card.	Replace control cards one at a time until the defective card is located. Replace cards in the following order. 1. Common services PCB, TD-4101596. 2. Processor I and II PCB's, TD-4101626 and TD-4101636.
h. EPABX stations cannot call other stations; system locked up. (See table 1.03, item Vb.)	Faulty strapping of master and slave numbers.	Check and if necessary correct strapping on station hunt PCB.
	Defective station hunt PCB.	Replace station hunt PCB, TD-4101656.
i. Stations can't transfer calls.	Can't access link.	Replace transfer and add-on links PCB, TD-4101706.
III. Feature Related Failures		
a. Toll restriction inoperative.	Improper class of service strapping or defective PCB.	Correct strapping or replace class of service PCB, TD-4101606.

TABLE 1.02 System Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
III. Feature Related Failures (Cont.)		
	Defective processor card.	Replace processor I PCB, TD-4101626.
b. Paging inoperative.	Strapping error.	Correct strapping on paging access PCB.
	Improper wiring.	Correct distributing frame wiring.
	Defective paging access card.	Replace paging access PCB, TD-4101926.
c. UNA audible signal device inoperative.	Improper wiring.	Check and if necessary, correct UNA bell wiring.
	Defective alarm card.	Replace alarm panel PCB, TD-4101786.
	Defective processor card.	Replace processor II PCB, TD-4101636.
d. UNA does not work properly.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
e. ANA inoperative.	Defective processor card.	Replace processor II PCB, TD-4101636.
f. Station hunt inoperative.	Defective station hunt card.	Replace station hunt PCB, TD-4101656.
IV. Other System Failures		
a. No dial tone; system operational.	Defective common services card.	Replace common services PCB, TD-4101596.
	Defective processor card.	Replace processor I PCB, TD-4101626.
	Defective memory.	Replace memory PCB, TD-4101616.
	Blown fuse on processor card.	Replace fuse.

TABLE 1.02 System Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
IV. Other System Failures (Cont.)		
b. No dial tone.	-12V power supply failure. (Faulty power supply control card.)	Repair or replace power supply control PCB, TD-4101766.
c. Dial tone on speech.	Defective common services card.	Replace common services PCB, TD-4101596.
d. Continuous dial tone, ring tone, busy tone.	Defective common services card.	Replace common services PCB, TD-4101596.
e. Busy tone missing or erratic.	Defective common services card.	Replace common services PCB, TD-4101596.
f. Busy tone on dial tone.	Defective processor card.	Replace processor II PCB, TD-4101636.
g. Busy tone on speech.	Defective common services card.	Replace common services PCB, TD-4101596.
	Defective processor card.	Replace processor II PCB, TD-4101636.
h. Ring tone on dial tone.	Defective common services card.	Replace common services PCB, TD-4101596.
i. Crosstalk.	Defective FET (field effect transistor) on any line or channel board.	Replace line PCB, TD-4101516; or trunk PCB, TD-410XXXX; or common services PCB, TD-4101596.
j. Transmission noise.	Poor system ground.	Correct as necessary.
	Defective common services card.	Replace common services PCB, TD-4101596.

TABLE 1.03 Station Troubles

SYMPTOM	PROBABLE CAUSE	REMEDY
I. Dial Tone Failures		
a. Single line rotary dial telephone cannot break dial tone.	Strapping error, A and A1 leads.	Make certain A and A1 leads are tied together on the line PCB or distributing frame.
	Telephone defective or not properly modified.	Replace defective telephone or modify telephone for A lead operation.
	Line card not repeating dial pulses.	Replace line PCB, TD-4101516.
	Defective register.	Replace register PCB, TD-4101666.
b. Tel-Touch telephone cannot break dial tone.	Tip and ring leads reversed on telephone.	Modify telephone.
	Defective Tel-Touch receiver.	Replace Tel-Touch receiver PCB, TD-4101676.
	Defective register.	Replace register PCB, TD-4101666.
c. No dial tone at one EPABX station.	Frame cabling error.	Correct cabling from TD-100 to telephone.
	Defective telephone.	Replace telephone or correct defect.
	Defective line card.	Replace line PCB, TD-4101516.
d. One EPABX station receives reorder tone instead of dial tone when it goes off-hook. (See table 1.02, item IIg.)	Improper strapping.	Correct strapping on class of service PCB.
	Defective line card.	Replace line PCB, TD-4101516.
e. EPABX station receives ringback tone instead of dial tone when it goes off-hook.	Defective line card.	Replace line PCB, TD-4101516.
	Defective register.	Replace register PCB, TD-4101666.

TABLE 1.03 Station Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
II. Transmission Failures		
a. One-way transmission.	Short on common highway.	Replace line PCB, TD-4101516. Replace trunk PCB, TD-410XXXX. Replace common services PCB, TD-4101596.
b. Speech fading at one station.	Defective amplifier.	Replace line PCB, TD-4101516.
c. Transmission bad between attendant and station. (See item IVa, table 1.04.)	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
	Defective line card.	Replace line PCB, TD-4101516.
III. Ringing Failures		
a. EPABX station does not ring when dialed. (See table 1.02, item IIf.)	Improper telephone connections.	Correct wiring.
	Faulty line card.	Replace line PCB, TD-4101516.
	Dialed number terminates in memory.	Replace memory PCB, TD-4101616.
b. Called station (single line telephone) rings continuously when dialed.	Defective power supply.	Repair or replace power supply.
	Defective common services card.	Replace common services PCB, TD-4101596.
c. Called station (key telephone) rings continuously.	Defective power supply control card.	Replace power supply control PCB, TD-4101766.
	Defective common services card.	Replace common services PCB, TD-4101596.

TABLE 1.03 Station Troubles (Cont.)		
SYMPTOM	PROBABLE CAUSE	REMEDY
IV. Signaling and Control Failures		
a. Key telephone cannot place call on hold.	Short between A and A1 leads.	Check and if necessary correct frame wiring. Check strap on line card; if necessary, remove strap.
	Defective line card.	Check and if necessary replace line PCB, TD-4101516.
b. Calls lost during station transfer.	Defective transfer link.	Replace transfer and add-on links PCB, TD-4101706.
V. Miscellaneous Failures		
a. Lamp on key telephone inoperative.	Burned out lamp.	Replace lamp.
	Cabling error.	Correct cabling from TD-100 to key telephone.
	Faulty lamp driver.	Replace line PCB, TD-4101516.
b. EPABX station cannot call other stations; system locked up. (See table 1.02, item IIh and table 1.04, item Ig.)	Faulty strapping of master and slave numbers.	Check and if necessary correct strapping on station hunt PCB.
	Defective station hunt PCB.	Replace station hunt PCB, TD-4101656.
c. Station calls busy line; breaks in on call.	Defective processor card.	Replace processor II PCB, TD-4101636.

TABLE 1.04 Console Troubles

SYMPTOM	PROBABLE CAUSE	REMEDY
I. Call Completing Failures		
a. Attendant extended call drops when answered at EPABX station.	Defective line card.	Replace line PCB, TD-4101516.
b. Attendant extended call drops when attendant hits CONNECT bar.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
c. Call drops after attendant hits RELEASE bar.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
d. Attendant gets wrong numbers.	Defective console dial pad.	Replace dial pad.
	Defective attendant register and links card.	Replace attendant register and links PCB, TD-4101696.
	Defective class of service card.	Replace class of service PCB, TD-4101606.
e. Attendant cannot always complete CO trunk calls.	Defective dial on console.	Replace quick-step dial.
f. Attendant cannot extend or transfer incoming calls.	Defective processor card.	Replace processor I PCB, TD-4101626.
	Defective attendant register and links card.	Replace attendant register and links PCB, TD-4101696.
	Defective memory.	Replace memory PCB, TD-4101616.
g. Attendant cannot dial extensions; system locks up. (Same as table 1.03, item V b.)	Faulty strapping of master and slave numbers.	Check and if necessary correct strapping on station hunt PCB.
	Defective station hunt PCB.	Replace station hunt PCB, TD-4101656.

TABLE 1.04 Console Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
I. Call Completing Failures (Cont.)		
h. Trunk gives false ring (disconnects on answer).	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
i. Busy verification inoperative.	Defective attendant register and links card.	Replace attendant register and links PCB, TD-4101696.
II. Call Holding Failures		
a. Call hold inoperative.	Defective processor.	Replace processor II PCB, TD-4101636.
b. Manual hold inoperative.	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
III. Trunk Related Failures		
a. Attendant cannot access a particular trunk.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
b. Attendant can reenter trunk after extending it.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
c. Attendant trunk inoperative.	Defective attendant register and links card.	Replace attendant register and links PCB, TD-4101696.
d. No CO dial tone; attendant cannot answer trunk calls.	No termination of numbers in memory.	Replace memory PCB, TD-4101616.
e. Automatic recall inoperative.	Improper strapping.	Correct strapping on trunk PCB.
f. All trunks seized when trunk reservation is in effect.	Defective CO trunk.	Replace CO trunk PCB, TD-4101536.

TABLE 1.04 Console Troubles (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
III. Trunk Related Failures (Cont.)		
g. Trunk releases anytime attendant extends and then hits the CONNECT bar.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
h. Attendant cannot dial out.	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
i. Trunk to which attendant is connected goes on hold when another call comes in.	Faulty trunk.	Replace trunk PCB, TD-410XXXX.
IV. Transmission Failures		
a. Transmission bad between attendant and EPABX station. (See table) 1.03, item II c.)	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
b. One-way transmission on busy verification.	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
V. Miscellaneous Failures		
a. TALK CITY and TALK EXT keys lit continuously.	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
b. Attendant can't release ATT LINE or trunks.	Defective attendant line and control card.	Replace attendant line and control PCB, TD-4101526.
c. No dial tone on ATT LINE.	Defective processor card.	Replace processor II PCB, TD-4101636.

TABLE 1.05 PCB Troubles

PCB		TROUBLE SYMPTOM	REFERENCE TABLE	REFERENCE ENTRY
Line card TD-4101516	1.	Crosstalk.	1.02	IV j
	2.	Single line rotary dial telephone cannot break dial tone.	1.03	I a
	3.	No dial tone at one station.	1.03	I c
	4.	EPABX station receives reorder tone when it goes off-hook.	1.03	I d
	5.	EPABX station receives ringback tone when it goes off-hook.	1.03	I e
	6.	One-way transmission.	1.03	II a
	7.	Speech fading at one station.	1.03	II b
	8.	Transmission bad between attendant and station.	1.03	II c
	9.	Station does not ring when dialed.	1.03	III a
	10.	Key telephone cannot place call on hold.	1.03	IV a
	11.	Lamp on key telephone inoperative.	1.03	V a
	12.	Attendant extended call drops when answered at EPABX station.	1.04	I a
Attendant line and control TD-4101526	1.	Transmission bad between attendant and station.	1.03 1.04	II c IV a
	2.	Manual hold inoperative.	1.04	II b
	3.	Attendant cannot dial out.	1.04	III h
	4.	One-way transmission on busy verification.	1.04	IV b
	5.	TALK CITY and TALK EXT keys lit continuously.	1.04	V a
	6.	Attendant can't release ATT LINE or trunks.	1.04	V b

TABLE 1.05 PCB Troubles (Cont.)

PCB		TROUBLE SYMPTOM	REFERENCE TABLE	REFERENCE ENTRY
CO Trunk TD-4101536	1.	CO trunk won't release.	1.02	I f
	2.	All trunks seized when trunk reservation is in effect.	1.04	III f
Common Services TD-4101596	1.	Ring tone hard to hear.	1.02	II a
	2.	Stations receive reorder tone when they go off-hook.	1.02	II g
	3.	No dial tone; system operational.	1.02	IV a
	4.	Dial tone on speech.	1.02	IV c
	5.	Continuous dial tone, ring tone, busy tone	1.02	IV d
	6.	Busy tone missing or erratic.	1.02	IV e
	7.	Busy tone on speech.	1.02	IV g
	8.	Ring tone on dial tone.	1.02	IV h
	9.	Crosstalk.	1.02	IV i
	10.	Transmission noise.	1.02	IV j
	11.	One-way transmission.	1.03	II a
	12.	Called station (single line/key telephone) rings continuously when dialed.	1.03 1.03	III b III c
Class of Service TD-4101606	1.	Local calls not going to proper stations.	1.02	II d
	2.	Toll restriction inoperative.	1.02	III a
	3.	Attendant gets wrong numbers.	1.04	I d
Memory TD-4101616	1.	Local stations hear camp-on busy tone when attendant extends call to odd-numbered station.	1.02	I d
	2.	Cannot complete calls to certain local stations.	1.02	II b

TABLE 1.05 PCB Troubles (Cont.)

PCB		TROUBLE SYMPTOM	REFERENCE TABLE	REFERENCE ENTRY
	3.	Local calls not going to proper stations.	1.02	II d
	4.	No dial tone/system operational.	1.02	IV a
	5.	EPABX station does not ring when dialed.	1.03	III a
	6.	Attendant cannot extend or transfer incoming calls.	1.04	I f
	7.	No CO dial tone; attendant cannot answer trunk calls.	1.04	III d
Processor I TD-4101626	1.	Trunk drops when transferred.	1.02	I b
	2.	Trunk drops when transferred to busy station.	1.02 1.02	I c II c
	3.	CO trunk won't release.	1.02	I f
	4.	All stations receive busy tone.	1.02	II e
	5.	Stations receive reorder tone when they go off-hook.	1.02	II g
	6.	Toll restriction inoperative.	1.02	III a
	7.	No dial tone/system operational.	1.02	IV a
	8.	Attendant cannot extend or transfer incoming calls.	1.04	I f
Processor II TD-4101636	1.	Trunk dropping calls.	1.02	I a
	2.	Trunk drops when transferred.	1.02	I b
	3.	Trunk drops when transferred to busy station.	1.02 1.02	I c II c
	4.	Stations receive reorder tone when they go off-hook.	1.02	II g
	5.	UNA audible signal device inoperative.	1.02	III c
	6.	ANA inoperative.	1.02	III e

TABLE 1.05 PCB Troubles (Cont.)

PCB		TROUBLE SYMPTOM	REFERENCE TABLE	REFERENCE ENTRY
	7.	Busy tone on dial tone.	1.02	IV f
	8.	Busy tone on speech.	1.02	IV g
	9.	Station calls busy line; breaks in on call.	1.03	V c
	10.	Call hold inoperative.	1.04	II a
	11.	No dial tone on ATT LINE.	1.04	V c
Station Hunt TD-4101656	1.	Cannot complete calls to certain EPABX stations.	1.02	II b
	2.	Local calls not going to proper stations.	1.02	II d
	3.	EPABX stations/attendant cannot call other stations; system locked up.	1.02 1.03 1.04	II h V b I g
	4.	Station hunt inoperative.	1.02	III f
Register TD-4101666	1.	Local calls not going to proper stations.	1.02	II d
	2.	Single line rotary dial phone cannot break dial tone.	1.03	I a
	3.	Tel-Touch phone cannot break dial tone.	1.03	I b
	4.	EPABX station receives ringback tone when it goes off-hook.	1.03	I e
Tel-Touch Receiver TD-4101676	1.	Tel-Touch phone cannot break dial tone.	1.03	I b
Attendant Register and Links TD-4101696	1.	Dropping calls; blast of camp-on busy tone to station when call is connected by attendant.	1.02	I e
	2.	Attendant gets wrong number.	1.04	I d

TABLE 1.05 PCB Troubles (Cont.)

PCB		TROUBLE SYMPTOM	REFERENCE TABLE	REFERENCE ENTRY
	3.	Attendant cannot extend or transfer incoming calls.	1.04	I f
	4.	Busy verification inoperative.	1.04	I i
	5.	Attendant trunk inoperative.	1.04	III c
Transfer Link TD-4101706	1.	Trunk drops when transferred.	1.02	I b
	2.	CO trunk won't release.	1.02	I f
	3.	Station can't transfer calls.	1.02	II i
	4.	Calls lost during station transfer.	1.03	IV b
Power Supply Control TD-4101766	1.	No dial tone.	1.02	IV b
	2.	Key telephone rings continuously when dialed.	1.03	III c
Alarm Panel Board TD-4101766	1.	UNA audible signal device inoperative.	1.02	III c
Paging Access TD-4101926	1.	Paging inoperative.	1.02	III b
Power Supply TD-4200237 or TD-4200341	1.	Stations do not ring when dialed.	1.02	II f
	2.	Called station (single line telephone) rings continuously when dialed.	1.03	III b
Trunks TD-410XXXX	1.	Trunk dropping calls.	1.02	I a
	2.	Trunk drops when transferred.	1.02	I b
	3.	Trunk drops when transferred to busy station.	1.02 1.02	I c II c

TABLE 1.05 PCB Troubles (Cont.)

PCB	TROUBLE SYMPTOM	REFERENCE	
		TABLE	ENTRY
	4. No talk path/intermittant talk path on trunk.	1.02	I g
	5. Can't dial out on trunk.	1.02	I i
	6. UNA does not work properly.	1.02	III d
	7. Crosstalk.	1.02	IV i
	8. One-way transmission.	1.02	II a
	9. Attendant extended call drops when attendant hits CONNECT bar.	1.04 1.04	I b III g
	10. Call drops after attendant hits RELEASE bar.	1.04	I c
	11. Trunk gives false ring (disconnects when answered).	1.04	I h
	12. Attendant cannot access a particular trunk.	1.04	III a
	13. Attendant can reenter trunk after extending it.	1.04	III b
	14. Trunk to which attendant is connected goes on hold when another call comes in.	1.04	III i

TABLE 1.00 Documents and Drawings

TITLE	NUMBER	
General Information	OA-000-001	
General Installation	OB-000-001	
Cabinet and Apparatus Installation	OB-000-002	
Feature Strapping	OB-000-003	
Console Installation	OB-000-004	
Cable Connections at Cross-Connect Terminals	OB-000-005	
Cabinet Tests and Inspections	OB-000-006	
Console Operation Tests	OB-000-007	
Station Operation Tests	OB-000-008	
General Maintenance	OC-000-001	
Access Test Set	OC-000-002	
Console Maintenance	OC-000-003	
Maintenance Guide	OC-000-004	
Trouble Analysis Guide	OC-000-005	
Power Supply Maintenance Test Procedures	OC-000-006	
Station User's Guide	OG-000-001	
Console Operating Instructions	OG-000-002	
Station User's Instructions	OG-000-003	
	CIRCUIT	NARRATIVE
Trunk Motherboard	TD4101507	
Line Circuit	TD4101517	OL-410-151
Attendant Line and Control	TD4101527	OL-410-152
Two-Way C.O. Trunk	TD4101537	OL-410-153
Common Control Feature #2	TD4101547	OL-410-154
Assigned Night Answer	TD4101557	OL-410-155
Line Motherboard	TD4101567	
Conference Network	TD4101577	OL-410-157
Power Failure Transfer	TD4101587	OL-410-158
Common Services	TD4101597	OL-410-159
Class of Service and Vacant Number Intercept	TD4101607	OL-410-160
Memory	TD4101617	OL-410-161
Processor (Board 1)	TD4101627	OL-410-162
Processor (Board 2)	TD4101637	OL-410-163
Tie Trunk, Loop or Battery and Ground Signaling	TD4101647	OL-410-164
Station Hunting	TD4101657	OL-410-165
Register	TD4101667	OL-410-166
Tel-Touch Receiver	TD4101677	OL-410-167
Link (Conference and Local)	TD4101687	OL-410-168
Attendant Register and Links	TD4101697	OL-410-169
Transfer and Add-On Links	TD4101707	OL-410-170
Channel Motherboard	TD4101717	
Tie Trunk, E & M, and Duplex	TD4101727	OL-410-172

TABLE 1.00 Documents and Drawings (Cont.)

TITLE	CIRCUIT	NARRATIVE
Power Supply Control	TD4101767	OL-410-176
DID Trunk	TD4101777	OL-410-177
Alarm Board	TD4101787	OL-410-178
Power Failure Transfer Card Extender	TD4101797	
Line Card Extender	TD4101807	
Channel and Trunk Card Extender	TD4101817	
Highway Amplifier	TD4101857	OL-410-185
Private Line and Manual Intercom	TD4101917	OL-410-191
Paging Access	TD4101927	OL-410-192
Dictation Access	TD4101937	OL-410-193
Data Monitor Test Set	TD4102074	OL-410-207
Call Forward–Follow Me	TD4102247	OL-410-224
Automatic Identified Outward Dialing	TD4102257	OL-410-225
Message Register #1	TD4102267	OL-410-226
Message Register #2	TD4102277	OL-410-227
Toll Restrictor	TD4102287	OL-410-228
Traffic Measure	TD4102297	OL-410-229
Quad Transfer and Add-On Link	TD4102587	OL-410-258
C.O. Trunk (CDH)	TD4102597	OL-410-259
PROM Programmer	TD4102767	OL-410-276
Number Translator	TD4102947	OL-410-294
Recorder Disconnect	TD4102957	OL-410-295
Busy Line/Busy Trunk Call Back	TD4102967	OL-410-296
Code Call	TD4102977	OL-410-297
Hot Line	TD4102987	OL-410-298
Speed Call	TD4102997	OL-410-299
C.O. Trunk, Battery Ground/E & M Signaling	TD4103007	OL-410-300
Dictation Interface	TD4103027	OL-410-302
Direct-In Line	TD4103037	OL-410-303
Tie Trunk – Ringdown	TD4103047	OL-410-304
Call Forward – Follow Me (Busy Line/No Answer)	TD4103087	OL-410-308
Dial Call and Directed Call Pick-Up	TD4103117	OL-410-311
Ragen Power Supply	TD4200237	
North Electric Power Supply	TD4200340	
Power Mate Power Supply	TD4200341	
Attendant Console	316619( )68	

familiar with both the physical and functional organization of the equipment and the concepts of time division multiplex (TDM) switching. For reference, and for the benefit of persons not familiar with the system, some of the characteristics of the equipment are discussed in the followings paragraphs. For more detailed information, consult the ITT practices listed in table 1.00.

2.02 Cabinet Arrangement. The EPABX has a maximum capacity of 100 lines, 12 local links, 24 trunks, with many features, some integral and others optional. In the case of trunks, the maximum capacity is 24, however, up to 10 of these may be substituted with tie trunks. Figure 1.00 shows the complete range of subassemblies in a complete 100-line system. For detailed descriptions of the functions performed by each subassembly, refer to Section OA-000-001, General Information, TD-100 EPABX.

The cabinet is shipped completely prewired requiring only local customer strapping; connections to external equipment, such as station telephone set lines and trunk lines, are made via plug-in cables at the cabinet.

The cabinet is equipped with three printed circuit board subracks. All features and services of the system are of the plug-in types. Thus, the basic requirements can be met at the time of the initial installation and expanded as required.

The plug-in boards fit into guides on a subrack and have connectors to mate to the motherboard at the rear of the subrack. Each board is equipped with two extractors, which are used when removing a board. Boards which have circuits to which time slots are allocated (trunks, links, registers, etc.) have BUSY switches located at the front of the board to busy-out the circuit, if required. Also, boards other than the common control circuit, have light-emitting diodes (LED's) at the front of the boards. A light-emitting diode lit indicates the circuit (line, trunk, register, etc.) is busy. Boards which have several strapping options available, such as the class of service and vacant number intercept board, must have the strapping done at the time of installation. Refer to Section OB-000-003 (Feature Strapping) for strapping options.

The system power is provided by a power supply located at the bottom of the cabinet. A 115 VAC 60-Hz supply is required by the power supply.

2.03 Motherboard Arrangement. Each subrack in the equipment cabinet has a motherboard which the various PCB's plug into. For reference the motherboards are numbered from top to bottom, 1, 2, and 3. Motherboard 1, on the upper subrack, is referred to as the line motherboard. Motherboard 2, on the middle subrack is referred to as the channel motherboard, and motherboard 3, on the lower subrack is referred to as the trunk motherboard.

2.04 Theory of Operation. A simplified block diagram of the system is shown in figure 1.01. The illustration shows the functional relationship of the lines and tie lines and the channel boards (registers, links, trunks, etc.), to the common control boards (common services, processor, and memory).

a. Common control circuitry. The common control circuitry is made up of four printed circuit boards; the common services board, processor 1 and processor 2 boards, and the memory board. These four boards are involved in almost all system functions.

The common services board contains the channel scanner with a master clock from which the 64 channel time slots and all signal timing is derived. It also contains the highway amplifier for the speech common highway and the circuitry for generating dial tone, busy tone, reorder tone, and ringback tone.

The processor is made up of two boards, processor 1 and processor 2. Working together, the two boards serve as the control unit for the TD-100. They monitor the I and SO (identity and status-out) leads of all channel units, and the OHO, OHT, and FB leads of the lines and tie lines. As shown in figure 1.01, the processor also looks at the register tens and hundreds leads. The processor uses its various inputs to update the status-outputs of the channels, to enable switching signals for various circuits, and to transfer data from one channel to another.

The memory board stores calling and called numbers and signals from the common services and processor boards. It includes the line scanner circuitry and the circuits which provide enable signals for the lines and tie lines. It also provides the circuitry for generating conference and attendant numbers and control signals for station hunting.

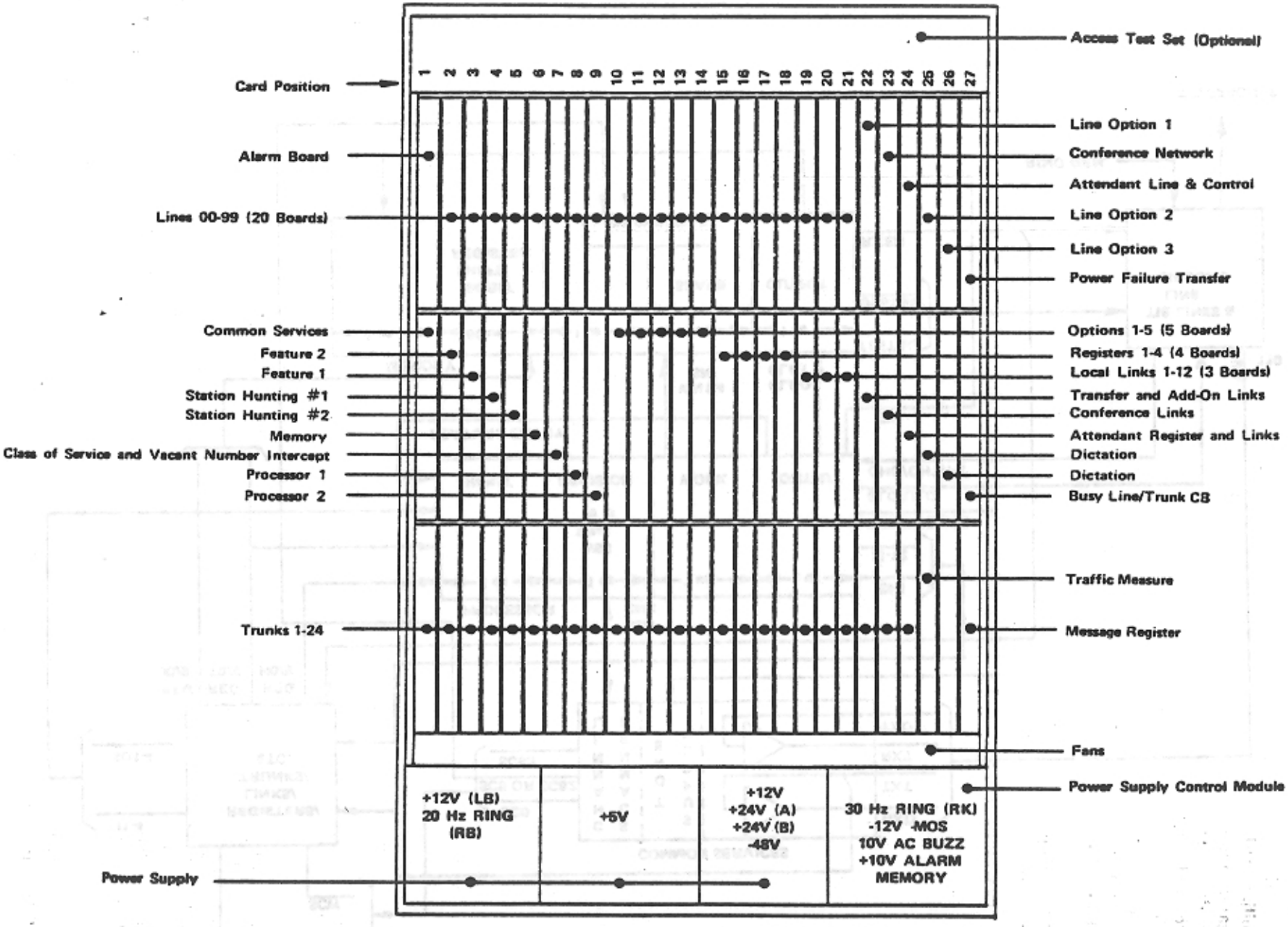

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FIGURE 1.00 Subassemblies of Cabinet

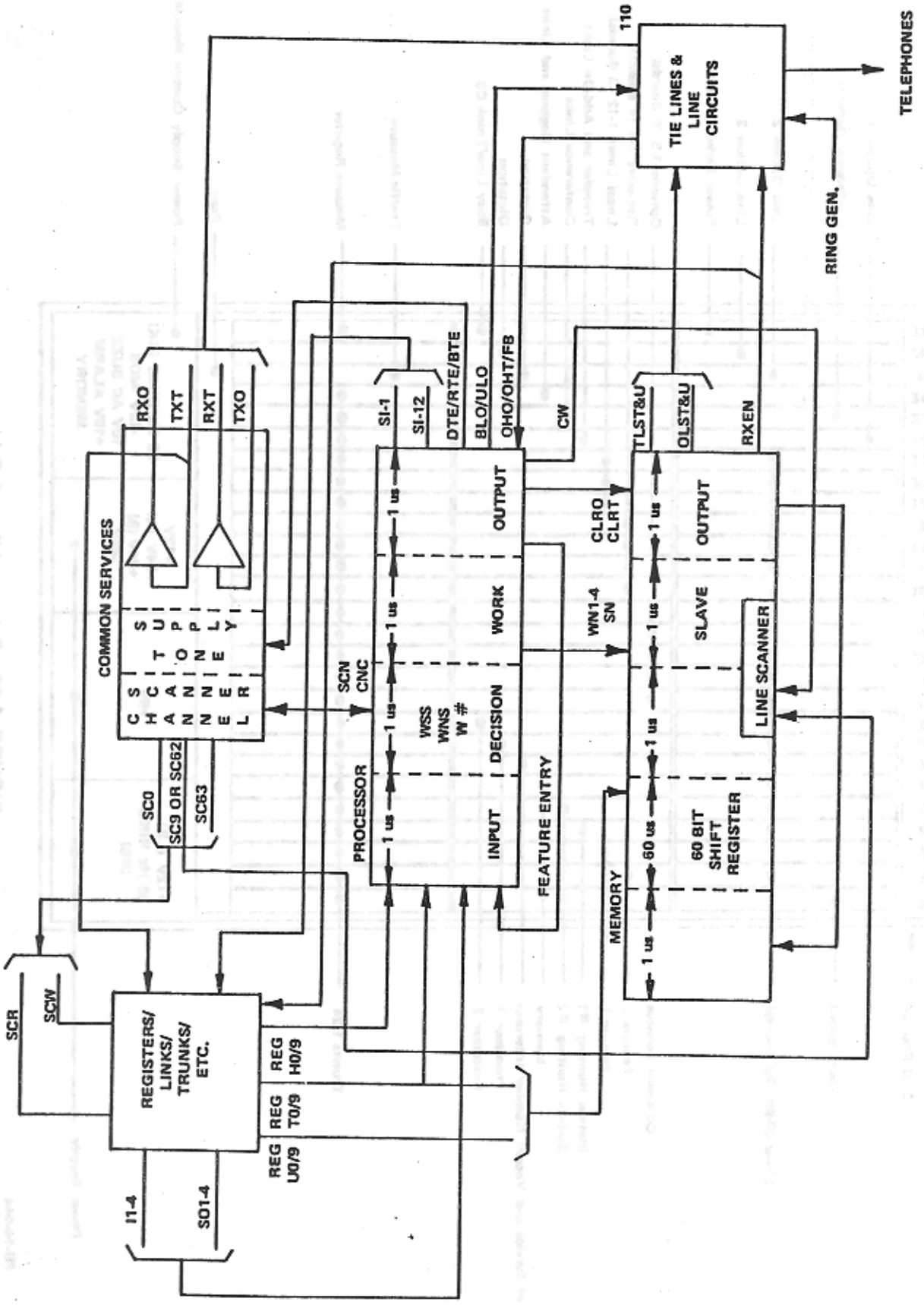


FIGURE 1.01 TD-100 System Block Diagram

b. Channels. All circuits assigned a time slot are considered channel units. Most commonly these include registers, links, and trunks. The attendant circuits and various optional circuits are also considered channel units. Each channel unit provides identity and status-out (I and SO) leads which are monitored by the processor, and status-in (SI) leads on which control signals are received from the processor.

As shown in figure 1.01, the I and SO leads, the register units, tens and hundreds leads, and the SI leads, connect the various channels to the common control circuitry. The I and SO leads transmit channel identity and status to the processor, the register units, tens and hundreds leads transmit called numbers to the processor and memory. The SI leads are used to send instructions to the channels from the processor.

c. Scanning. The TD-100 system uses two scanning networks. The processor, under control of the channel scanner, scans the channel units; the line scanner in the memory scans 100 lines and 10 tie lines.

Channels are scanned in sequence, with the access time for each channel being one microsecond. The 64 channels then, are scanned in 64 microseconds. During one microsecond of each 64 microsecond scan, the line scanner scans one line or tie trunk. A complete scan of the 100 lines and 10 tie trunks takes approximately 7.04 milliseconds.

The master clock in the common services board has a fundamental frequency of 16 MHz. Through a network of frequency dividers, the output of the master clock provides the timing signals required in the system.

The channel scanner in the common services board divides a channel scan into a read scan (SCR) and a write scan (SCW). During the read scan, channel identity and status are transmitted to the processor. In the case of the registers, the called number is transmitted from the channel to the processor and memory. During the write scan, which occurs three time slots after the read scan, channel instruction data is transmitted from the processor to the channel unit.

When a channel receives a one microsecond SCR command, channel identity (trunk, register, link, etc.), channel status (free, busy, etc.), and for registers, the called number, are transmitted to the processor and/or memory in a parallel format.

A station request for service is detected by the processor during the line scan. When such a demand occurs, the line number is temporarily stored in the memory, and the processor is instructed to look for an idle register. On finding an idle register, the processor marks the line identity out of storage and into the channel of the idle register. On completion of dialing, the called line is tested and if idle, the proper FB (free/busy) signal is sent to the memory while the processor looks for an idle link. Both called and calling numbers are then transferred to the time slot of the selected link, and the register is instructed to release. The link then maintains supervision of the call.

d. Common highway. All speech paths are multiplexed into a common highway with the 64 channels being scanned sequentially for one microsecond each.

In each line circuit, a hybrid converts the two-wire balanced telephone line to a two-wire unbalanced line (transmit and receive). Two line switches, TxT (transmit terminator) and RxT (receive terminator), connect the hybrid transmit and receive leads to the common highway for the terminator. Two amplifiers, with each amplifier having a gain of one complete the transmission paths.

Enabling of the line circuits is done by converting the calling and called station number into a decimal form (in the memory circuitry), and enabling each line circuit by a combination of its units and tens digits in conjunction with a receive enable signal (RXEN).

During the allocated time slot, the two station numbers are decoded and the appropriate TxT, TxO, RxT, and RxO switches are enabled (TxT and TxO for one microsecond, determined by RXEN). Thus, during that time slot station 1 can transmit to station 2 via amplifier 1, and station 2 can transmit to station 1 via amplifier 2. The four

switches are then inhibited for 63 microseconds before being enabled for the next one microsecond channel scan. When the receive switch is enabled, the transfer of energy charges a storage capacitor which discharges during the 63 microsecond inhibited period. Thus, with the high sampling rate and the storage capacitor, the transmitted voice frequencies are returned to their original form.

When the call is complete and the stations go on-hook, the assigned channel detects the on-hook conditions, and the channel is returned to the "free" status, ready for the next call.

With a trunk-to-station or trunk-to-console call in progress, the station line circuit or console line circuit switching is the same as explained above. However, the trunk only appears as the originator on the common highway and is converted to the common highway by the RXEN signal during the write scan of the trunk's channel.

3.00 FLOW CHARTS

3.01 General. Two types of flow charts are used in this document and in the appendix. These are: the overview flow charts and the more detailed operational flow charts. Both types of flow charts, their contents, organization, etc., as applicable to this document are discussed in the following paragraphs.

3.02 Symbols. Flow chart symbols are shown in figure 1.02. The use of each symbol is explained below. The letter accompanying each explanation coincides with the alphabetic designation alongside the respective symbol in the illustration.

a. Process instruction. The process instruction block represents a group of instructions for performing a given function.

b. Predefined process. The predefined process block is used to represent a process that is specified elsewhere. In these applications, this block is accompanied by a connector (item g) which indicates the number of the flow chart for the named process.

c. Notation. The notation block is used to add a descriptive comment, explanatory note, etc., to an instruction block, auxiliary operation block, etc. The dashed line connects the notation block to the associated flow chart symbol.

d. Auxiliary operation. The auxiliary operation block contains information or instructions to supplement a major function.

e. Manual operation. The manual operation block is used for instructions relating to an operation performed by a station user. trunk party, or the attendant.

f. Offpage connector. The offpage connector is used on a flow chart of more than one page, to direct entry and exit from one page to another. The offpage connector always uses an alphabetic character.

NOTE: In the appendix, where a flow chart consists of more than 2 pages, the offpage connectors are accompanied by a notation indicating the next or preceding page.

g. Connector. The connector is used to designate entry and exit from one flow chart to another. The number in the connector corresponds to the number of a specific flow chart.

h. Terminal. The terminal block is used at the beginning or end of a flow chart, or as a point of interruption in the flow chart. Information concerning the entry, interruption, or exit is contained in the block.

i. Display. The display block is used for information concerning a visual or audible signal. In this application, the display block generally indicates that a lamp or light emitting diode (LED) lights, flashes, or extinguishes, or that a device such as the console buzzer operates or cuts off.

j. Action block. The action block is used to note an event which can be observed. The action block contains information concerning the event. In the operational flow charts, information concerning circuit changes which occur are shown to the left or right of the action block.

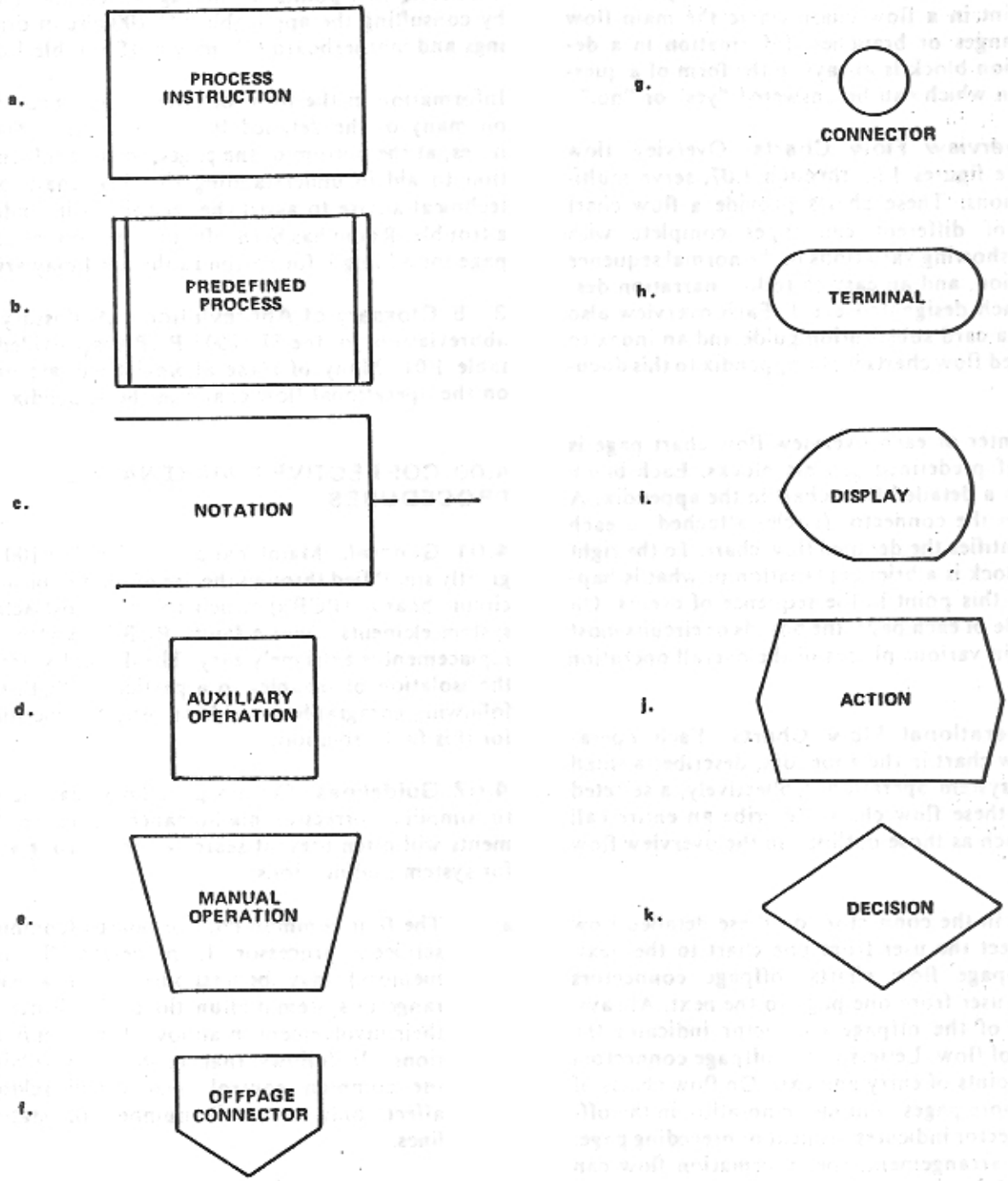


FIGURE 1.02 Flow Chart Symbols

k. Decision. The decision block represents a point in a flow chart where the main flow changes or branches. Information in a decision block is always in the form of a question which can be answered "yes" or "no."

3.03 Overview Flow Charts. Overview flow charts, see figures 1.03 through 1.07, serve multiple functions. These charts provide a flow chart analogy of different call types complete with branches showing variations in the normal sequence of operation, and an easy to follow narration describing each designated event. Each overview also serves as a card substitution guide and an index to the detailed flow charts in the appendix to this document.

In the center of each overview flow chart page is a series of predefined process blocks. Each block represents a detailed flow chart in the appendix. A number in the connector (circle) attached to each block identifies the detailed flow chart. To the right of each block is a brief explanation of what is happening at this point in the sequence of events. On the left side of each page, the boards or circuits most involved in various phases of the overall operation are listed.

3.04 Operational Flow Charts. Each operational flow chart in the appendix, describes a small part of a system operation. Collectively, a selected group of these flow charts describe an entire call process such as those outlined in the overview flow charts.

Numerals in the connectors on these detailed flow charts direct the user from one chart to the next. On multipage flow charts, offpage connectors direct the user from one page to the next. Always, the point of the offpage connector indicates the direction of flow. Letters in the offpage connectors indicate points of entry and exit. On flow charts of three or more pages, a numeric notation in the offpage connector indicates the next or preceding page. With this arrangement, the information flow can easily be followed, forward or backward, as required.

Wherever possible, each detailed flow chart indicates the signals present and the respective logic levels. This information, usually adjacent to an action block, is provided for the skilled technician wishing to use a logic probe, word recognizer, oscilloscope, or equivalent test device to isolate a trouble. Test points for the signals can be found by consulting the applicable TD-100 circuit drawings and motherboard schematics. (See table 1.00.)

Information in the form of notes is also provided on many of the detailed flow chart pages. These notes, at the bottom of the pages, include information to aid in understanding the flow chart, and technical advise to assist the technician in finding a trouble. Room has been left at the bottom of each page for adding information as the need may arise.

3.05 Glossary of Abbreviations. A glossary of abbreviations for the TD-100 EPABX is provided in table 1.01. Many of these abbreviations are used on the operational flow charts in the appendix.

4.00 CORRECTIVE MAINTENANCE PROCEDURES

4.01 General. Maintenance of the TD-100 is greatly simplified through the use of plug-in printed circuit boards (PCB's) which contain most active system elements. Once a faulty PCB is located, its replacement is extremely easy. The difficulty lies in the isolation of troubles to a particular PCB; the following paragraphs provide an orderly procedure for this fault isolation.

4.02 Guidelines. Certain guidelines may be set to simplify corrective maintenance. These statements will often prevent searching in a wrong area for system malfunctions.

a. The four common control boards (common services, processor I, processor II, and memory) may be responsible for a wide range of system malfunctions. This is due to their involvement in almost all system functions. It follows that problems involving the common control boards will seldom affect only a small number of station lines.

   1. The common services board contains the master clock (from which the 64 channel time slots and all signal timing is derived) and the highway amplifier for the speech common highway. Circuitry is also provided to generate dial tone, busy tone, reorder tone, and ring-back tone, and switch these tones onto the common highway.

TABLE 1.01 Glossary of Abbreviations

ABBREVIATION	MEANING
A--Q	Data leads from processor I to II
AH	Attendant hookswitch flash
AHI 1 + 2	Automatic hold incoming 1 and 2
AHO	Automatic hold outgoing
AIN	Artificial intrude
ALK	Attendant line key
ALL	Attendant line lamp
ALMC	Alarm master clock
AOB	Add-on busy
$\overline{\text{AOE}}$	Add-on enable
$\overline{\text{AOE + IE}}$	Add-on enable and intrude enable
ARK	Attendant release key
AS 1 + 2	Attendant switch 1 and 2
ATK 1 + 2	Attendant trunk key 1 and 2
ATL 1 + 2	Attendant link 1 and 2
BLO	Busy lockout
BRD	Battery reversal deny
BRX	Bar receive
BT	Busy tone
BTE	Busy tone enable
BUZ	Buzzer
CCK	Code call key
CK	Conference key
CL	Conference lamp
CLRO	Clear originator
CLRT	Clear terminator
CNC	Channel number compare
CNE	Conference network enable
COB	Camp-on busy
CONF	Conference
CONK	Connect key
$\overline{\text{CONN}}$	Connect
$\overline{\text{CONN}}$	Connect (inverted)
$\overline{\text{CPO}}$	Camp-on
$\overline{\text{CS = 2}}$	Channel scan twice (inverted)
CW	Call waiting
DCP	DC Pulse
DH1-3	Dial horizontal 1-3
DL1-4	Dial longitudinal 1-4
DTE	Dial tone enable
ETXT	Enable terminator transmit
ES	Enable search
FB	Free/busy
HICL 1 + 2	Hold incoming link 1 and 2
HLD	Hold
HOGL	Hold outgoing link (or line)

TABLE 1.01 Glossary of Abbreviations (Cont.)

ABBREVIATION	MEANING
HOT	Hold trunk (automatic)
HT	Hold trunk
IB	Inhibit busy
ICL 1 + 2	Incoming link 1 and 2
IDO	Inhibit decoder originator
IDT	Inhibit decoder terminator
IE	Intrude enable
IED	Intrude enable delayed
IES	Intrude enable start
IIE	Inhibit intrude enable
IL 1 + 2	Intercept lamp 1 and 2
ILSZ 1 + 2	Incoming link seize 1 and 2
I1	Identity 1
I2	Identity 2
I3	Identity 3
I4	Identity 4
LF	Lamp flash
LP	Last pulse
LRL 1 + 2	Link release 1 and 2
LW	Lamp wink
LWT	Lamp wink (trunk)
MOH	Music on hold
NE	Number enable
NIC	Night incoming call
NM	Number match
NS	Night switch
NT	Night
OCCTM 1-24	Occupancy time 1-24
OFE	Overflow enable
OFI1-4	Overflow information 1-4
OGL	Outgoing link (or line)
OHO	Off-hook originator
OHT	Off-hook terminator
OLST0-11	Originator line scan 0-11 (tens)
OLSU0-9	Originator line scan 0-9 (units)
OO1-8	Originator out 1-8
OVFL	Overflow
PAG	Paging
PC	Peg count
PCGP 22 & 23	Peg count group 22 and 23
PGL	Page lamp
PK	Page key
PL	(for future use)
PRO	Power-on reset
R	Ring

TABLE 1.01 Glossary of Abbreviations (Cont.)

ABBREVIATION	MEANING
RC	Restricted code
RD1	Ring drop 1 (line side)
RD2	Ring drop 2 (line side)
RH	Register hold
RLSE	Release
ROT	Reorder tone
RRL	Register release
RTE	Ringback tone enable
RXA	Receive add-on
RXEN	Receive enable
RXENT	Receive enable (trunks)
RXO	Receive originator
RXT	Receive terminator
SCN	Store channel number
SCR	Scan channel read
SCW	Scan channel write
SC0	Scan channel zero
SC1	Scan channel 1
SC60	Scan channel 60
SC62	Scan channel 62
SH	Station hunting
SIN	Status-in
SI1	Status-in 1, Seize
SI2	Status-in 2, off-hook originator
SI3	Status-in 3, off-hook terminator
SI4	Status-in 4, Free (not busy)
SI5	Status-in 5, Intrude
SI6	Status-in 6, Consultation Hold
SI7	Status-in 7, In add-on
SI8	Status-in 8, Found busy channel
SI9	Status-in 9, Called subscriber answered – reset
SI10	Status-in 10, Conference
SI11	Status-in 11, New station number
SI12	Status-in 12, Attendant recall
SN	Store number
SOD	Status-out, delayed
SO1	Status-out 1
SO2	Status-out 2
SO3	Status-out 3
SO4	Status-out 4
SPR	Status pulse record
$\overline{SZ}$	Seize (inverted)
SZD	Seize delayed
T	Tip
TA	Trunk (key) lamp

TABLE 1.01 Glossary of Abbreviations (Cont.)

ABBREVIATION	MEANING
TB	Trunk lamp
TCK	Talk city key
TCL	Talk city lamp
TD1	Tip (console during PFT)
TD2	Tip (attendant line during PFT)
TEK	Talk extension key
TEL	Talk extension lamp
TK	Trunk group key
TL	Tie line
TLST0-11	Terminator line scan 0-11 (tens)
TLSU0-9	Terminator line scan 0-9 (units)
$\overline{\text{TN}}$	Terminator number (inverted)
T/O	Terminator/originator
TO1-4	Terminator out 1-4 (tens digit)
TO5-8	Terminator out 5-8 (units digit)
TO9-12	Terminator out 9-12 (hundreds digit)
TOC1-8	Terminator out 1-8 (class of service)
TR	Tip (to dictation recorder)
TRAC	Trunk access control
TRES	Trunk reservation
TRK	Trunk reservation key
TRO	Terminator register output
TRUC	Busy verification
TS	Trunk switch
TSC	Trunk switch common
TTE	Tel-Touch enable
TXA	Transmit add-on
TXO	Transmit originator
TXT	Transmit terminator
T1	8 megahertz timing clock
T2	4 megahertz timing clock
T3	2 megahertz timing clock
$\overline{\text{T3}}$	2 megahertz timing clock (inverted)
T4	1 megahertz timing clock
$\overline{\text{T4}}$	1 megahertz timing clock (inverted)
ULO	Unassigned lockout
UNAE	Unassigned night answer enable
VNI	Vacant number intercept
VNI/COS	Vacant number intercept/class of service
WAN	Write attendant number
WN1-4	Write number 1-4
XFER	Transfer
1 SEC	1 second timing pulse
10 ms	10 millisecond timing pulse
50 ms	50 millisecond timing pulse

2. Processors I and II work together to monitor the status and identity of all channel circuits and to control these channel units as required by the station-user or the attendant. The processor is the control unit for the TD-100 and matches requests for service to the necessary equipment to provide that service.

3. The memory board stores calling and called station numbers; it also stores signals from common services and the processor. The line scanner circuitry is contained on the memory board as is circuitry to provide enable signals for the line circuits. The number generator for conference and attendant number circuitry as well as control signals for station hunting are also contained on the memory board.

b. Each station line has an assigned line circuit; problems that are peculiar to one station line may often be traced to an individual line circuit. Each line circuit board contains five line circuits, thus problems affecting groups of five station lines may often be traced to individual line circuit boards.

c. Certain TD-100 subsystems are duplicated and are shared on a first come-first served basis by all station lines. These circuits are registers, links, trunks and tie-trunks (when more than one trunk or tie-trunk is assigned to one access code). Problems involving these boards may at first appear to be transient; that is they will seem to come and go. In reality, one of these circuits may be completely non-functional, but since the circuit is not accessed on every seizure or always by the same station line, the problem seems to be intermittent.

d. The TD-100 has some circuitry used mainly by the attendant. Problems relating to attendant operation may often be traced to the attendant register, the attendant line and control, or the attendant's console.

e. Problems which are truly erratic may often be linked to electrical noise within the signaling circuitry. This noise arises from an inadequate cabinet ground, improper power supply operation, or extremely poor commercial AC power service.

4.03 Analytic Process. Successful, efficient corrective maintenance of the TD-100 requires the use of a basic analytic process. This process may be divided into three main functions; gathering data, analyzing data and locating fault(s), and correcting fault(s).

a. Gathering data is of primary importance; maintenance personnel attempting to clear troubles in the TD-100 system need a clear definition of fault symptoms. Certain basic questions must be asked of the attendant and affected station-users.

1. What alarm indications are given on the system's alarm panel?

2. Is the system completely down or is only one function affected?

3. Are all stations affected or only isolated stations or groups of stations? stations?

4. Does the problem seem to be continuous or transient?

5. Does the problem occur at certain times of day or during night service?

It is important to gather data from as many sources as possible rather than rely heavily on the reports of only one or two station-users. Remember too, that the reporters may not be telephony-oriented. Their reports of trouble symptoms may therefore be vague and sometimes erratic.

b. Analysis of data thus gathered should also be handled in an orderly manner. The first step is the collation of trouble reports into groups of similar complaints. From this it may be possible to see a pattern emerge with regard to call type, station group, time of day or some other pertinent condition present at the time difficulty is encountered. When the conditions at the time of difficulty are defined, the call may then be duplicated. It is at this point that the maintenance person

may experience the reported difficulty and define it with more precise technical terms.

Compound troubles may also be encountered. Although in many cases, more than one set of symptoms may arise from a common source, it is important to separate these symptoms and search for one trouble at a time. When a trouble source is finally isolated and corrected, and it happens that this clears more than one trouble, this may be considered as a logical consequence of proper corrective maintenance.

Location of a particular fault within the system depends upon the answer to these questions.

1. What happened that should not have happened?

2. What did not happen that should have happened?

3. What circuitry is involved?

This may seem overly simplistic, but it is none-the-less true. To answer these questions, it is necessary to know the correct sequence of events. The overview flow charts and the operational flow charts in the appendix describe in detail the proper sequence of events in various types of calls or call operations.

Once the proper sequence of events for a particular switching operation is known, deviations from that sequence can be recognized. When the deviation is recognized, it only remains to answer the third question, "what circuitry is involved," in order to locate the possible sources of trouble.

Paragraphs 4.05 and 4.06 provide the necessary information to guide the maintenance person from the trouble report data to the proper overview flow chart which gives a preliminary indication of which PCB(s) could cause particular types of trouble.

c. Correcting faults, once located, will usually consist of only the replacement of one or more plug-in boards. If it is determined that the power supply or power supply control box may be faulty, consult OC-000-006 for a complete description of the testing and replacement of these two subassemblies. Other faults, usually mechanical (broken wires, solder splashes, etc.), must be dealt with on an individual basis.

4.04 System Inoperative. The most urgent TD-100 malfunction is a total system failure. This should result in the system going into a power failure transfer mode of operation, in which certain preselected station lines are automatically connected to CO trunks for emergency use. A power failure transfer may result from one or more of the following reasons.

a. Failure of one or more of the power supply voltages.

b. Any major alarm as displayed on the alarm board.

c. Manual operation of the XFER switch on the TD-100 alarm board.

d. Manual operation of the TRANSFER switch on the rear of the TD-100 console.

Operation of the power failure transfer circuitry is automatic in the case of a or b above. If the situation which caused the transfer is corrected, the system will automatically revert to normal operation, but the alarm indicator on the alarm board will remain lit until manually reset.

Therefore, when investigating an inoperative system, first check the transfer switches described in c and d, and then check the alarm board to determine the source of the power failure transfer. If the cause is either of the transfer switches, reposition it to its normal operation position and, after noting which alarm LED's are lit, operate the alarm reset switch on the alarm board.

If neither of the power failure transfer switches was operated, note which of the major alarm LED's are lit.

a. If the green power LED is not lit, a power supply difficulty is being experienced. Consult ITT practice OC-000-006 for a complete test and replacement procedure for the power supply and power supply control box. Note that a momentary AC power outage could have caused a major alarm and transfer, but

when AC power was restored, the TD-100 should have returned to its normal operation.

b. If the red HT MAJ LED is lit, this indicates a dangerously high TD-100 cabinet temperature. Check the operation of the ventilation fans; make certain that the cabinet doors were properly installed and that the air flow through the filters is unobstructed.

c. If the red MC LED is lit, this indicates a master clock failure. The master clock is located on the common services board.

d. If the red BUS LED is lit, this indicates a failure on the G-P leads between processors I and II, or a failure on the SI leads from the processor.

4.05 Data Analysis and Fault Location. After problem data has been collated as described in paragraph 4.01a and the alarm board checked as described in paragraph 4.04, the trouble to be cleared first must be selected. If there is more than one trouble, the one to be cleared first is the one that is depriving the largest group of station-users from the greatest amount of service. For example, if a group of five stations cannot get dial tone and, at the same time, one station-user complains of low level reception, the dial tone problem should be cleared first.

When the trouble to be cleared has been selected and verified, the maintenance person should attempt to duplicate the trouble call from a station instrument located within reach of the TD-100 cabinet.

NOTE: To simplify observation and to avoid interruption of calls in progress, testing is best done during periods of very light traffic.

To duplicate calls involving the attendant's console (transfer, attendant controlled conference, etc.), access to the console is required. This may necessitate, depending on the location of the console, an additional tester. It may also be necessary to attach one or two test telephones to the desired station lines at the MDF, and place these nearby the TD-100 cabinet. Note the type of call to be duplicated and provide access to the necessary equipment. Consult the overview flow chart for each type to be duplicated.

4.06 Final Trouble Isolation. When the trouble has been narrowed to a particular operation as described in the preceding paragraphs, final trouble isolation may begin. While this process relies in part on the training and intuitive judgement of the maintenance person, there are certain basic guidelines.

a. Do not substitute PCB's at random.

b. In duplicated circuits such as links, trunks, registers, etc., operate the busy switch on each circuit in order to isolate the trouble to a particular board.

c. Work by the process of elimination. By means of the busy switches, set the call repeatedly, using differing combinations of equipment. When a particular circuit has just been eliminated from the call, and the trouble clears, the chances are good that the PCB is the trouble source.

d. When it becomes absolutely necessary to substitute PCB's, turn off the system power before removal or insertion of any board.

e. Mark all boards clearly so that PCB's inserted and found to not relieve the trouble may be removed and the originals reinserted. While it is possible that two PCB's will need to be replaced to cure one problem, this is not likely.

f. When checking logic levels or voltage levels, check at the source and at various spots toward the destination. Intervening circuits may cause trouble.

g. Change wiring on the TD-100 cabinet only after the most judicious checking and double checking. It is extremely unlikely that wiring errors will exist on TD-100 units in the field.

h. Boards which are judged faulty should be reinserted in the cabinet and their operation rechecked before they are returned for repair. A tag should be attached to each board describing the faulty portion of its operation.

i. Do not return faulty boards to the spare PCB storage area.

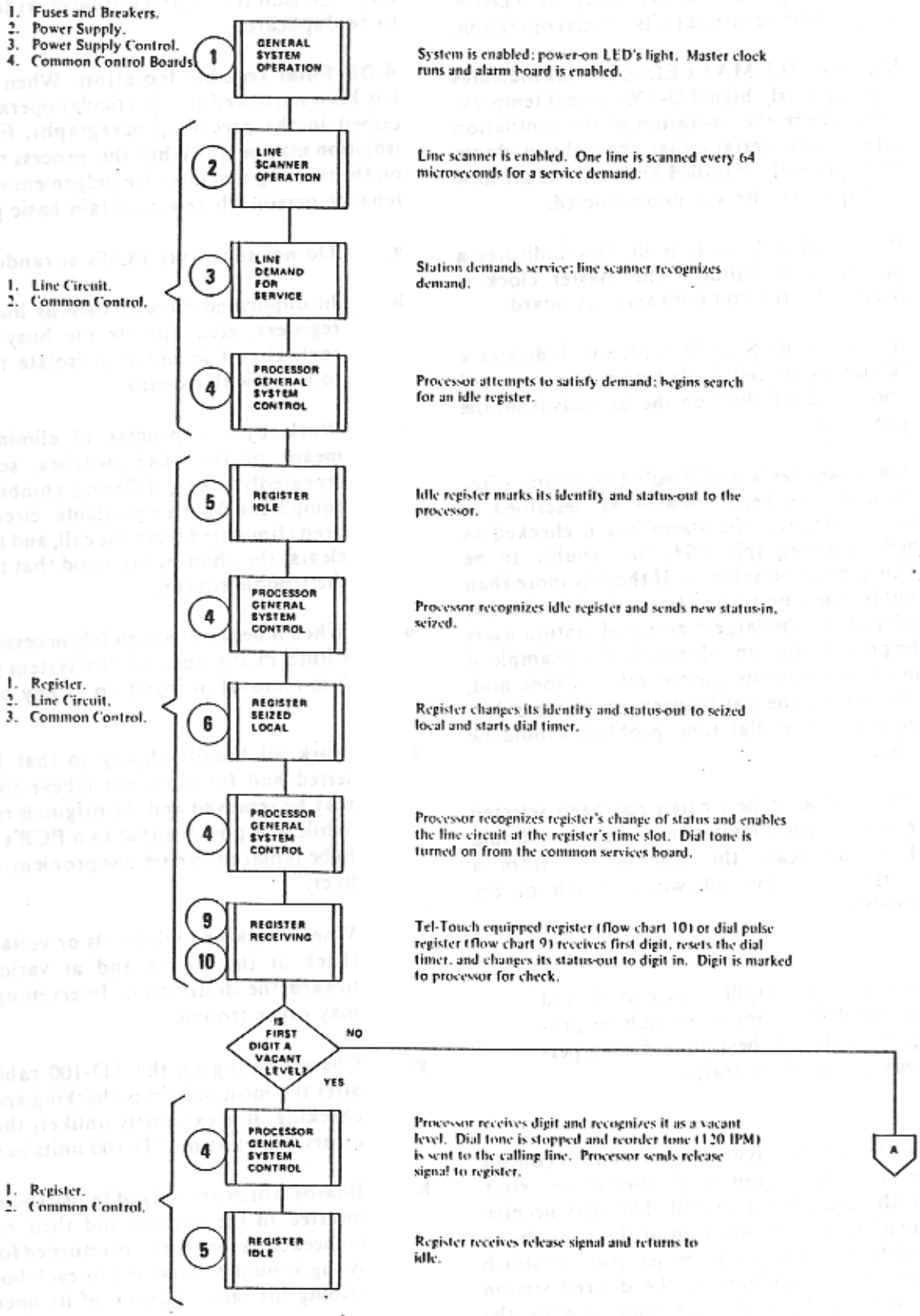


FIGURE 1.03 Overview – Local Call (Sheet 1 of 4)

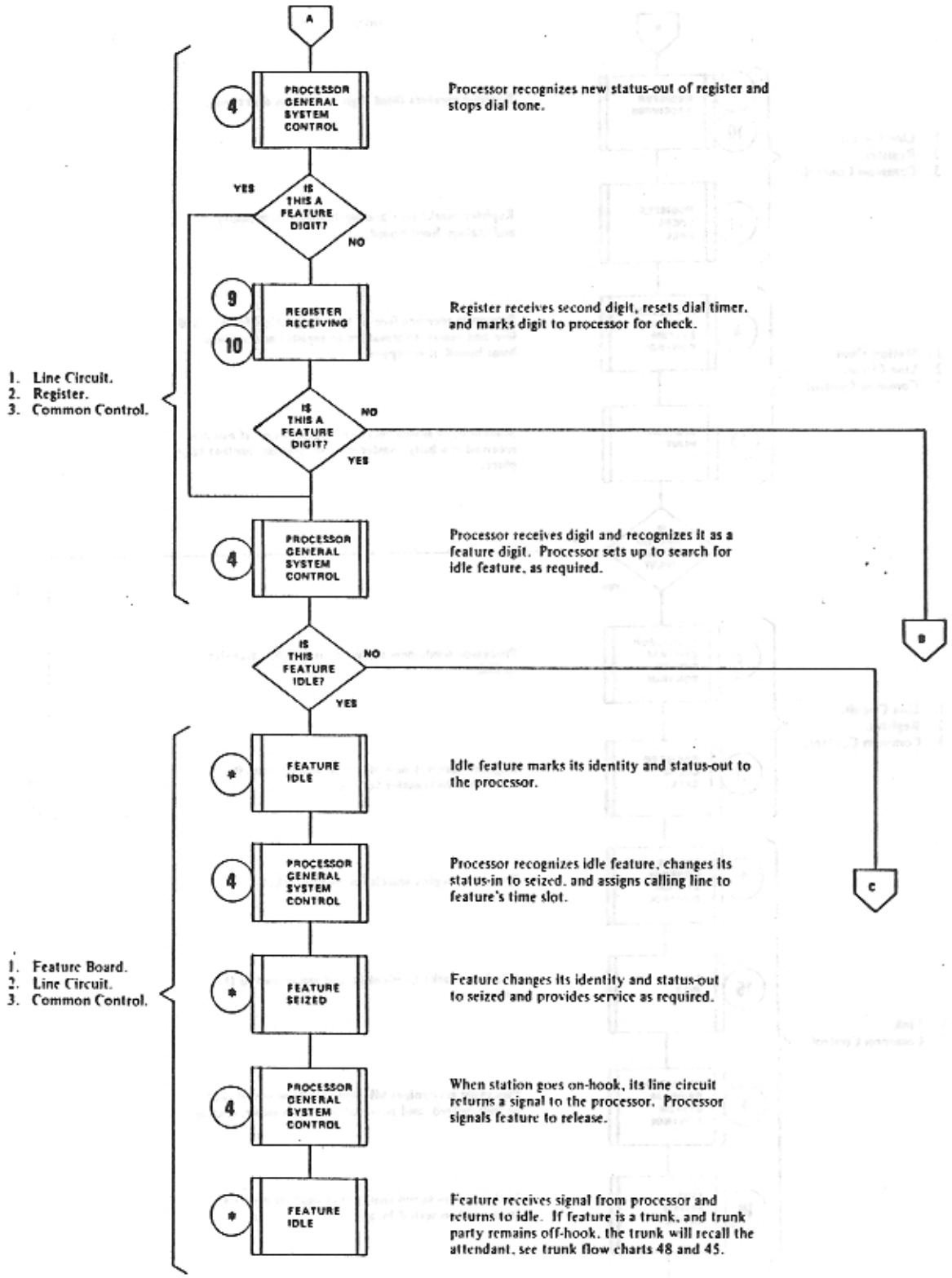


FIGURE 1.03 Overview – Local Call (Sheet 2 of 4)

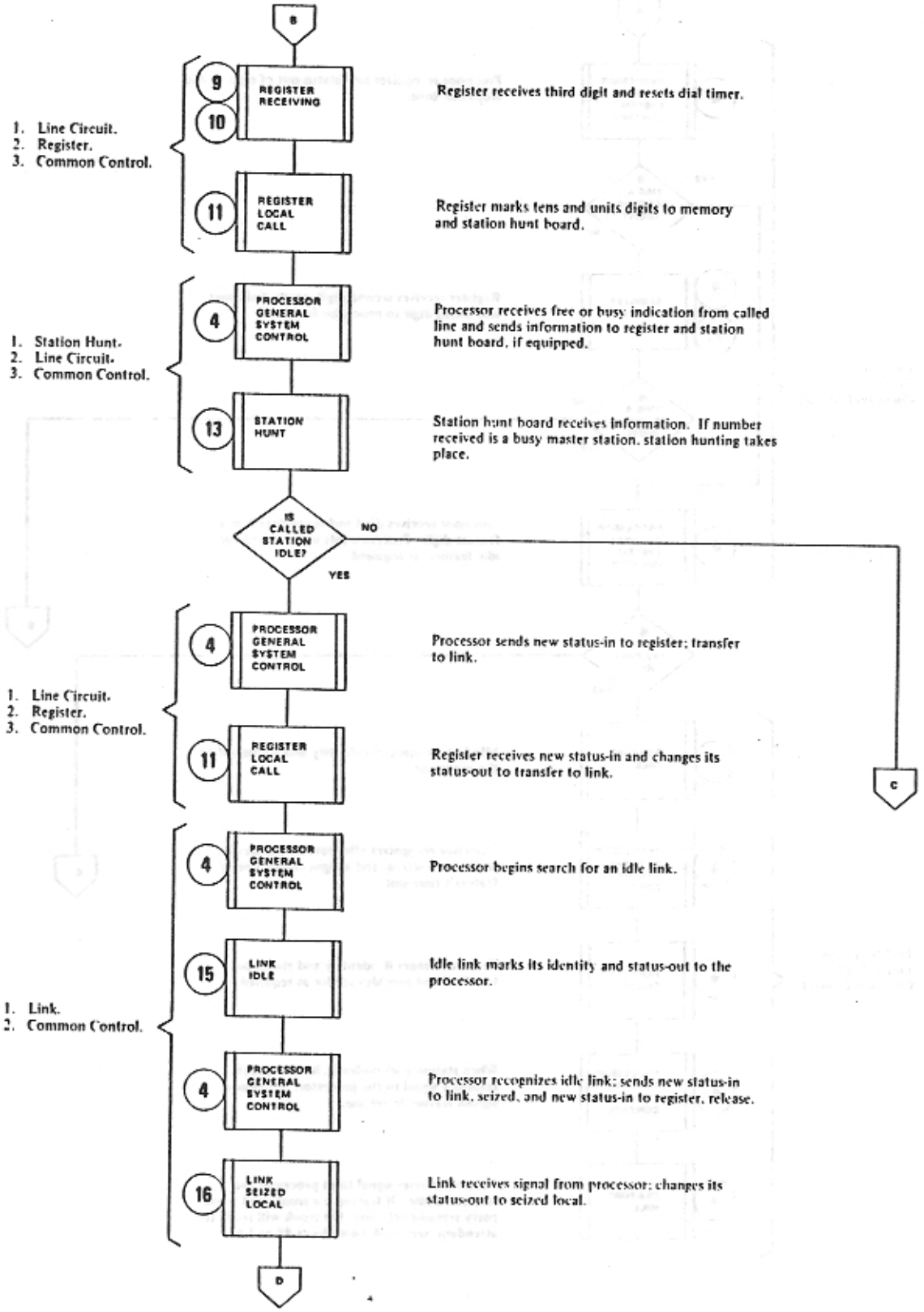
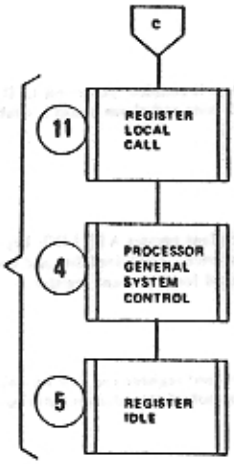


FIGURE 1.03 Overview – Local Call (Sheet 3 of 4)

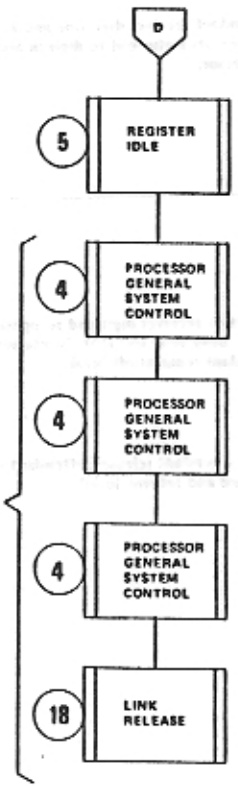


1. Register.
2. Line Circuit.
3. Common Control.

Register receives signal from processor and changes its status-out to busy line or busy feature called.

Processor signals memory to clear and register to release. Busy tone (60 IPM) is returned to the calling line.

Register receives release signal from processor and returns to idle.



1. Register.
2. Common Control.

1. Line Circuit.
2. Link.
3. Common Control.

Register receives release signal from processor and returns to idle.

Processor causes called station to ring and calling station to receive ringback tone until called station answers or calling line releases.

When called station answers, its line circuit returns a signal to the processor. Processor signals common services to stop ringback tone.

When either station goes on-hook, its line circuit returns a signal to the processor. Processor signals link to release and remaining line circuit to receive busy tone (60 IPM) as long as it remains off-hook.

Link receives release signal from processor and returns to idle.

FIGURE 1.03 Overview – Local Call (Sheet 4 of 4)

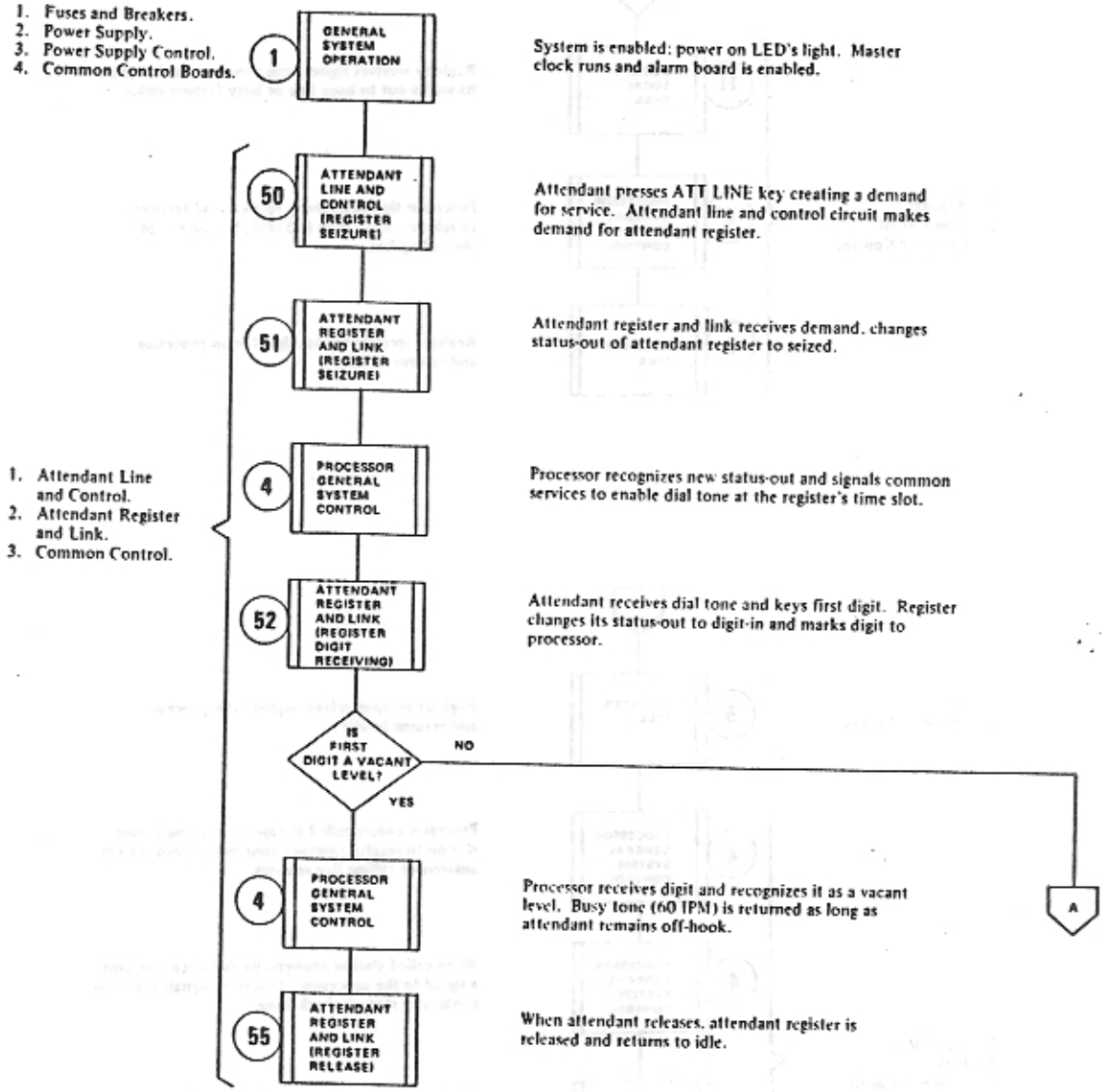


FIGURE 1.04 Overview -- Attendant Originated Call (Sheet 1 of 4)

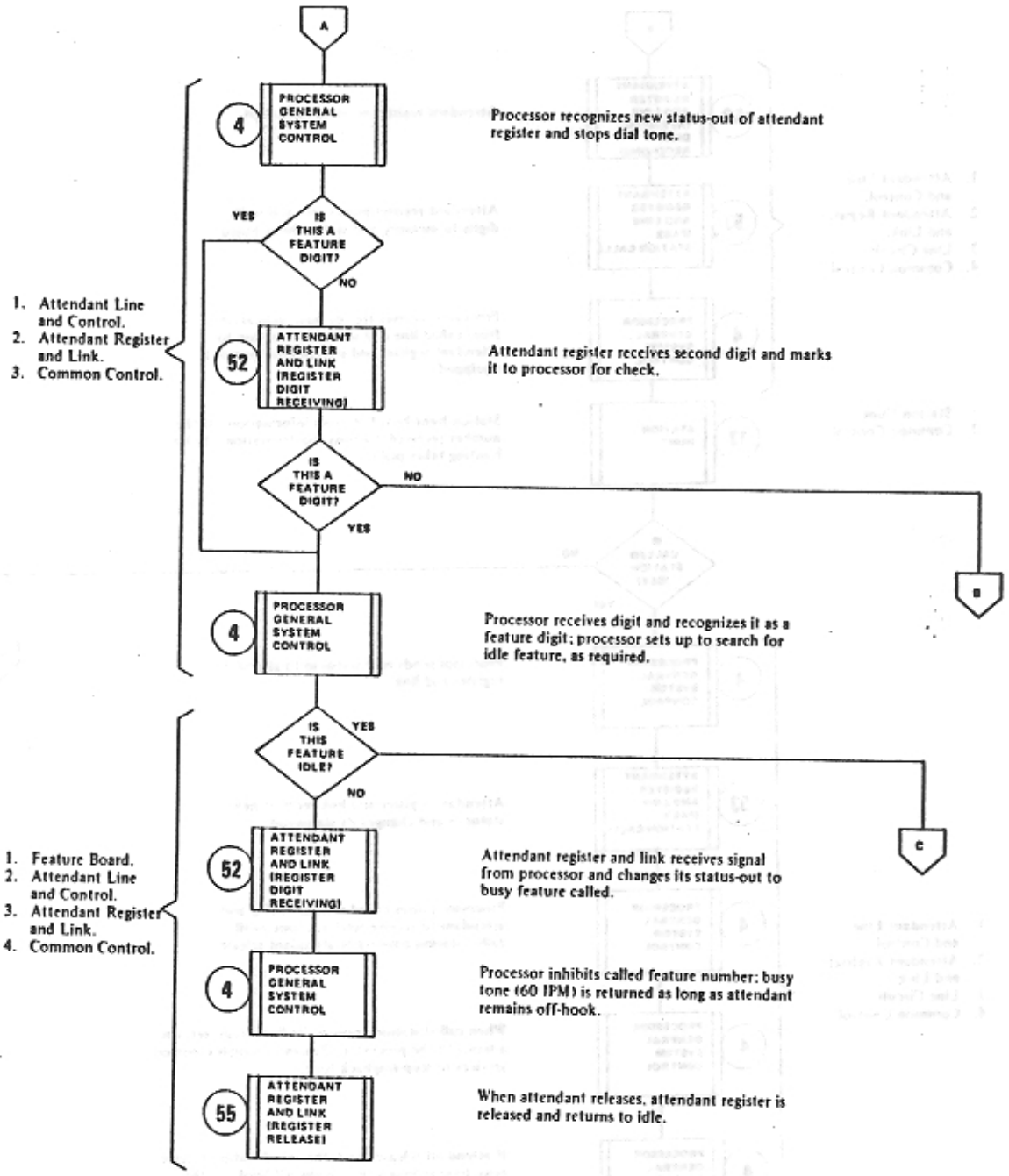


FIGURE 1.04 Overview – Attendant Originated Call (Sheet 2 of 4)

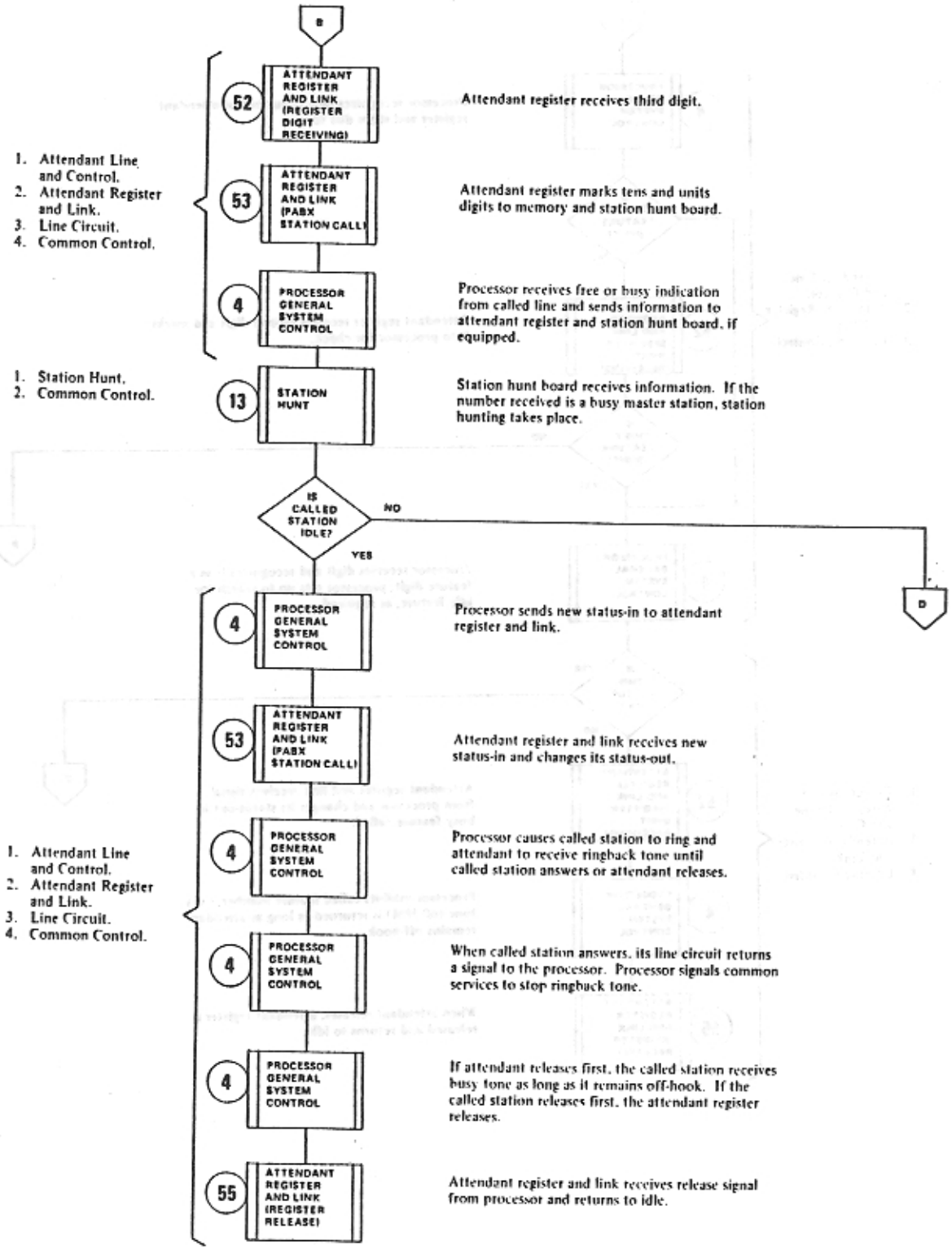


FIGURE 1.04 Overview – Attendant Originated Call (Sheet 3 of 4)

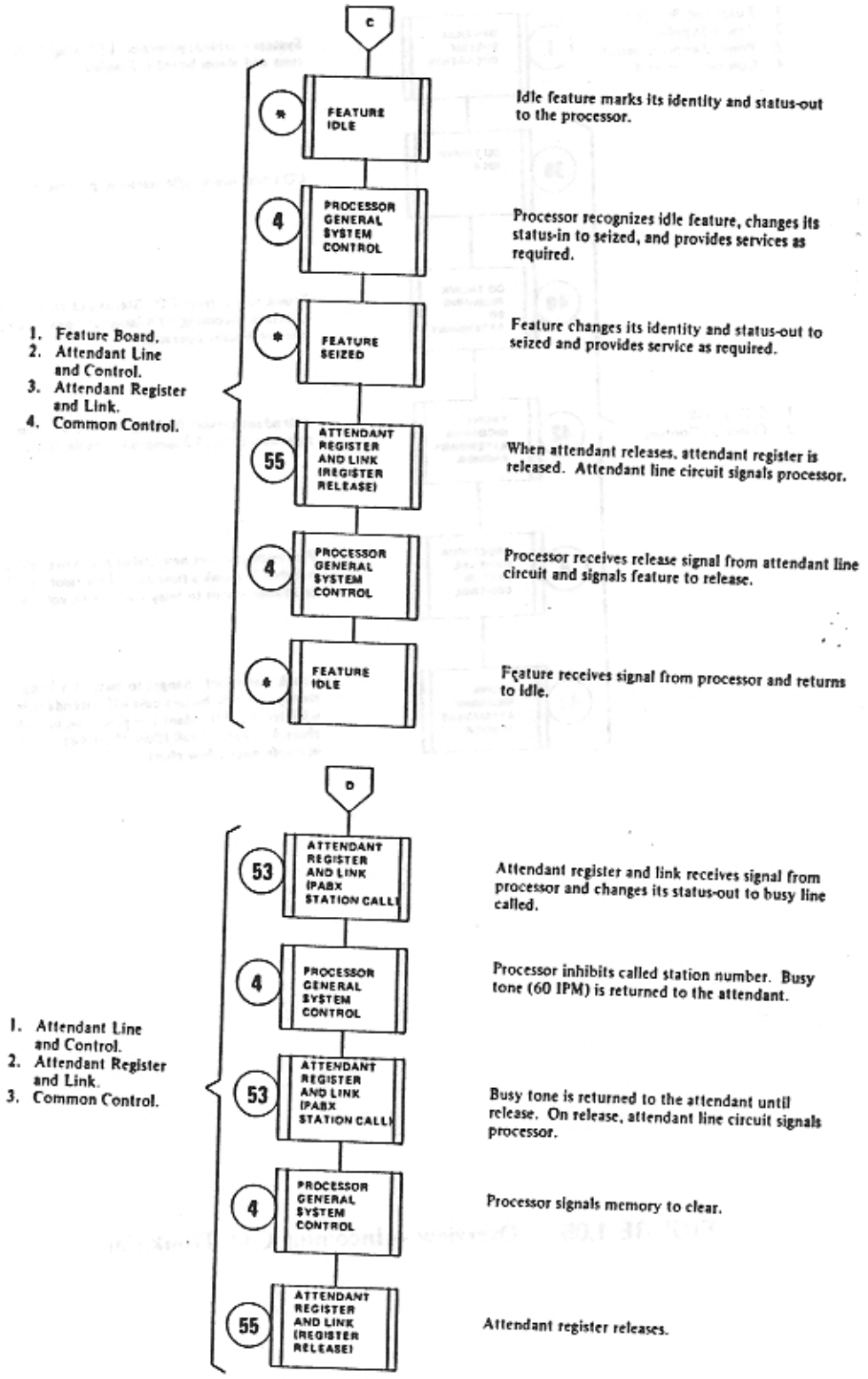


FIGURE 1.04 Overview – Attendant Originated Call (Sheet 4 of 4)

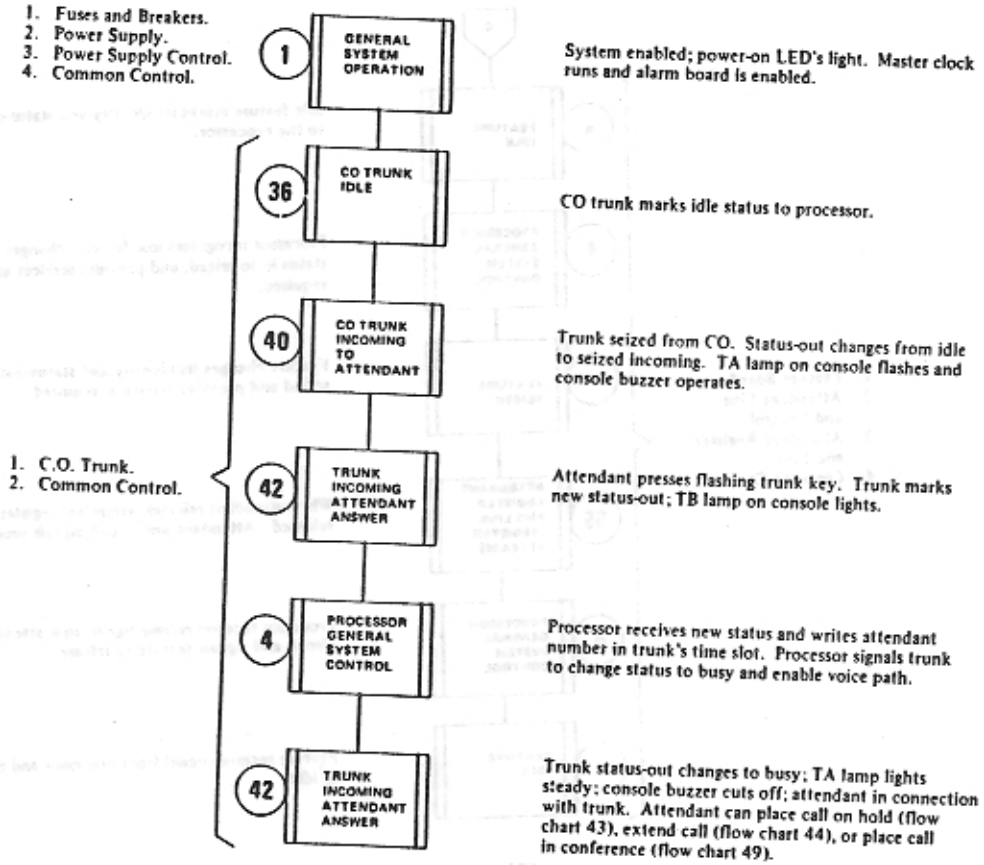


FIGURE 1.05 Overview – Incoming C.O. Trunk Call

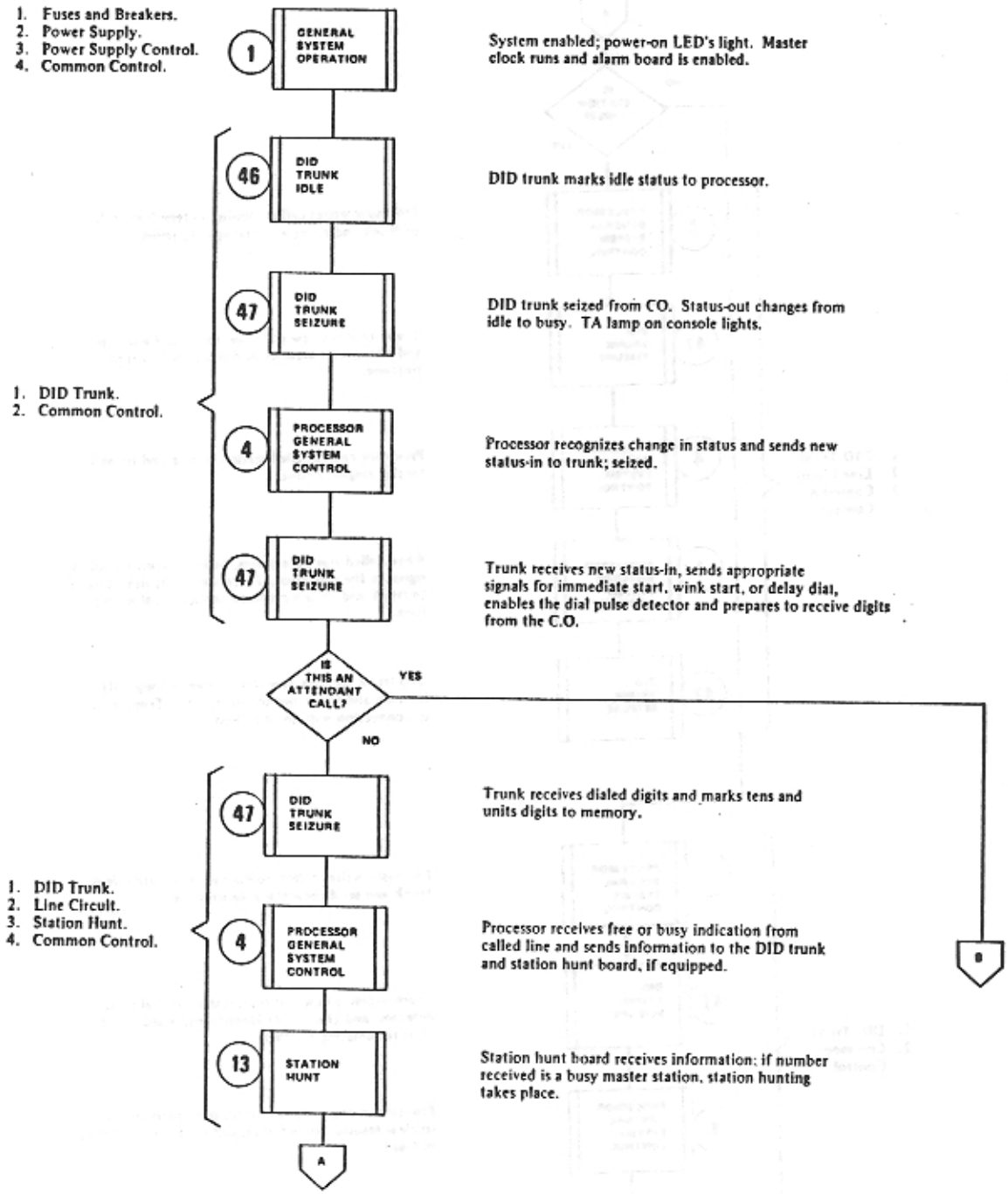
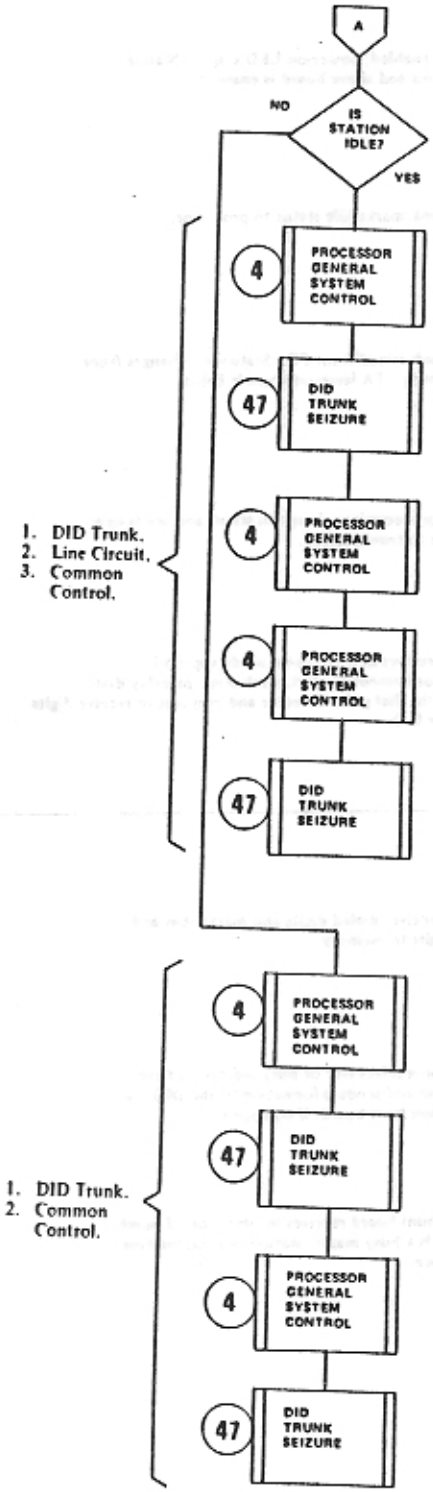


FIGURE 1.06 Overview – Incoming DID Trunk Call (Sheet 1 of 3)



Processor writes called number in terminate side of trunk and sends new status-in to trunk.

Trunk receives new status-in, resets dial pulse detector, and changes its identity and status-out to apply ringtone.

Processor causes called station to ring and trunk to receive ringback tone.

When called station answers, its line circuit returns a signal to the processor. Processor marks new status-in to trunk and signals common services to stop ringback tone.

DID trunk receives new status-in and changes its identity and status out to trunk busy. Trunk party in connection with local station.

Processor writes called number in terminate side of trunk and sends new status-in to trunk.

Trunk receives new status-in, resets the dial pulse detector, and changes its identity and status-out to clear terminating number.

Processor recognizes new status-out, instructs memory to clear terminating number, and sends new status-in to trunk.

Trunk receives new status-in and depending on strapping, returns busy tone to the calling party or forwards the call to the attendant. (See leg B of this overview for call routed to the attendant.)

FIGURE 1.06 Overview – Incoming DID Trunk Call (Sheet 2 of 3)

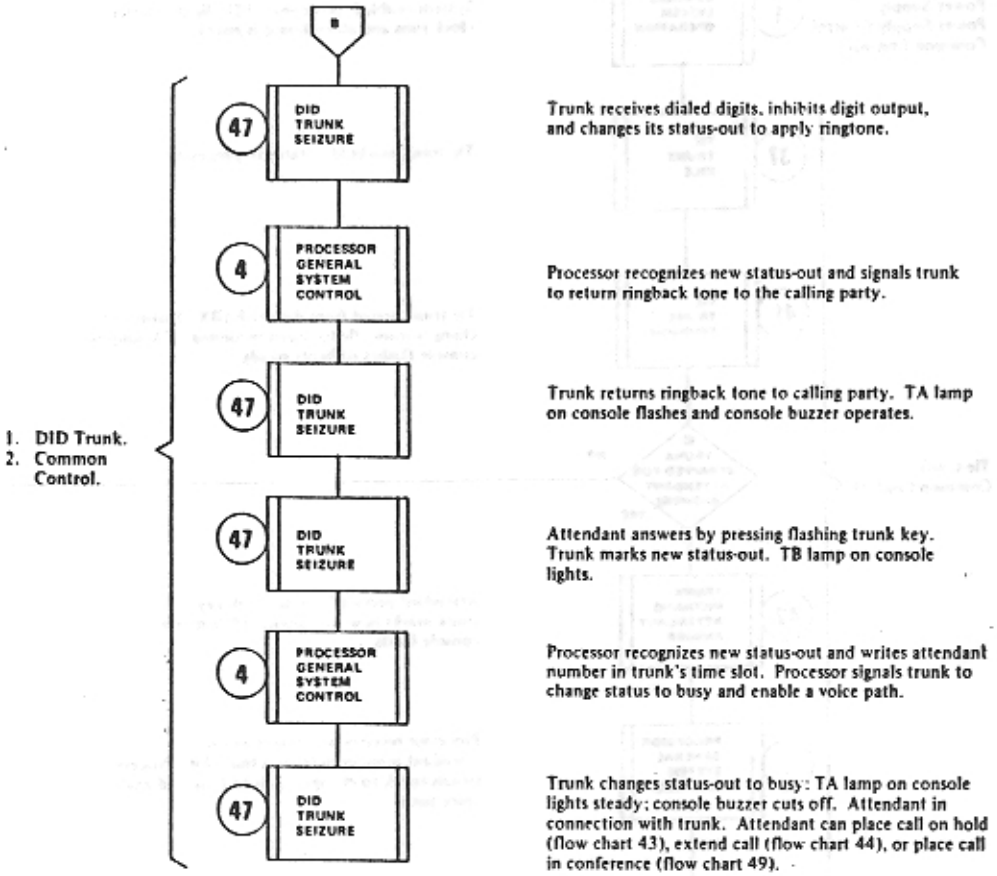


FIGURE 1.06 Overview – Incoming DID Trunk Call (Sheet 3 of 3)

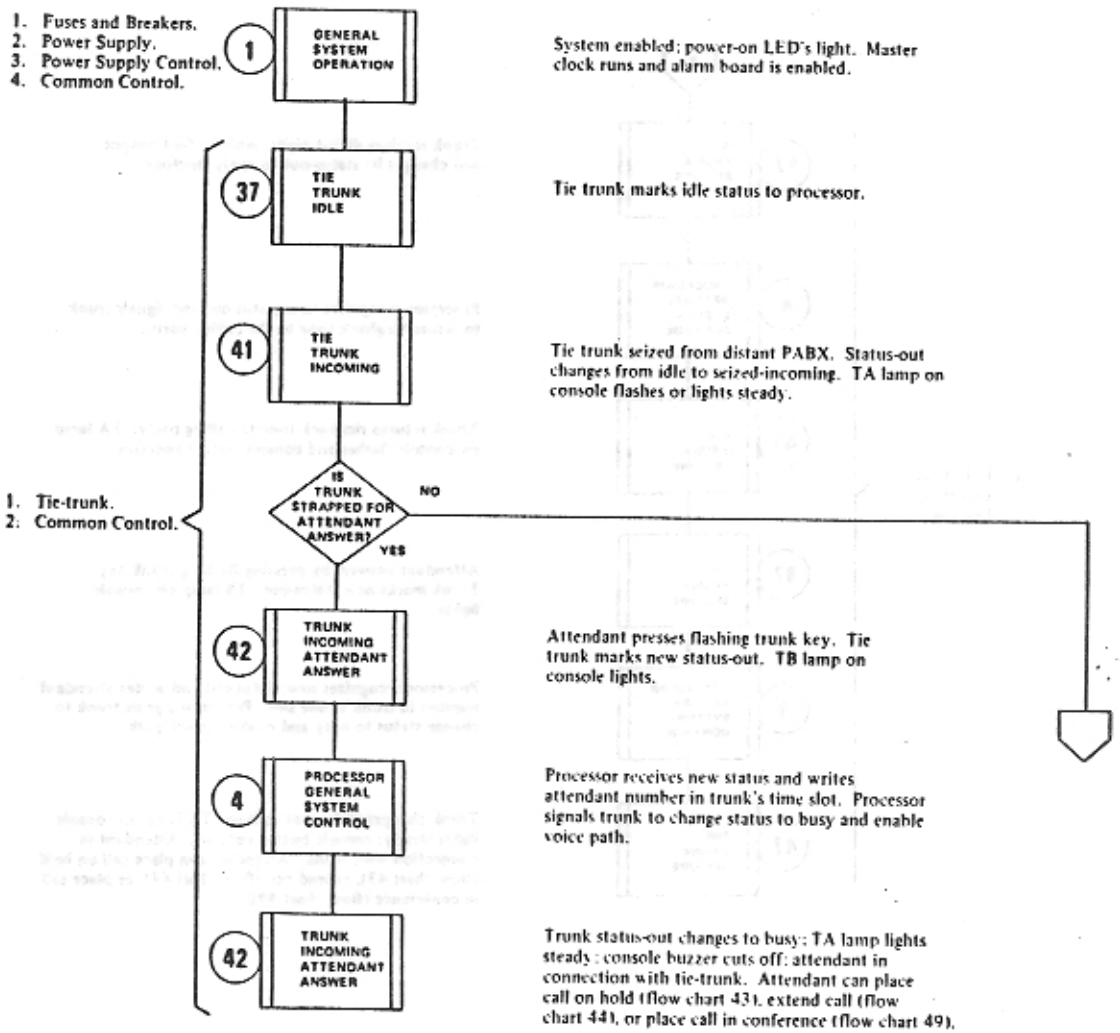


FIGURE 1.07 Overview – Incoming Tie Trunk Call (Sheet 1 of 5)

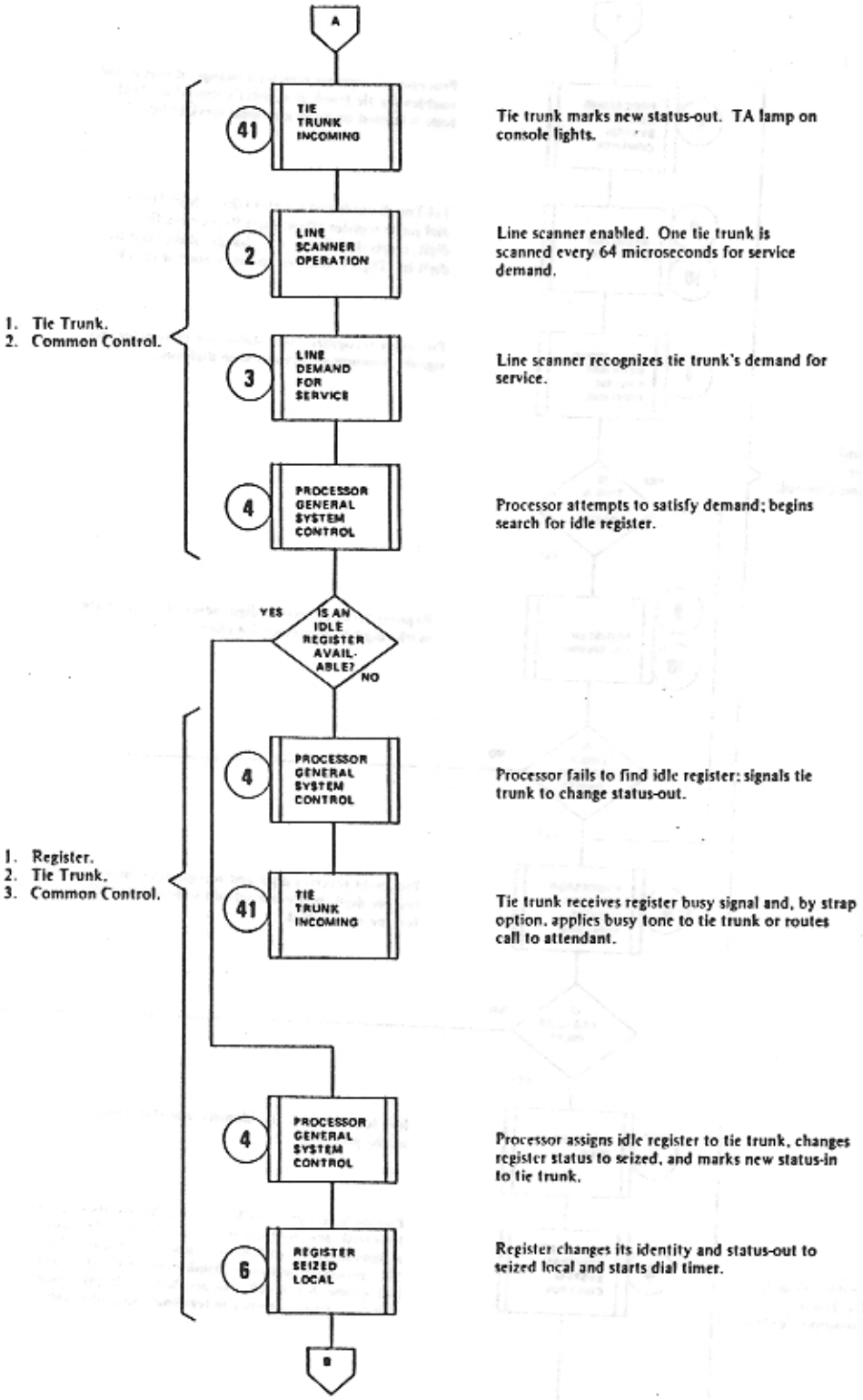


FIGURE 1.07 Overview – Incoming Tie Trunk Call (Sheet 2 of 5)

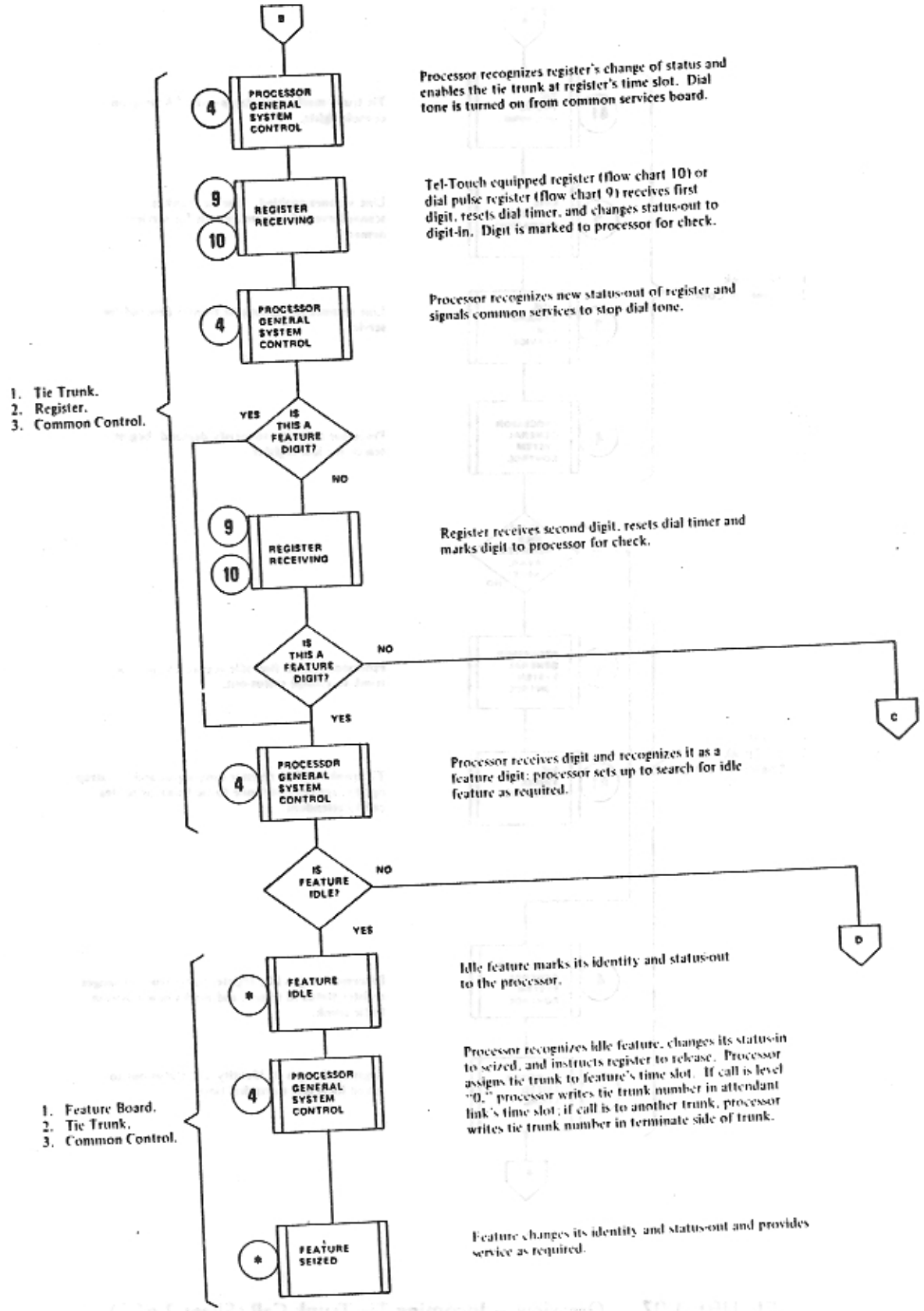


FIGURE 1.07 Overview - Incoming Tie Trunk Call (Sheet 3 of 5)

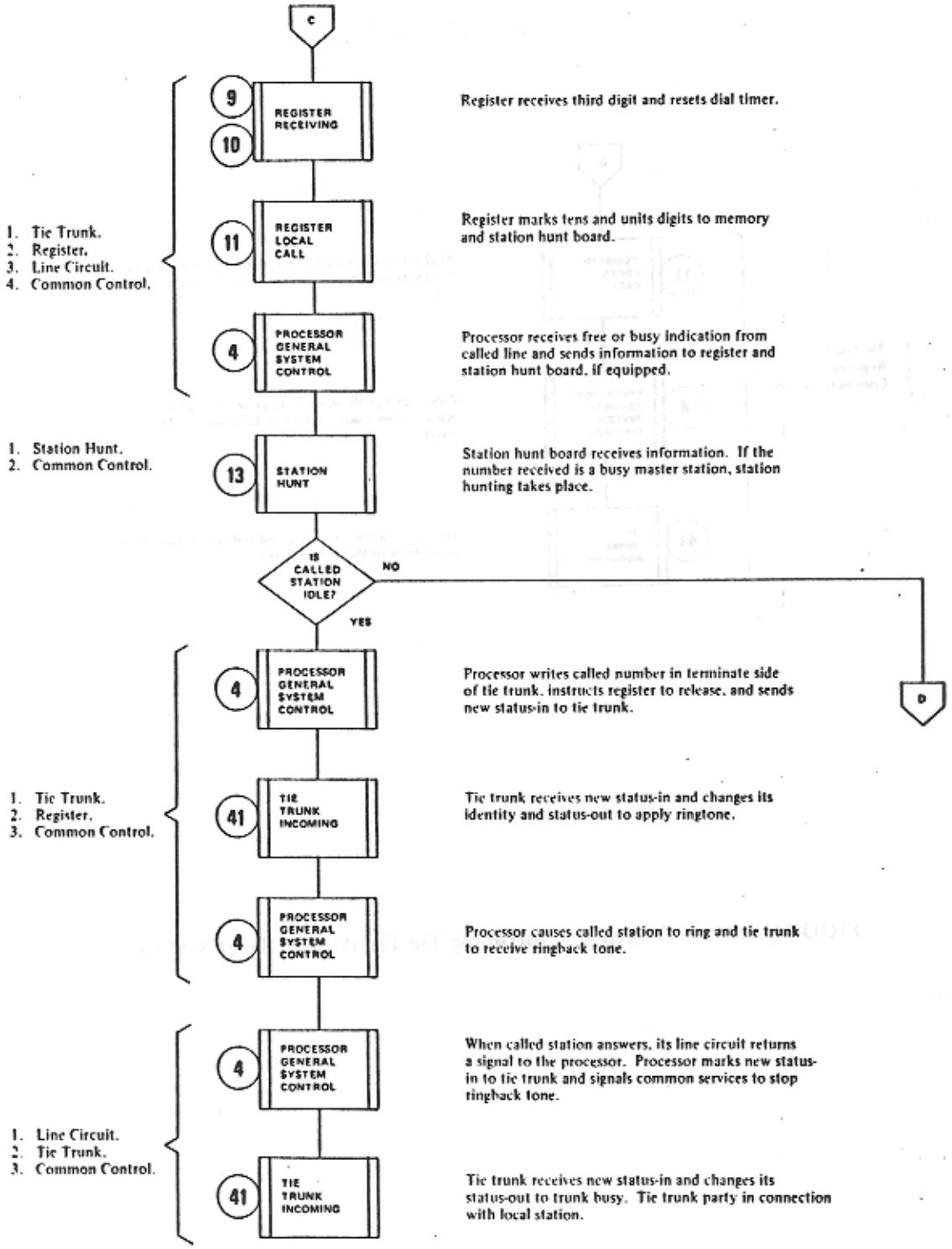


FIGURE 1.07 Overview – Incoming Tie Trunk Call (Sheet 4 of 5)

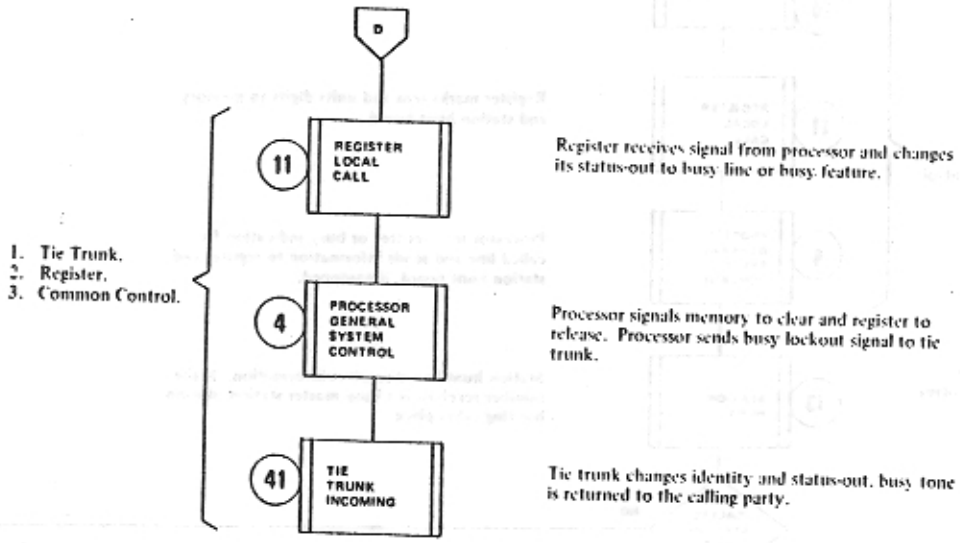


FIGURE 1.07 Overview – Incoming Tie Trunk Call (Sheet 5 of 5)

MAINTENANCE FLOW CHARTS
TD-100 EPABX

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A-1.00 INTRODUCTION

A-1.01 General. This appendix contains the detailed operational flow charts supplemental to ITT Section OC-000-005, Trouble Analysis and PCB Replacement Guide for the TD-100 EPABX. Each flow chart provides an easily understood analysis of a particular TD-100 operation such as register seizure, link seizure, etc. The overview flow charts in section OC-000-005 serve as an index to these more detailed flow charts.

The flow charts are recommended for use by maintenance personnel familiar with the organization and operation of TD-100 EPABX. Properly applied, the flow charts can be of great value in tracing a trouble to a replaceable PCB assembly.

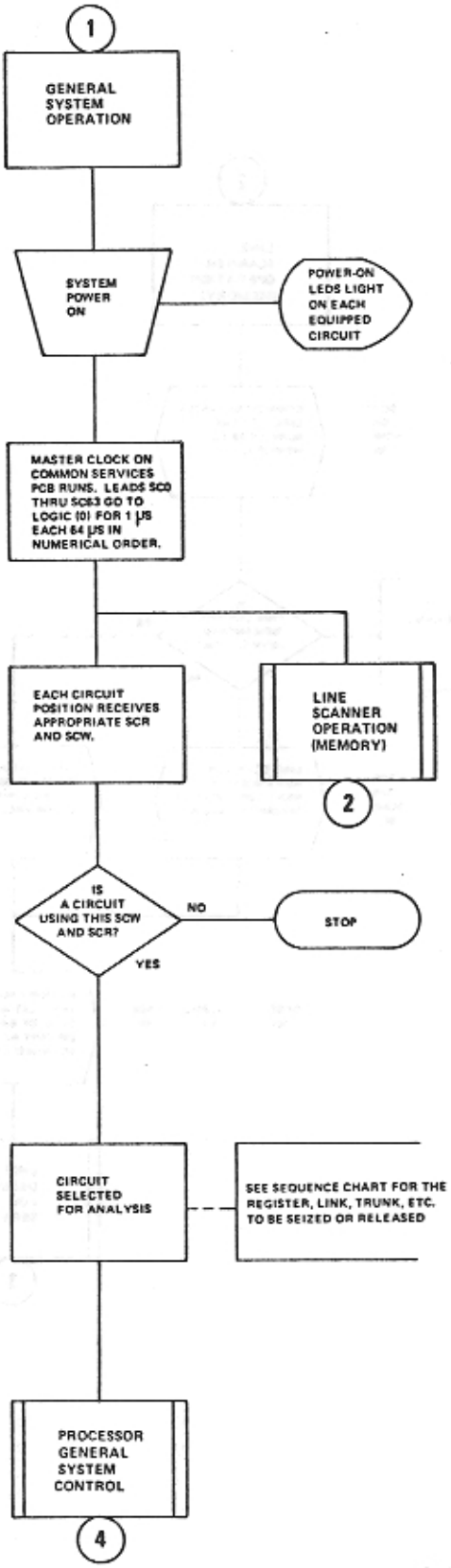


FIGURE A-1.00 Flow Chart 1, General System Operation

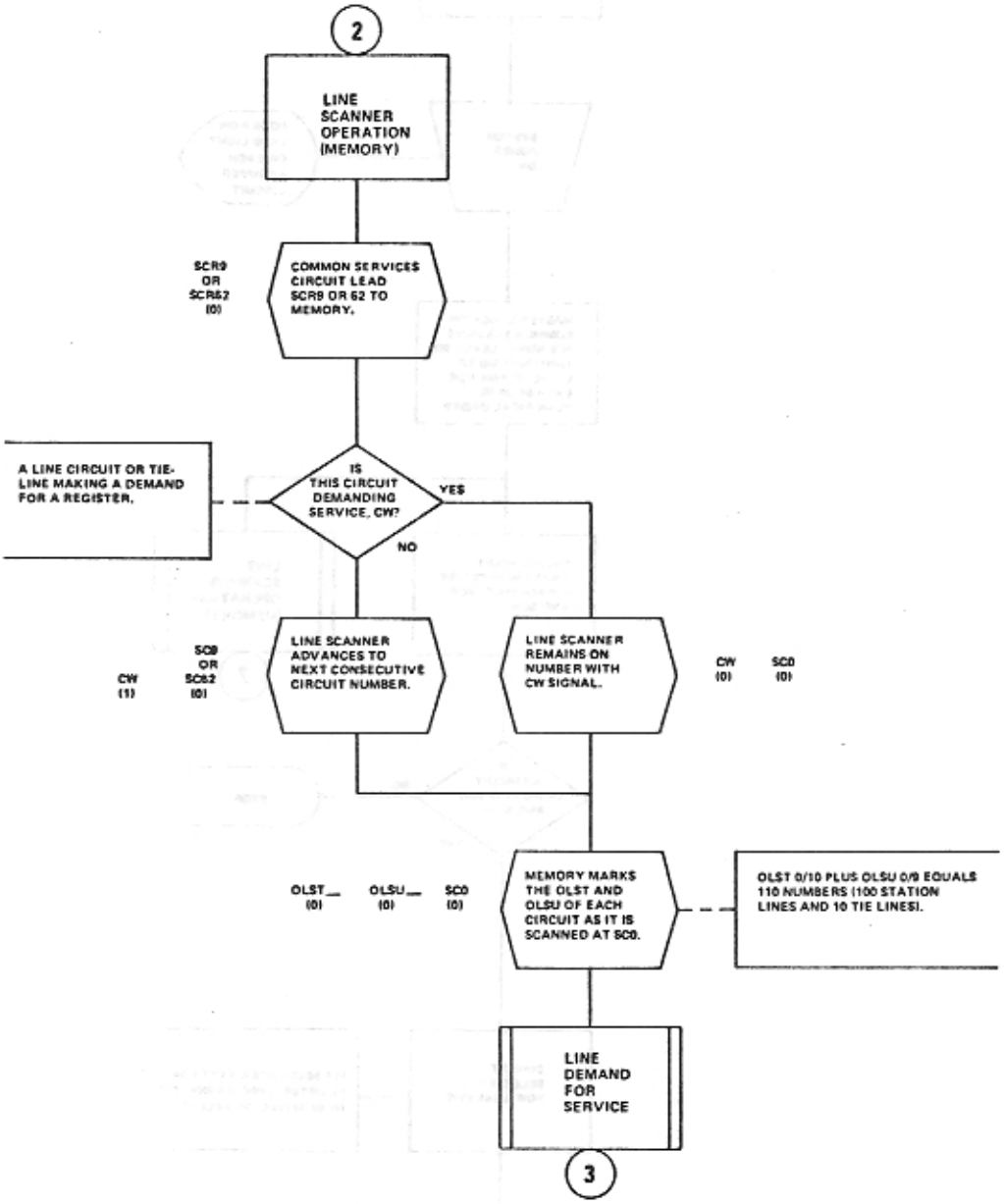
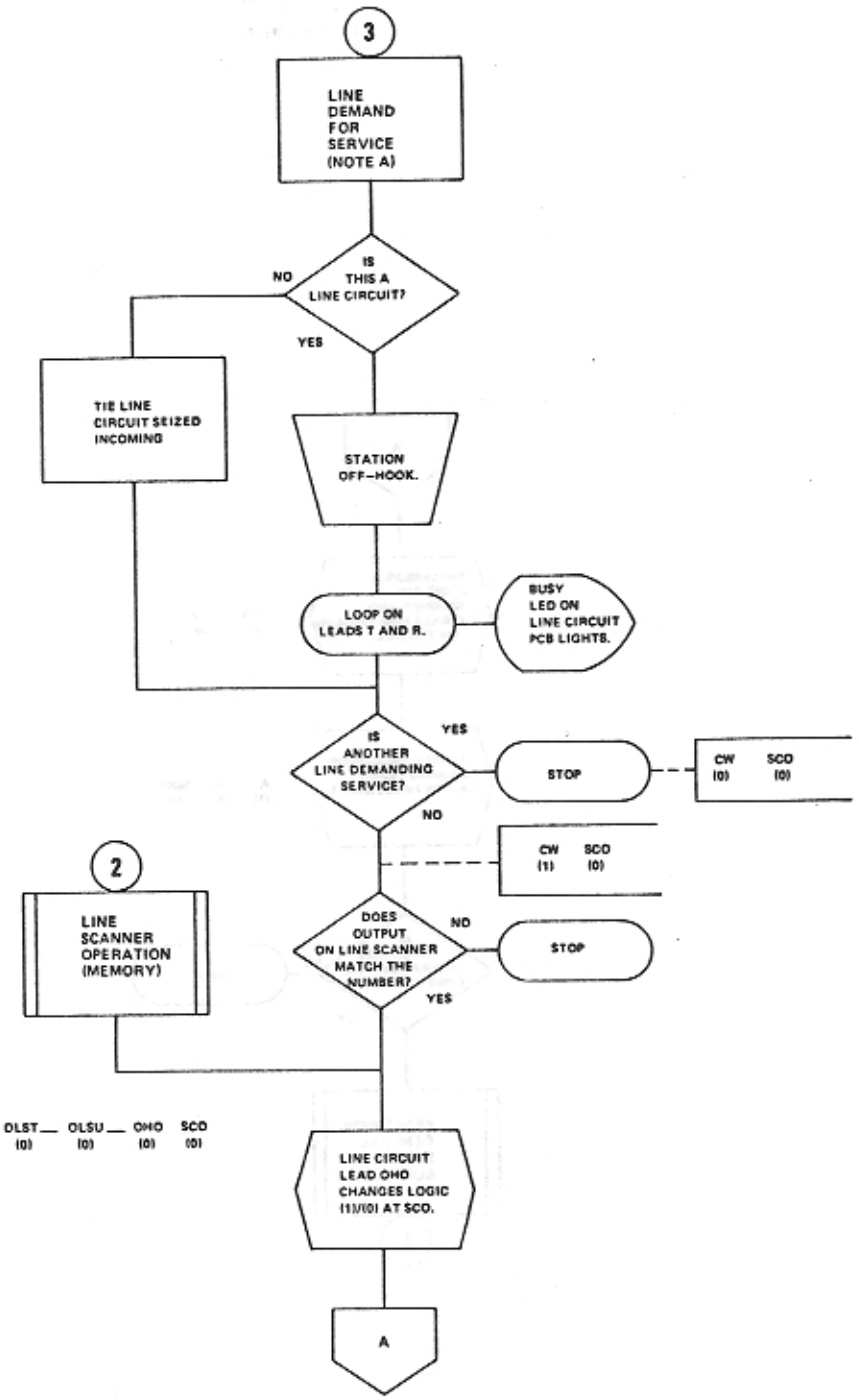


FIGURE A-1.01 Flow Chart 2, Line Scanner Operation



NOTES:

A. A LINE DEMAND FOR SERVICE IS CONSIDERED AS A FEATURE ENTRY TO THE PROCESSOR.

FIGURE A-1.02 Flow Chart 3, Line Demand for Service (Sheet 1 of 2)

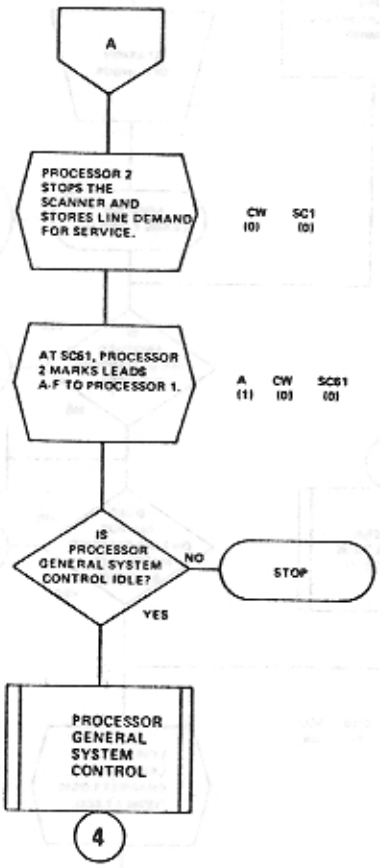


FIGURE A-1.02 Flow Chart 3, Line Demand for Service (Sheet 2 of 2)

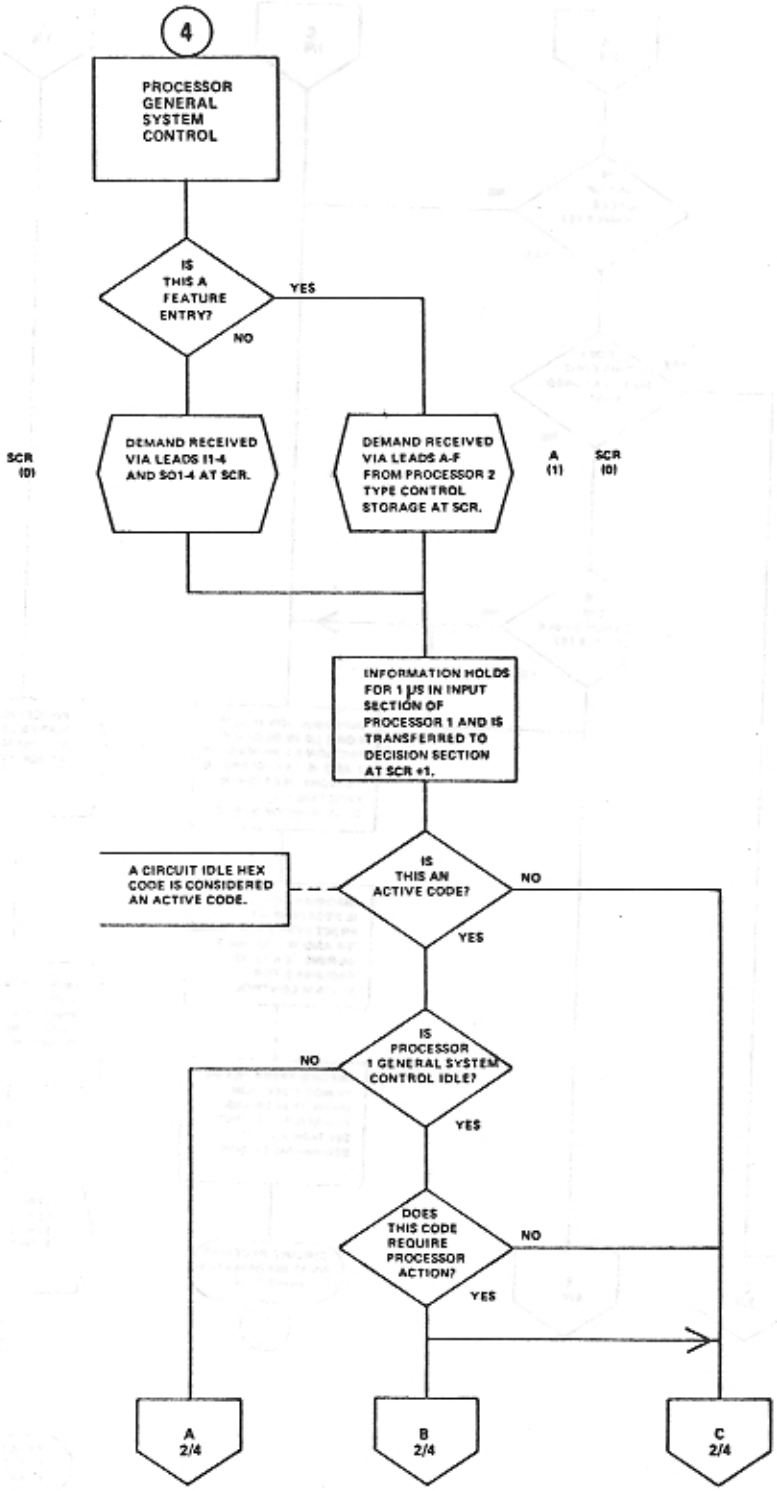
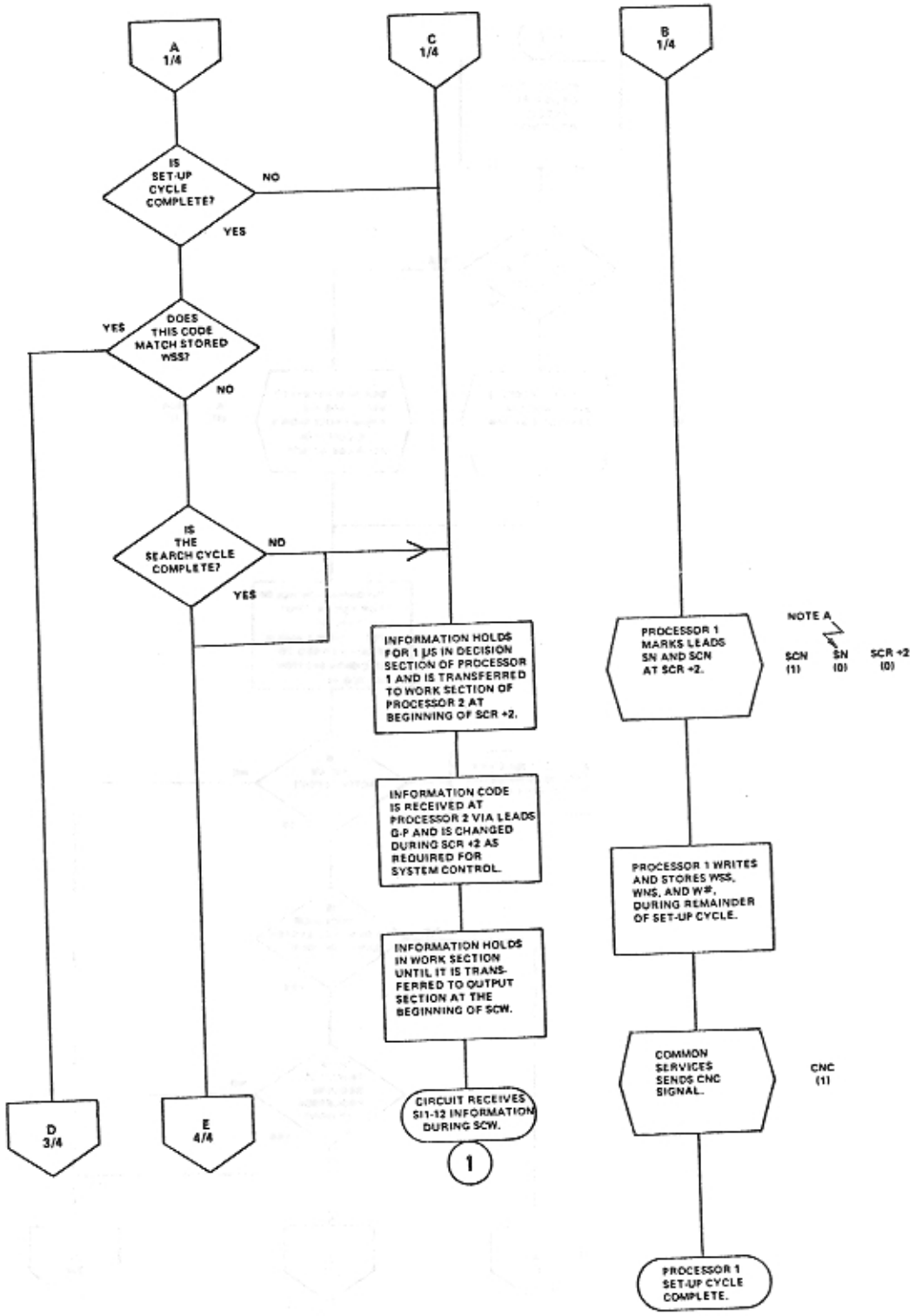


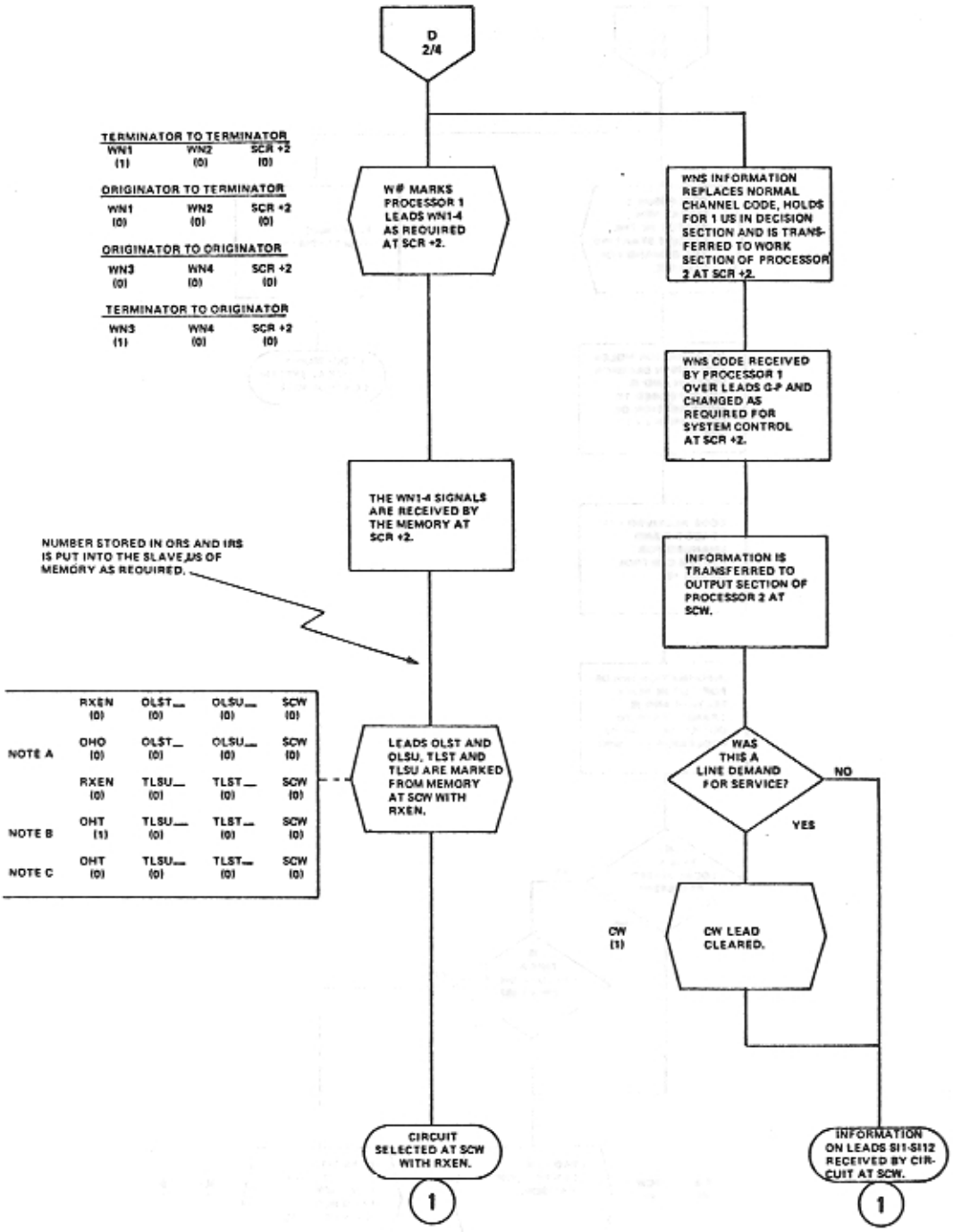
FIGURE A-1.03 Flow Chart 4, Processor General System Control (Sheet 1 of 4)



NOTES:

A. LEAD SN STORES THE NUMBER IN THE SLAVE SIDE OF MEMORY.

FIGURE A-1.03 Flow Chart 4, Processor General System Control (Sheet 2 of 4)



NOTES:

A. ORIGINATING LINE ASSIGNED

B. TERMINATING LINE ASSIGNED, STATION ON-HOOK AND RINGING.

C. TERMINATING LINE ASSIGNED, STATION OFF-HOOK.

FIGURE A-1.03 Flow Chart 4, Processor General System Control (Sheet 3 of 4)

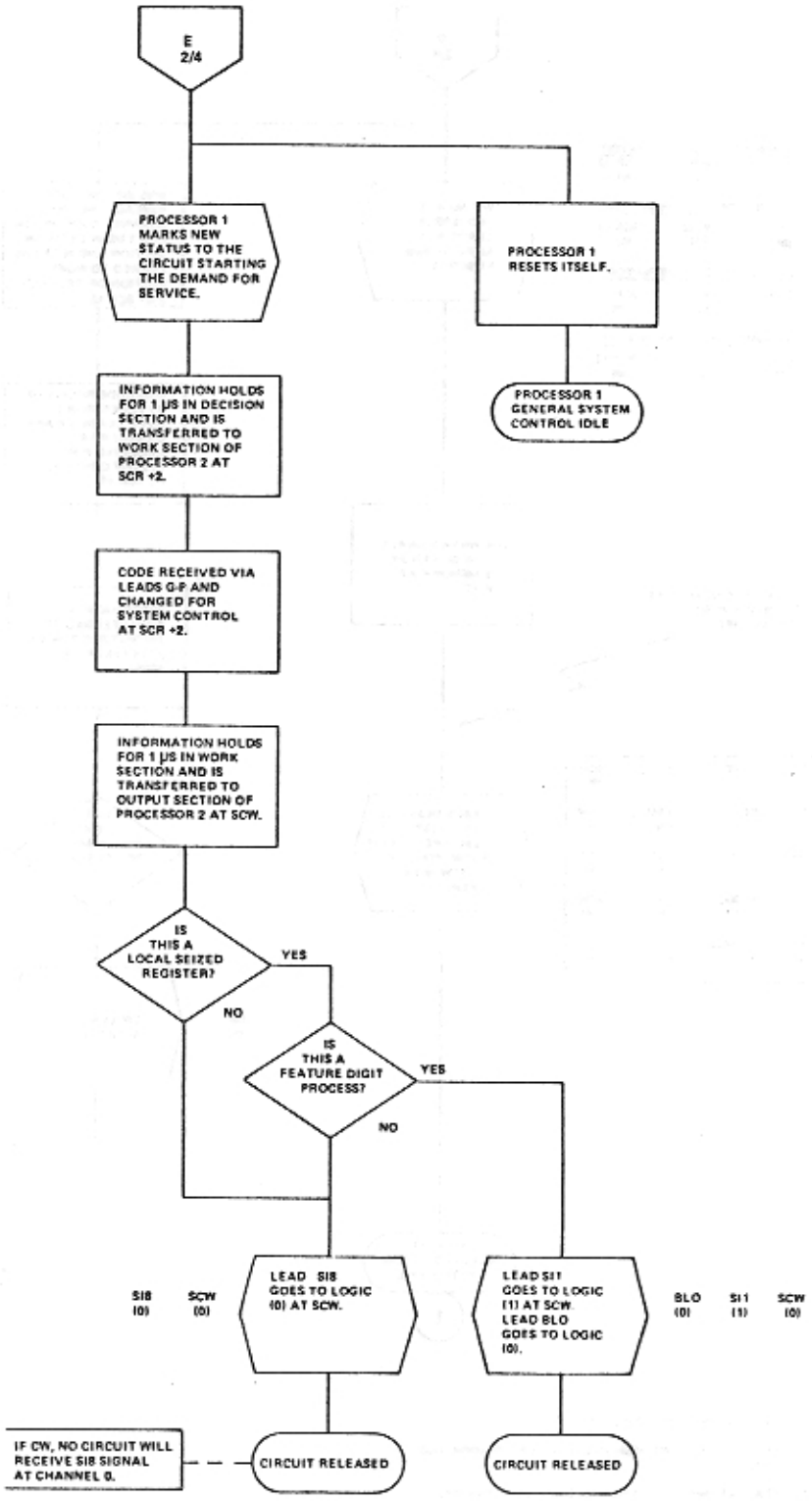


FIGURE A-1.03 Flow Chart 4, Processor General System Control (Sheet 4 of 4)

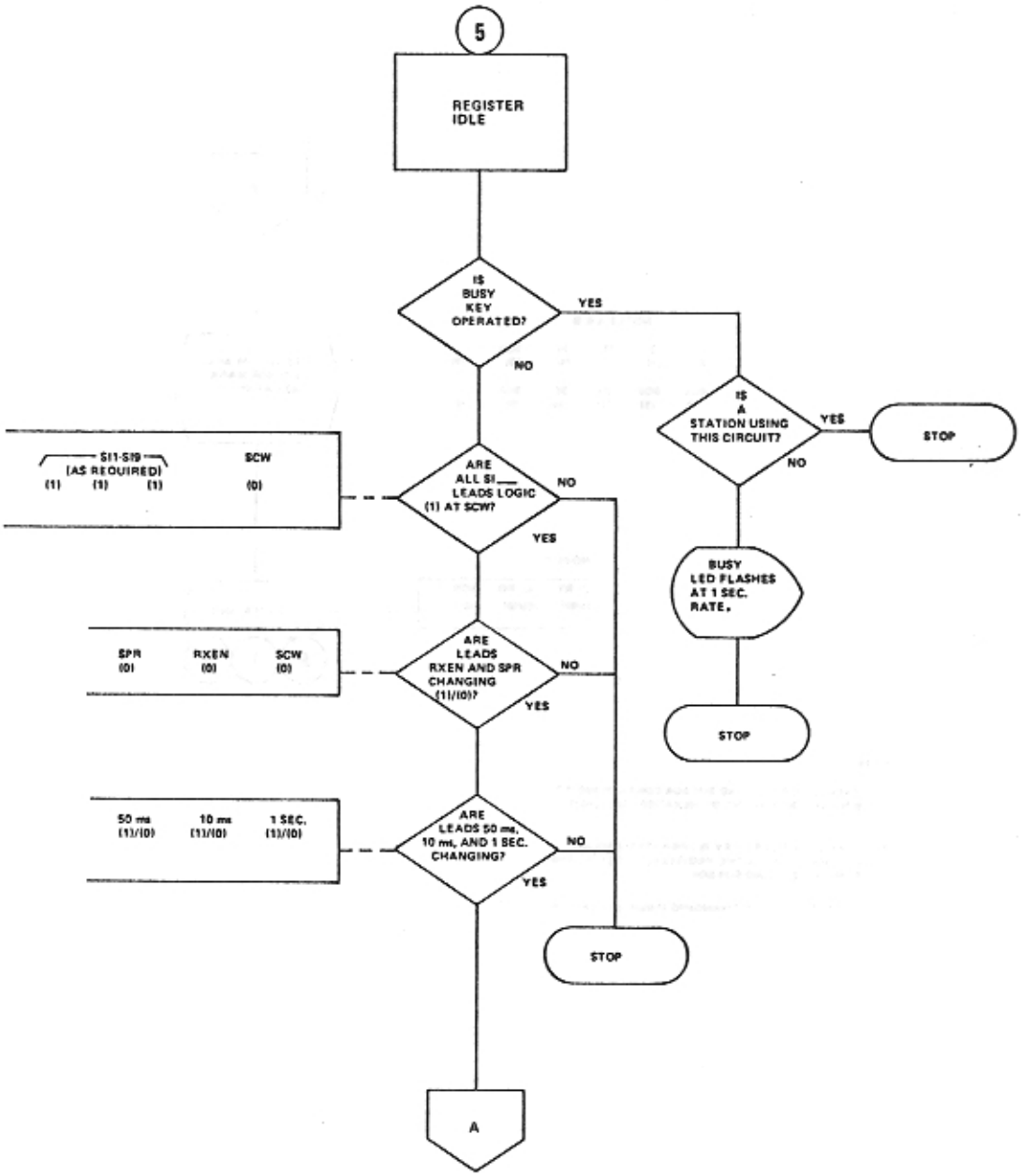
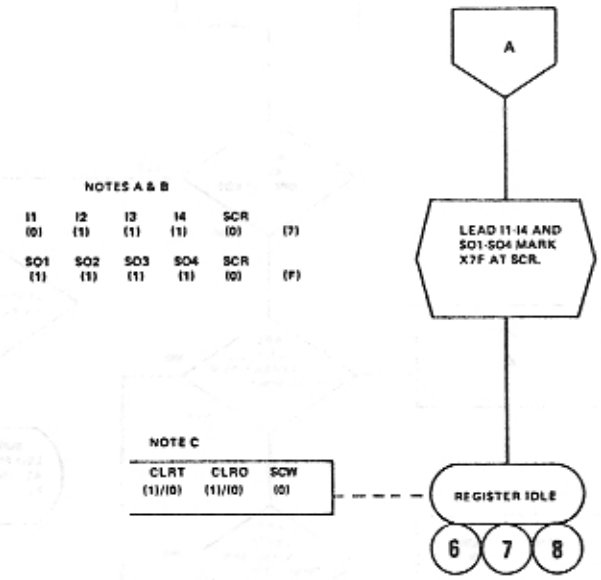


FIGURE A-1.04 Flow Chart 5, Register Idle (Sheet 1 of 2)



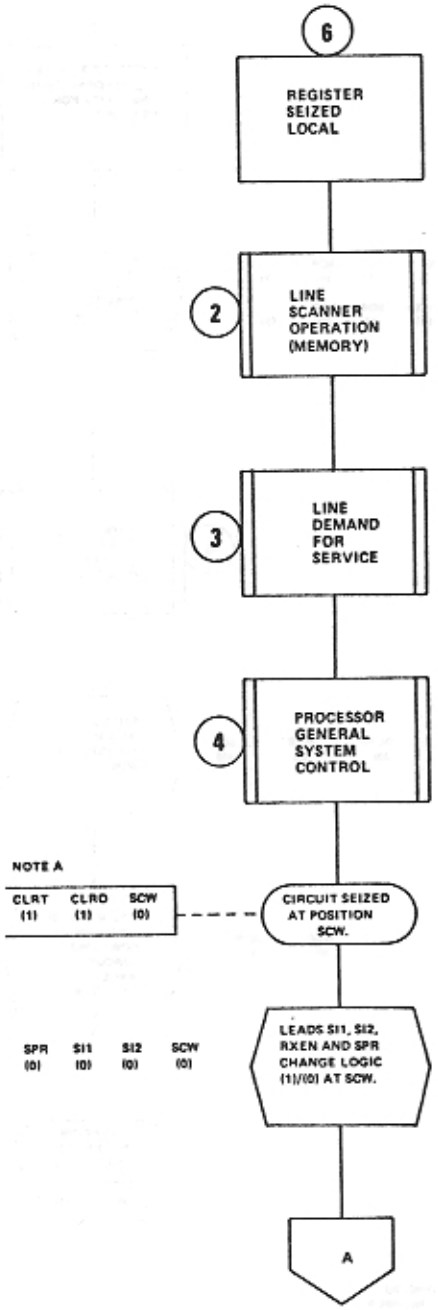
NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 7F.

B. IF REGISTER BUSY KEY IS OPERATED AND NO STATION IS USING THE REGISTER, I1 WILL BE THE SAME AS I2-I4 AND SO1-SO4.

C. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

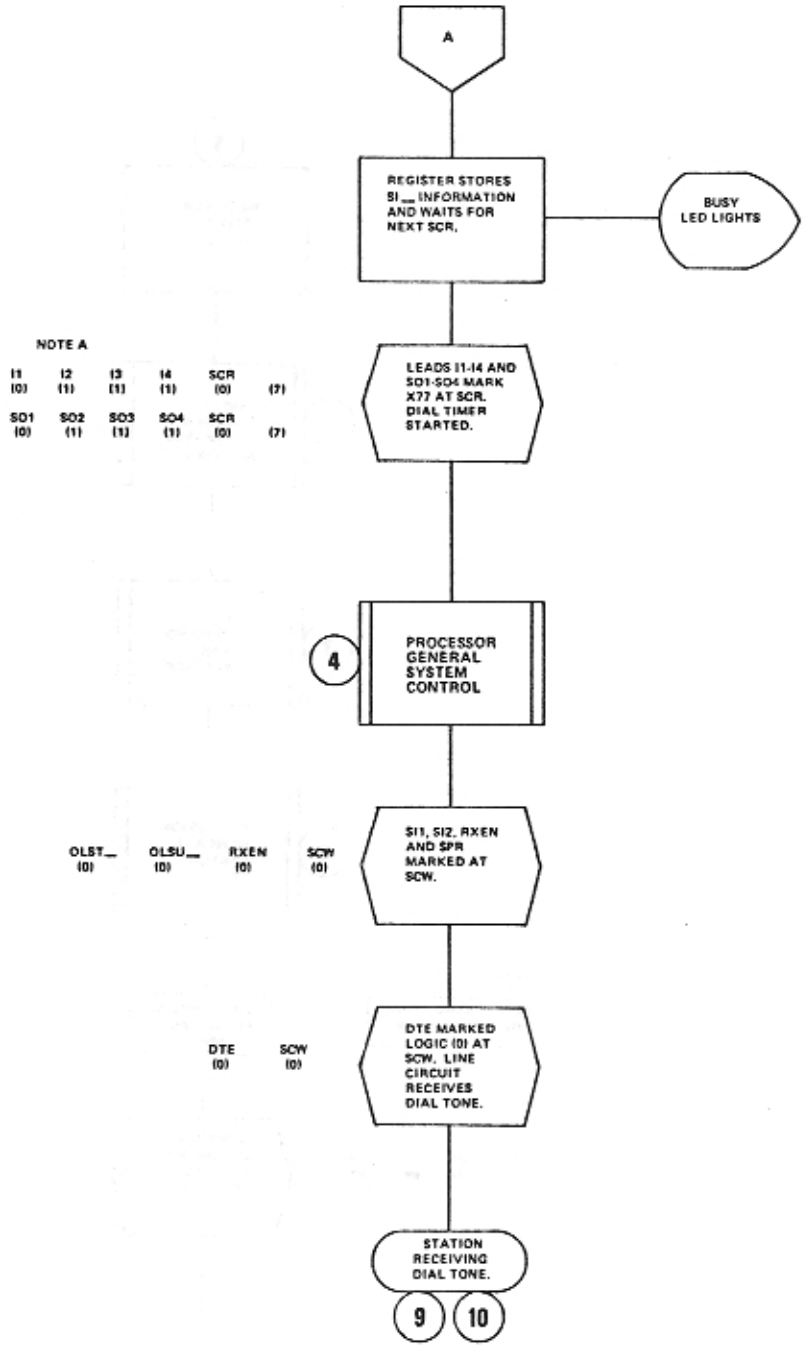
FIGURE A-1.04 Flow Chart 5, Register Idle (Sheet 2 of 2)



NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

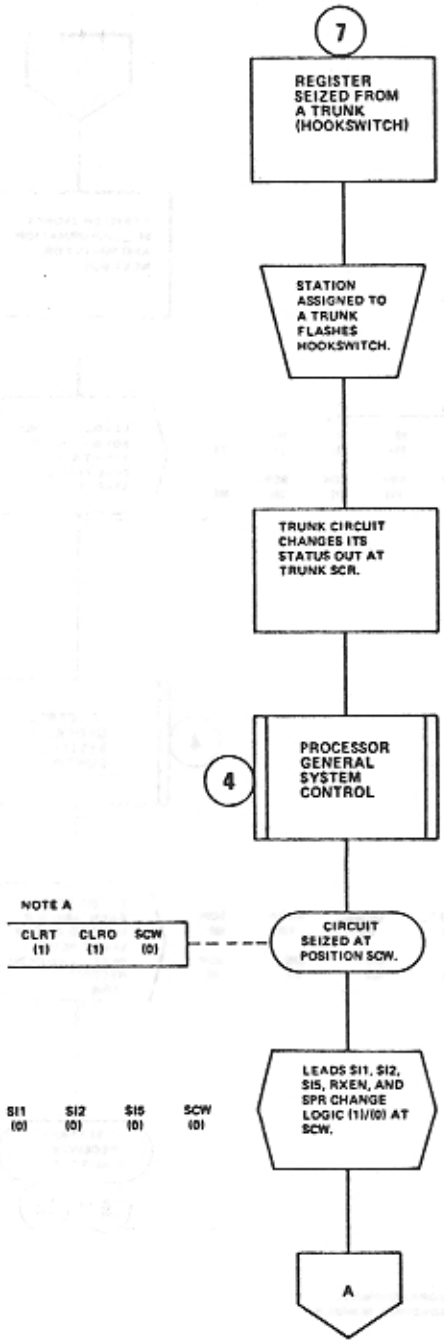
FIGURE A-1.05 Flow Chart 6, Register Seized Local (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL NUMBER 77.

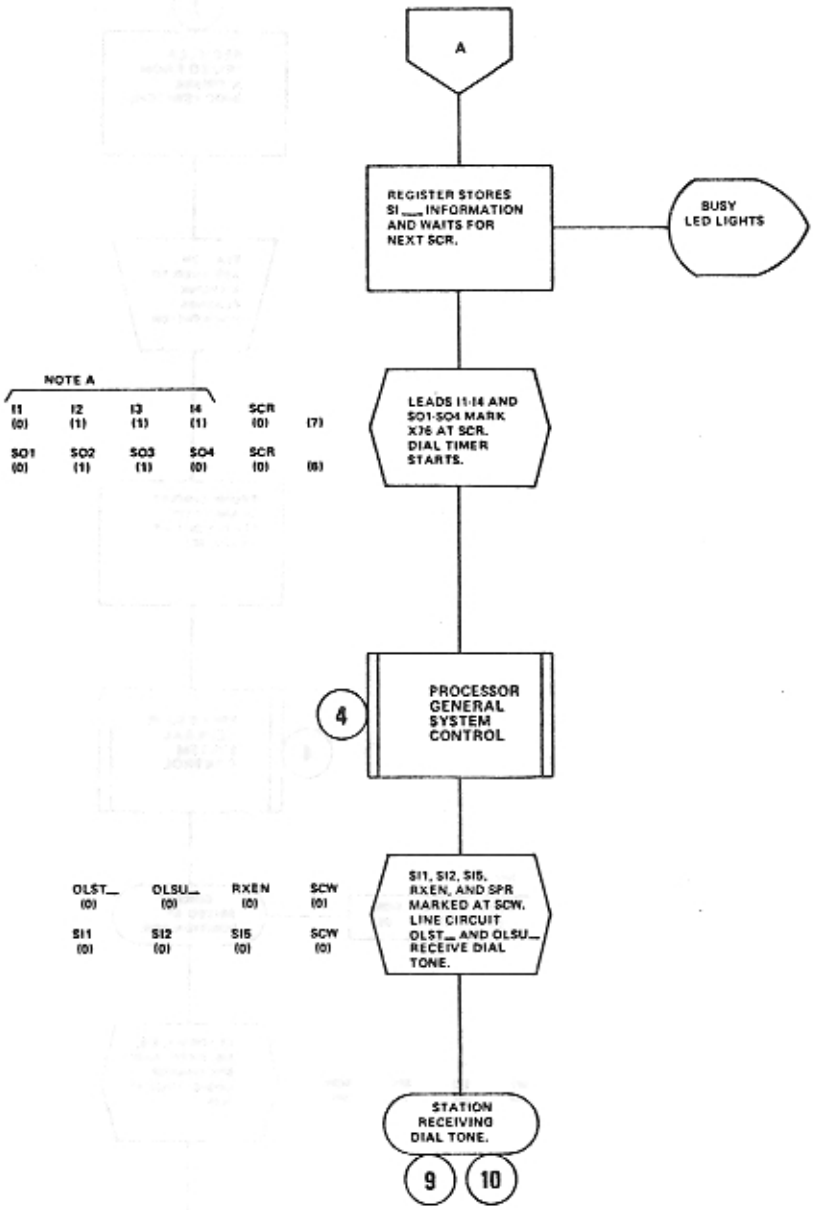
FIGURE A-1.05 Flow Chart 6, Register Seized Local (Sheet 2 of 2)



NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

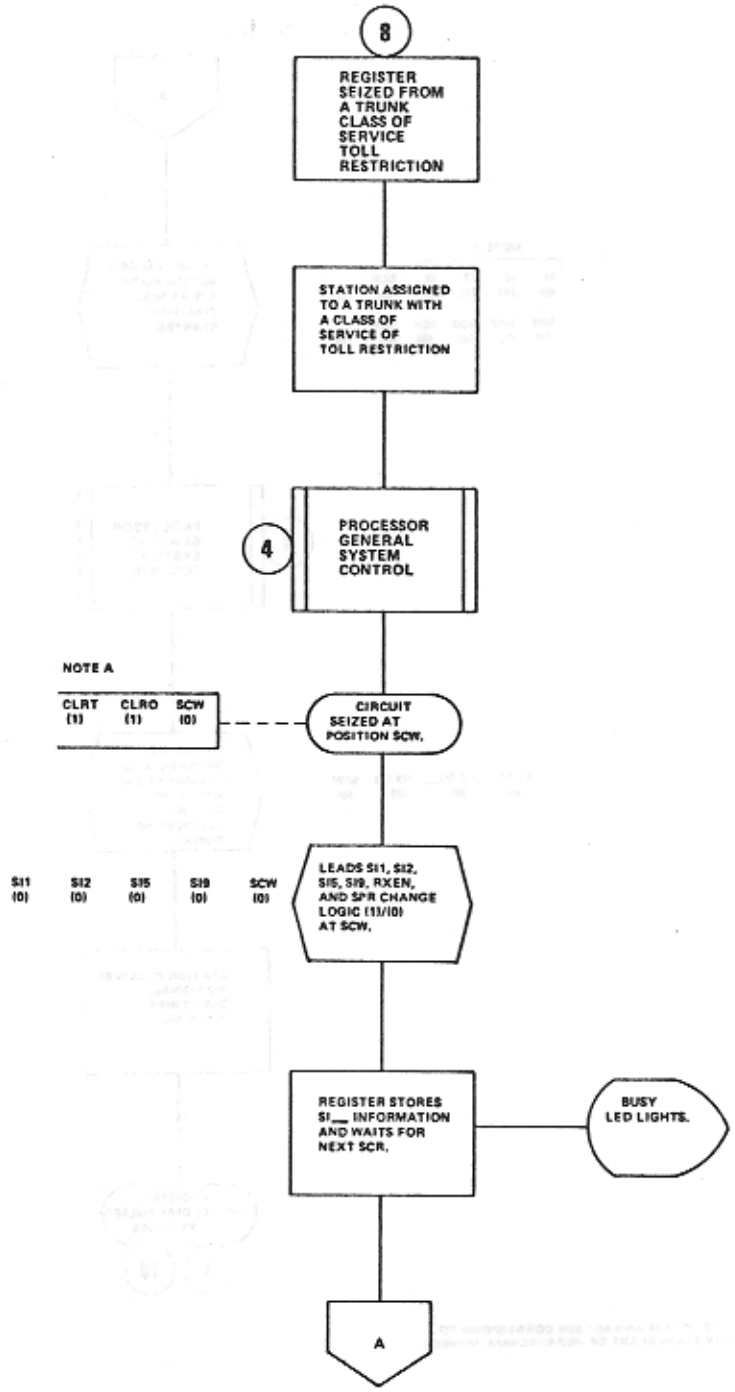
FIGURE A-1.06 Flow Chart 7, Register Seized from a Trunk (Hookswitch) (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL NUMBER 78.

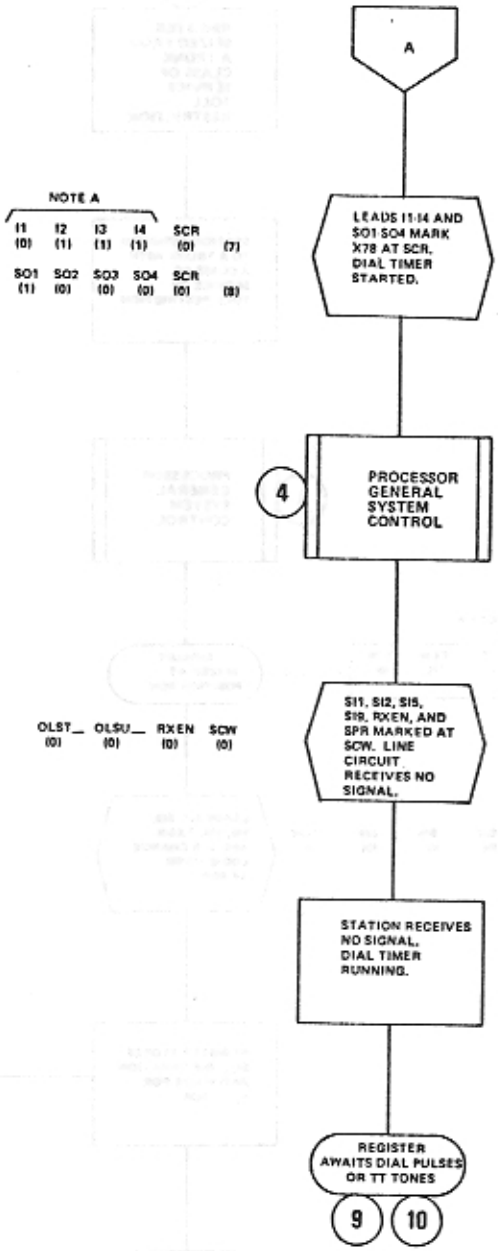
FIGURE A-1.06 Flow Chart 7, Register Seized from a Trunk (Hookswitch) (Sheet 2 of 2)



NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

FIGURE A-1.07 Flow Chart 8, Register Seized from a Trunk (Class-of-Service Toll Restriction) (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL NUMBER 78.

FIGURE A-1.07 Flow Chart 8, Register Seized from a Trunk (Class-of-Service Toll Restriction) (Sheet 2 of 2)

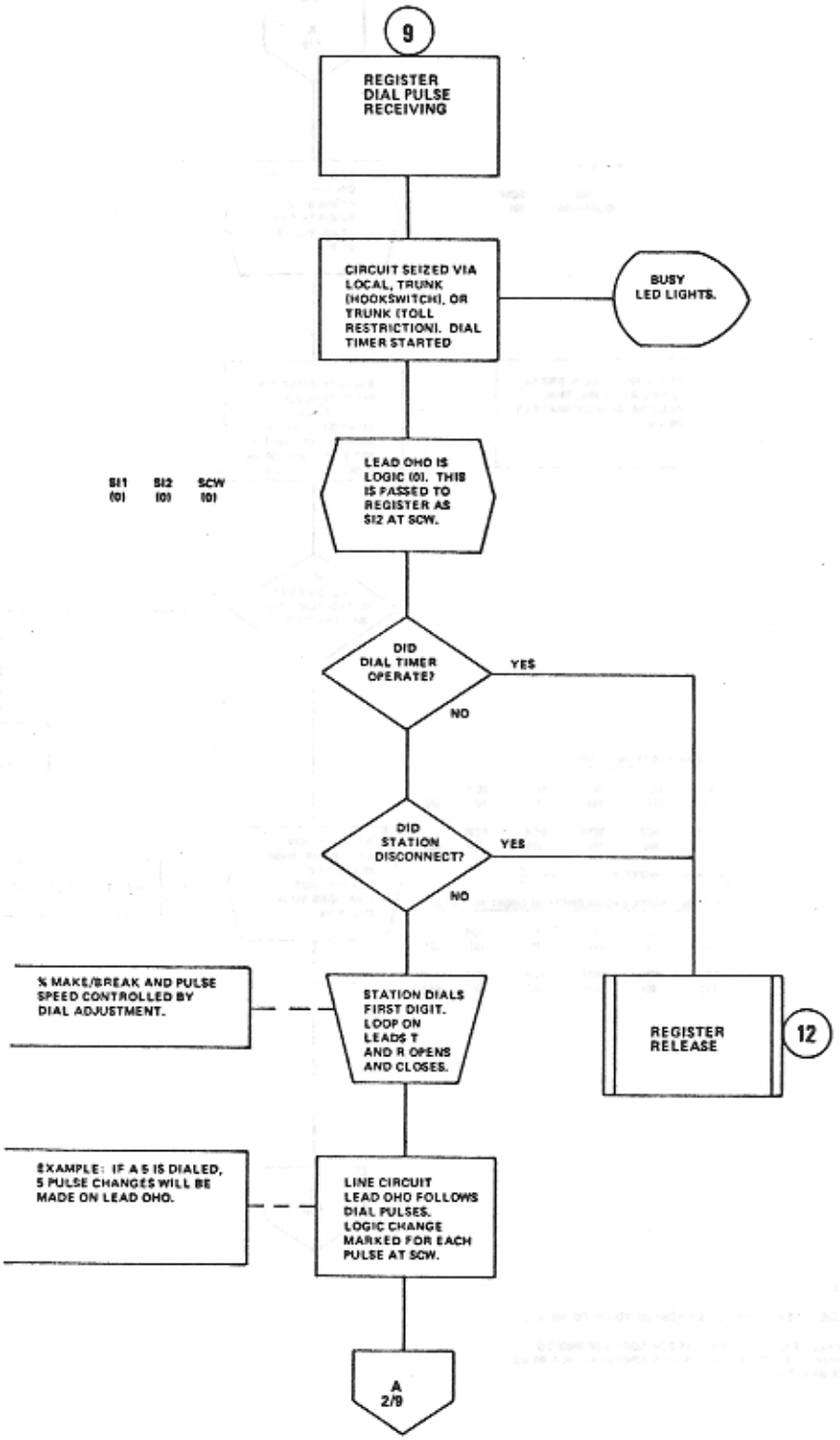
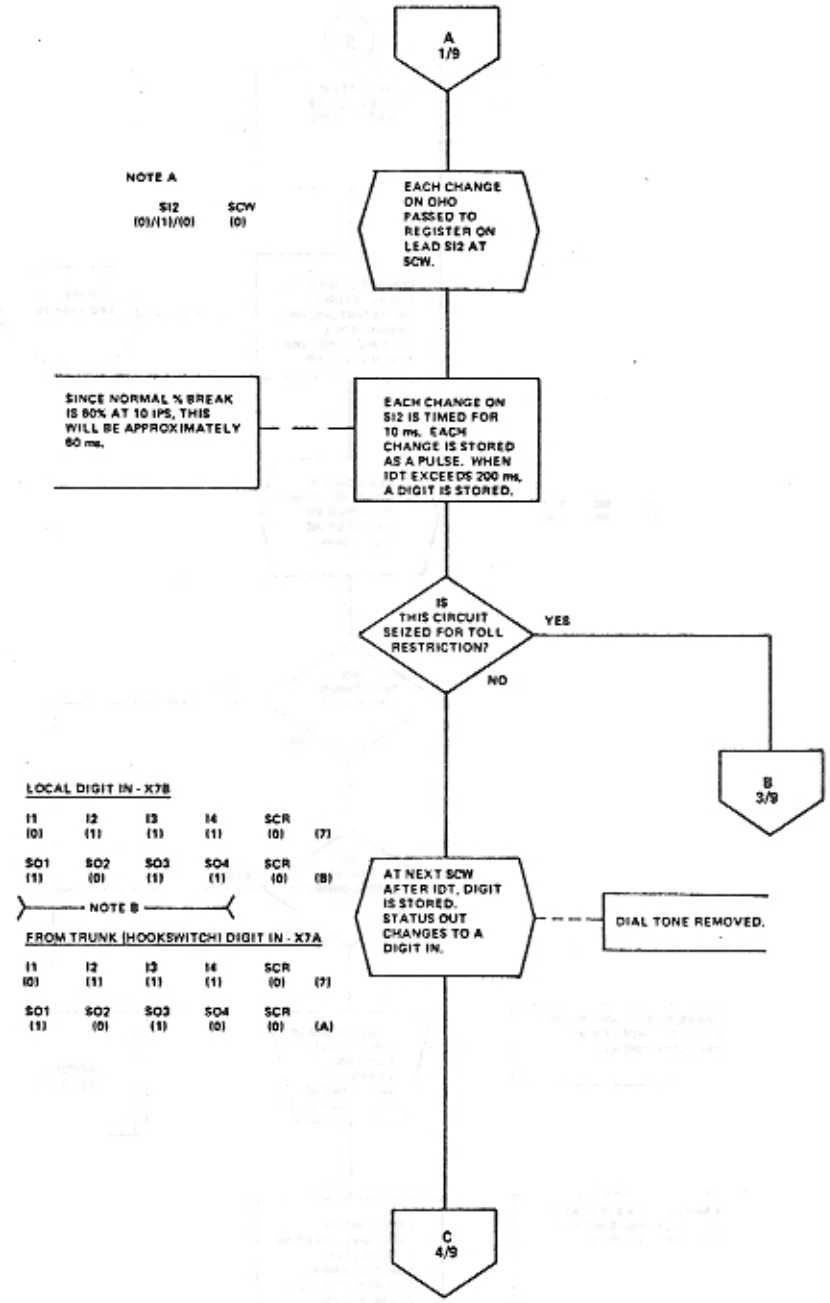


FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 1 of 9)

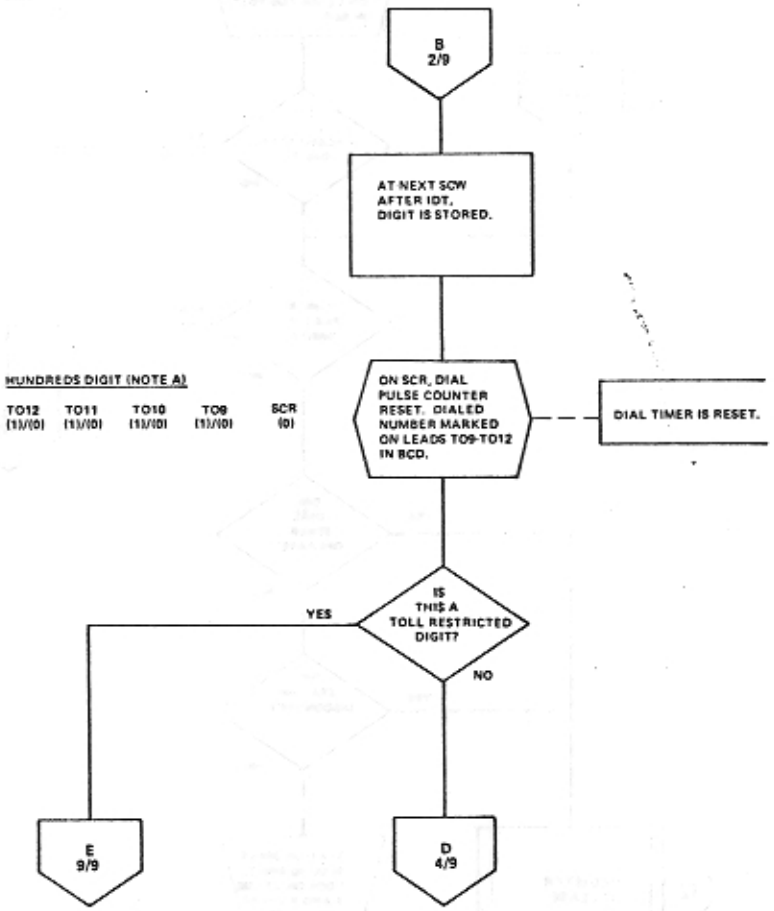


NOTES:

A. LOGIC LEAD CHANGES FROM (0) TO (1) TO (0), etc.

B. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL NUMBERS 7B AND 7A.

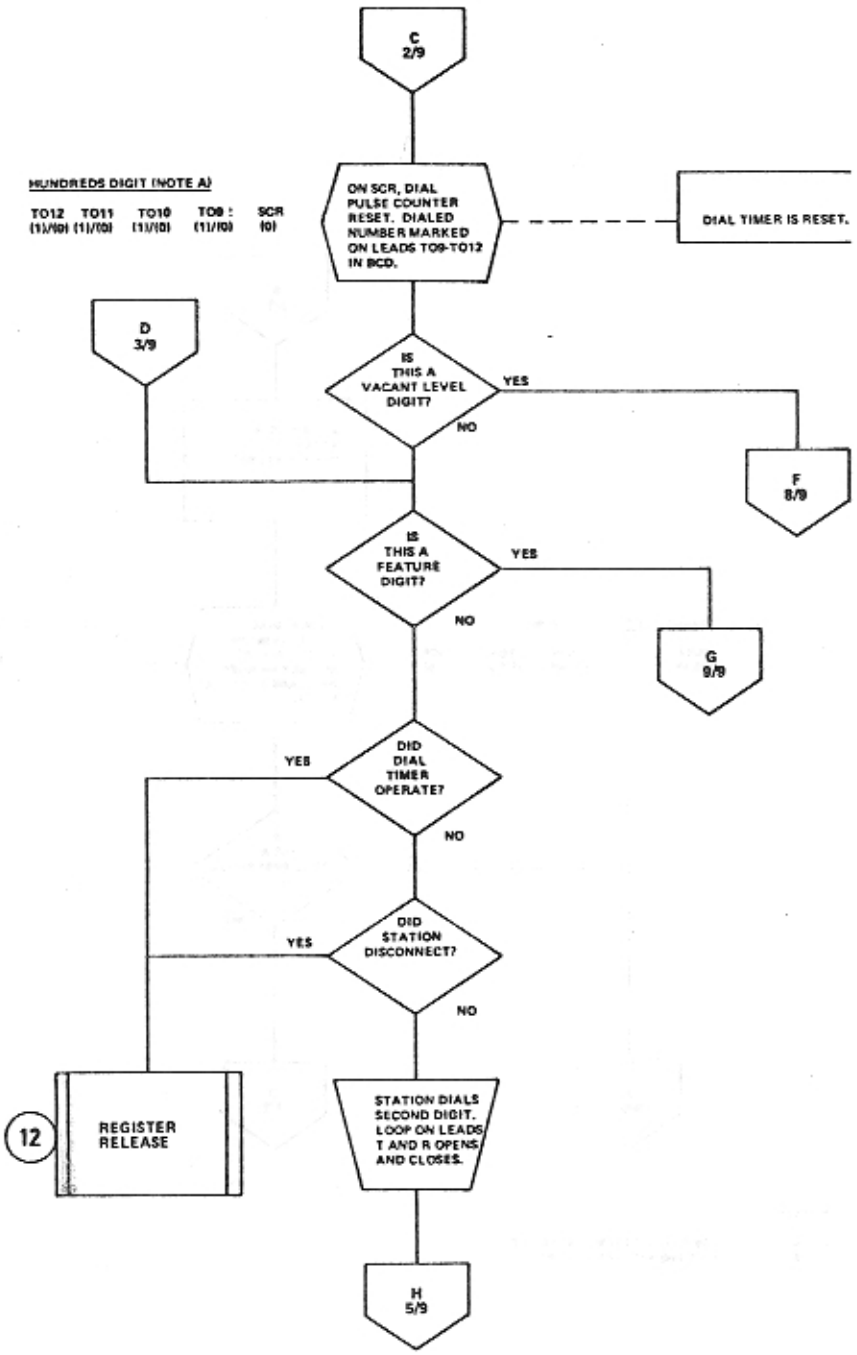
FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 2 of 9)



NOTES:

A. VALUES OF TO9-TO12 CORRESPOND TO BCD EQUIVALENT OF THE HUNDREDS DIGIT.

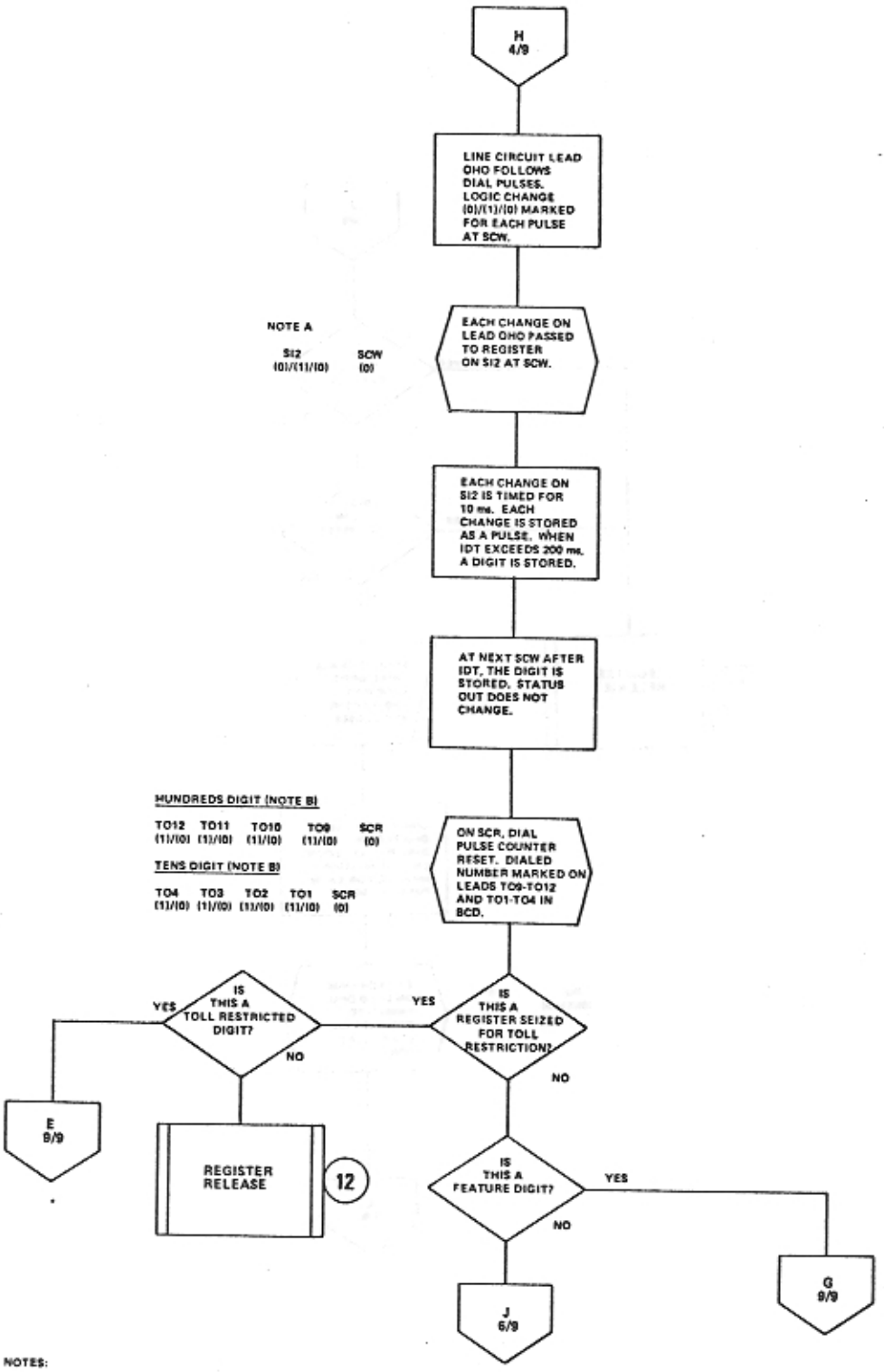
FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 3 of 9)



NOTES:

A. VALUES OF TO9-TO12 CORRESPOND TO BCD EQUIVALENT OF THE HUNDREDS DIGIT.

FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 4 of 9)



NOTES:

A. LOGIC LEVEL CHANGES FROM (0) TO (1) TO (0), etc.

B. VALUES FOR TO9-TO12 AND TO1-TO4 CORRESPOND TO BCD EQUIVALENTS OF THE HUNDREDS AND TENS DIGITS RESPECTIVELY.

FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 5 of 9)

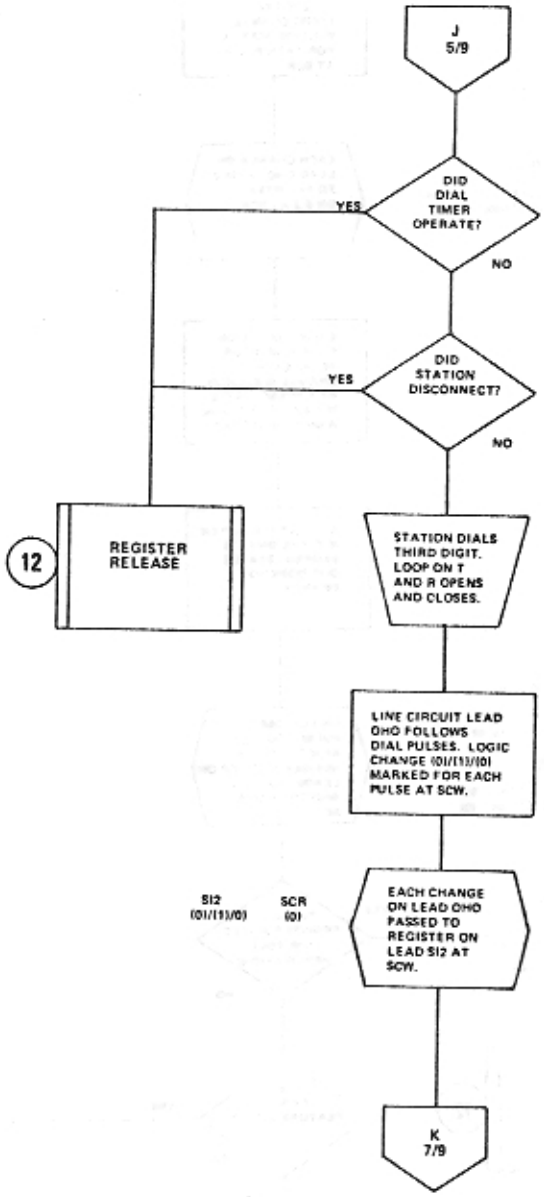
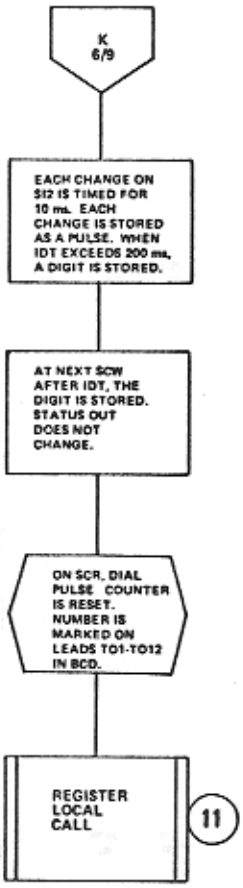


FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 6 of 9)



HUNDREDS DIGIT (NOTE A)

TO12	TO11	TO10	TO9	SCR
(1)/(0)	(1)/(0)	(1)/(0)	(1)/(0)	(0)

TENS DIGIT (NOTE A)

TO4	TO3	TO2	TO1	SCR
(1)/(0)	(1)/(0)	(1)/(0)	(1)/(0)	(0)

UNITS DIGIT (NOTE A)

TO8	TO7	TO6	TO5	SCR
(1)/(0)	(1)/(0)	(1)/(0)	(1)/(0)	(0)

NOTES:

A. VALUES FOR TO9-TO12, TO1-TO4, AND TO5-TO8 CORRESPOND TO BCD EQUIVALENTS OF THE HUNDREDS, TENS, AND UNITS DIGITS, RESPECTIVELY.

FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 7 of 9)

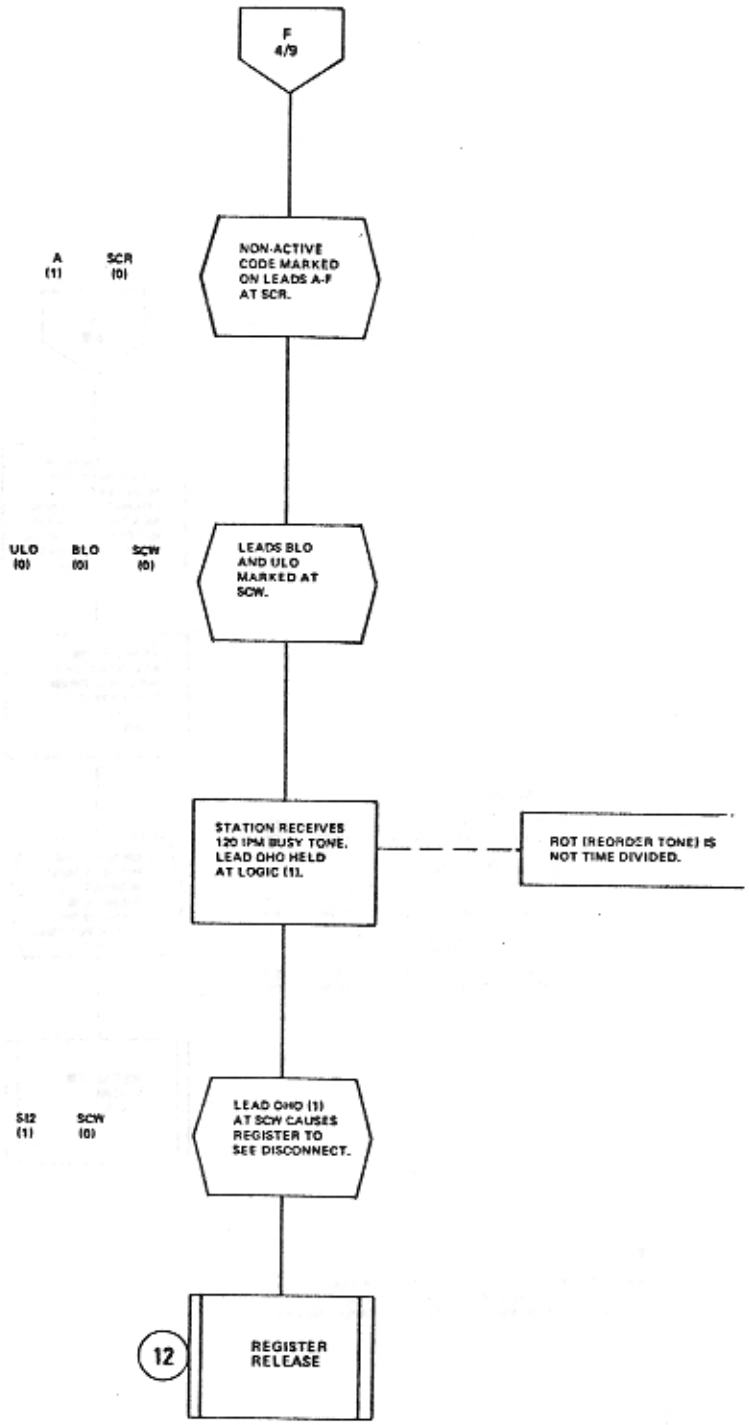


FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 8 of 9)

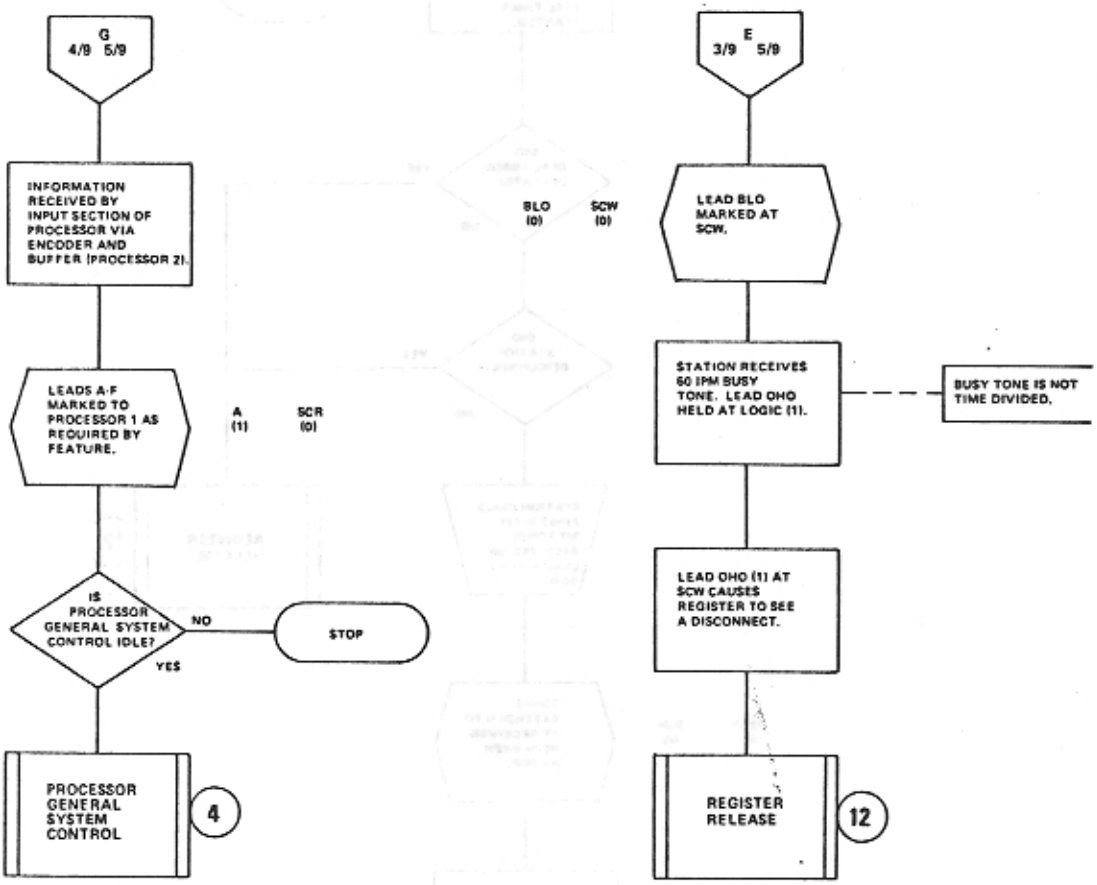


FIGURE A-1.08 Flow Chart 9, Register Dial Pulse Receiving (Sheet 9 of 9)

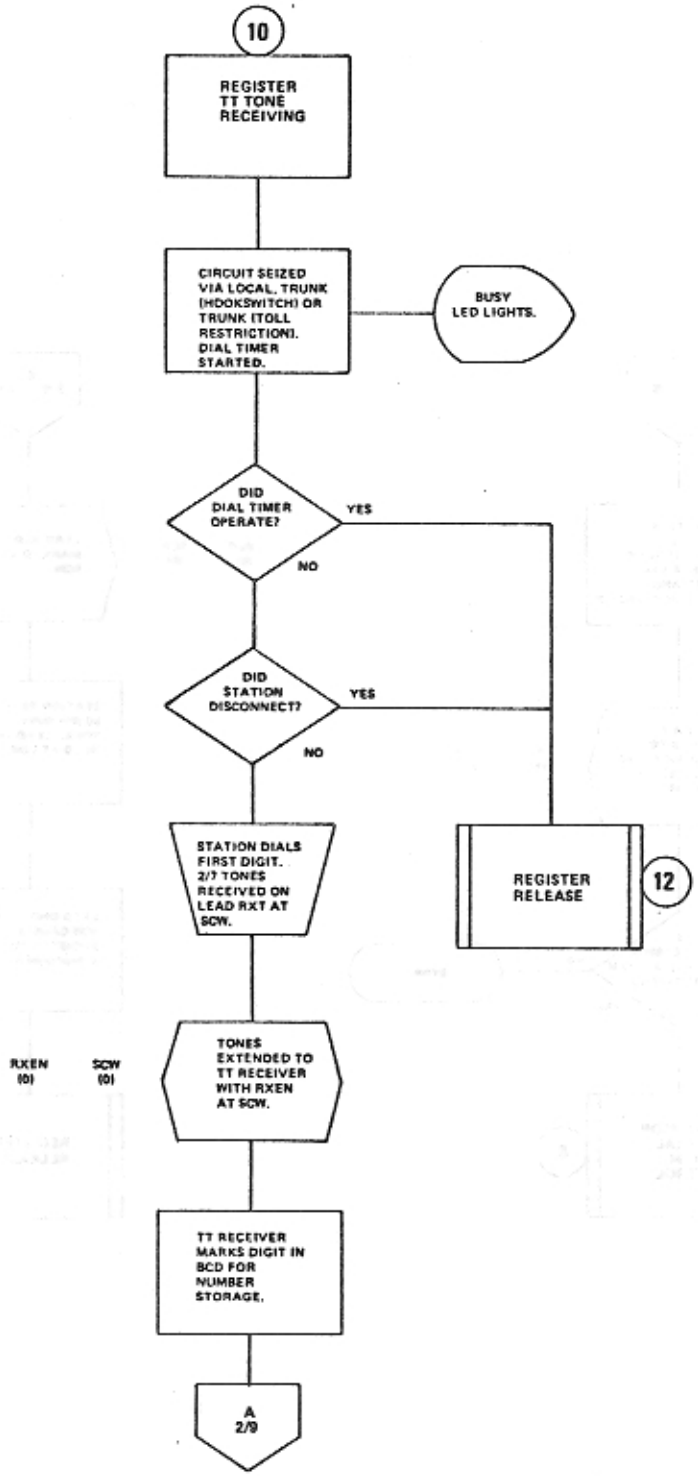
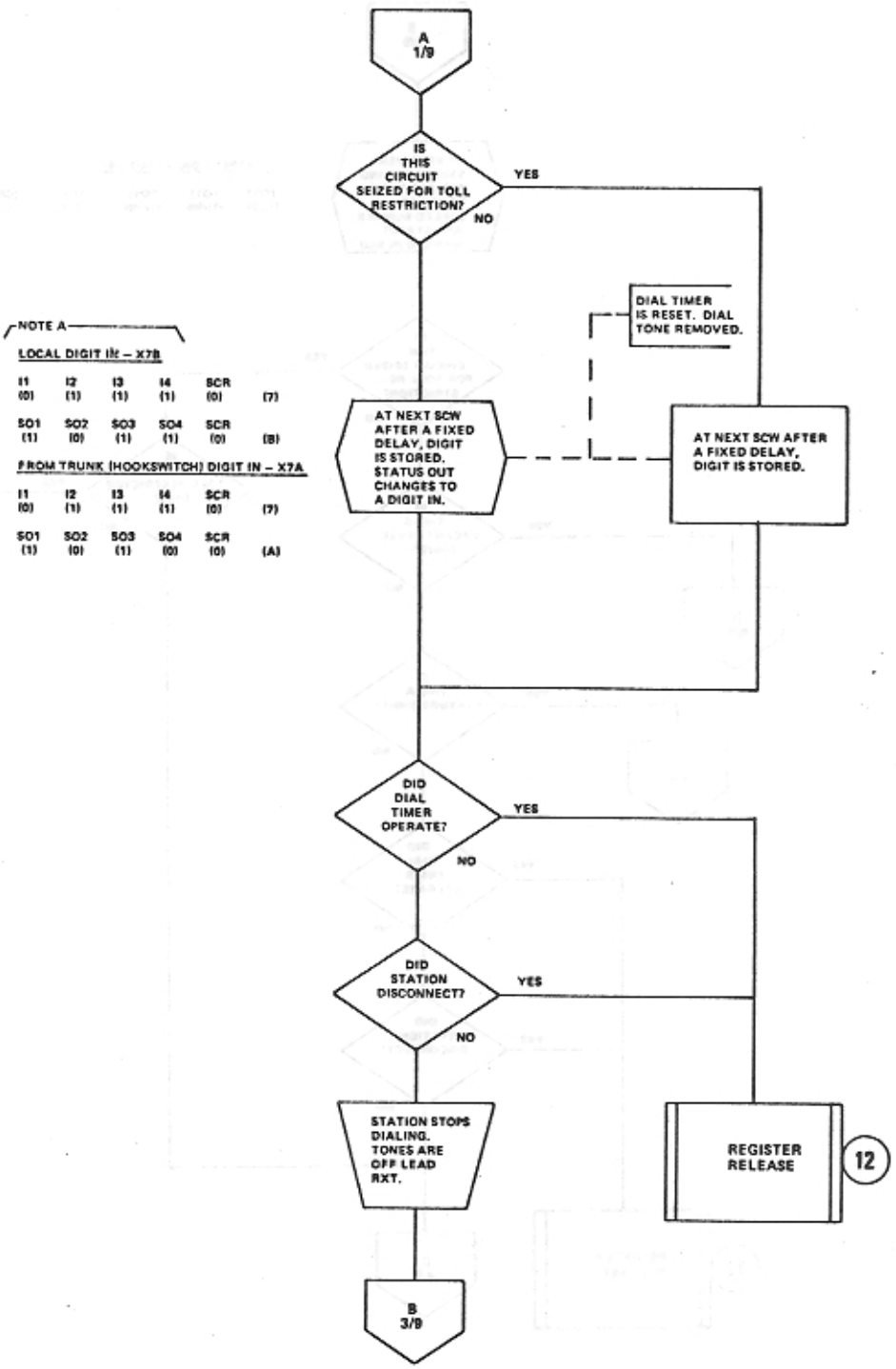


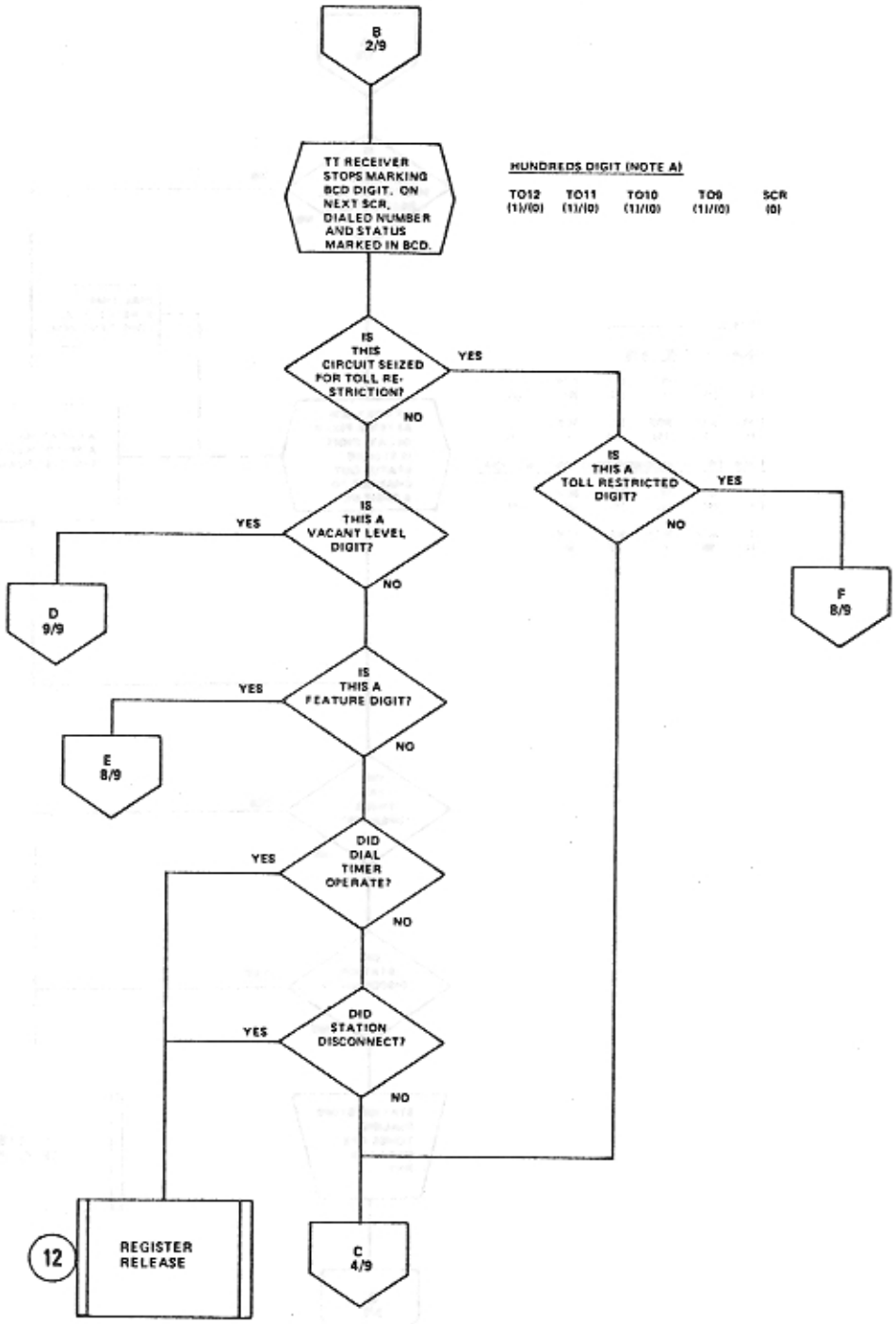
FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 1 of 9)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 7B AND 7A.

FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 2 of 9)



NOTES:

A. VALUES OF TO9-TO12 CORRESPOND TO BCD EQUIVALENT OF THE HUNDREDS DIGIT.

FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 3 of 9)

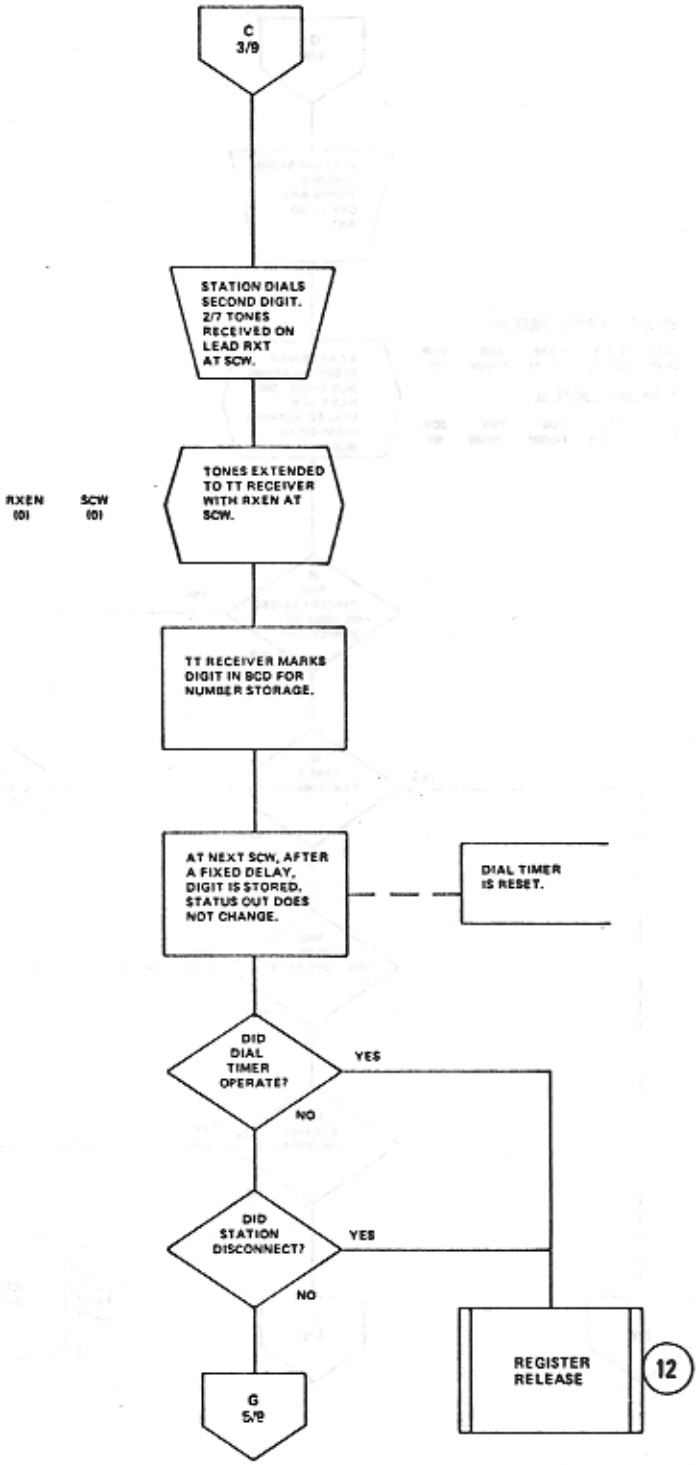
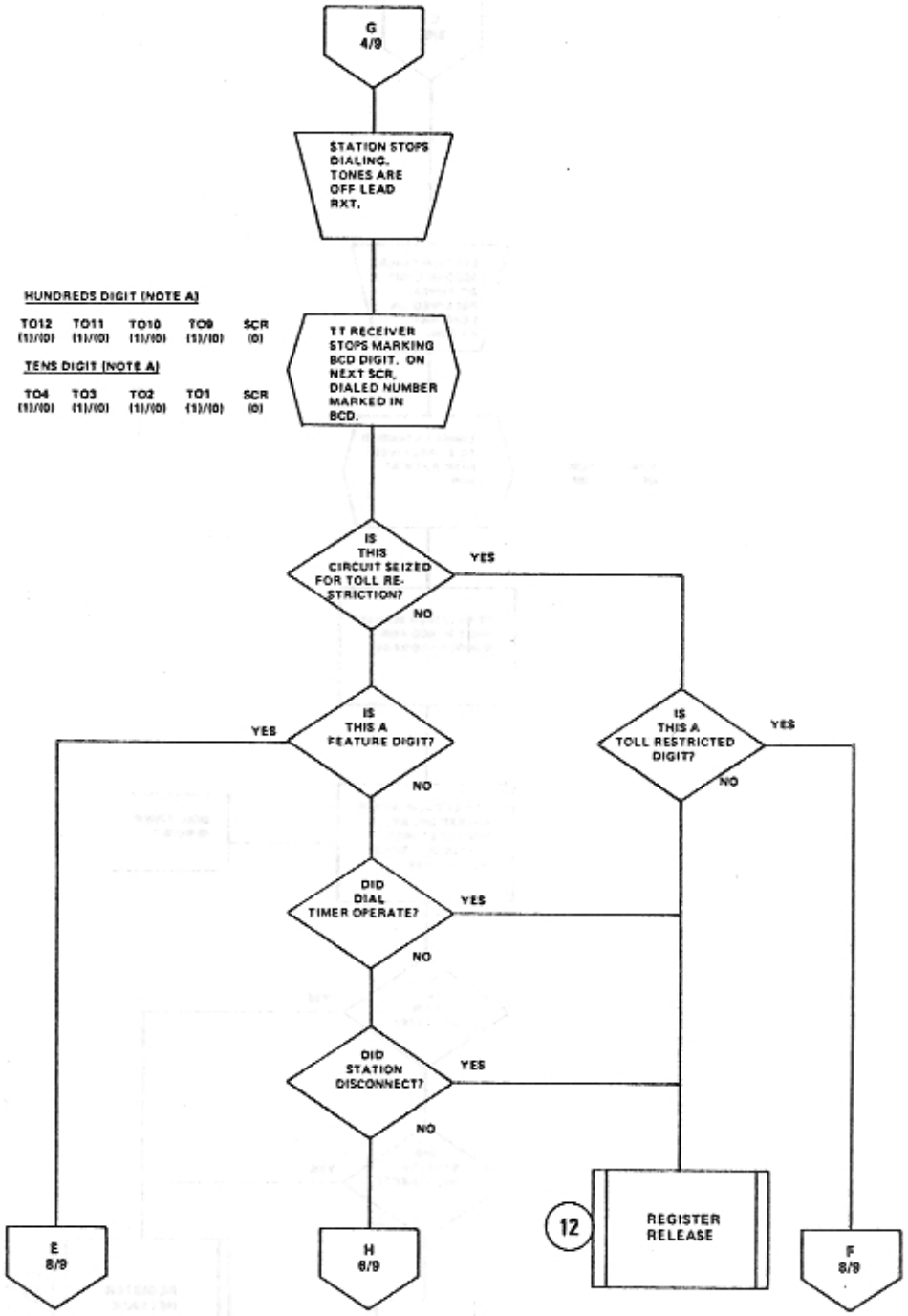


FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 4 of 9)



NOTES:

A. VALUES OF TO9-TO12 AND TO1-TO4 CORRESPOND TO BCD EQUIVALENTS OF THE HUNDREDS AND TENS DIGITS, RESPECTIVELY.

FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 5 of 9)

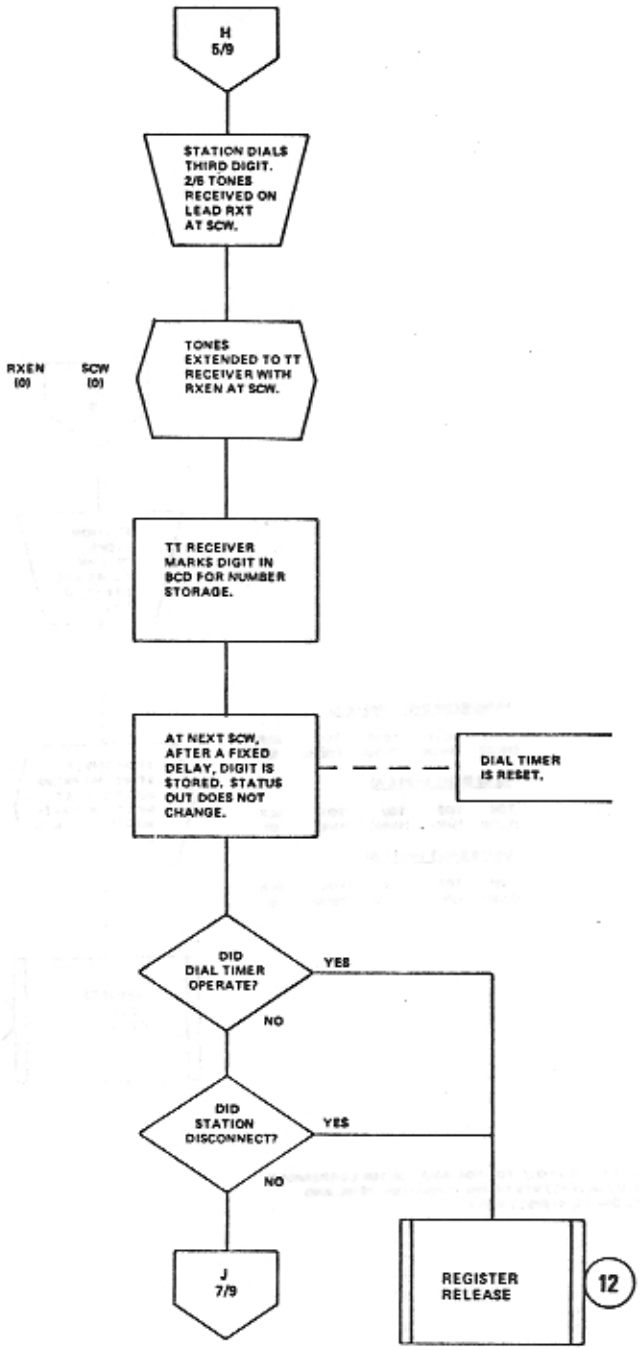
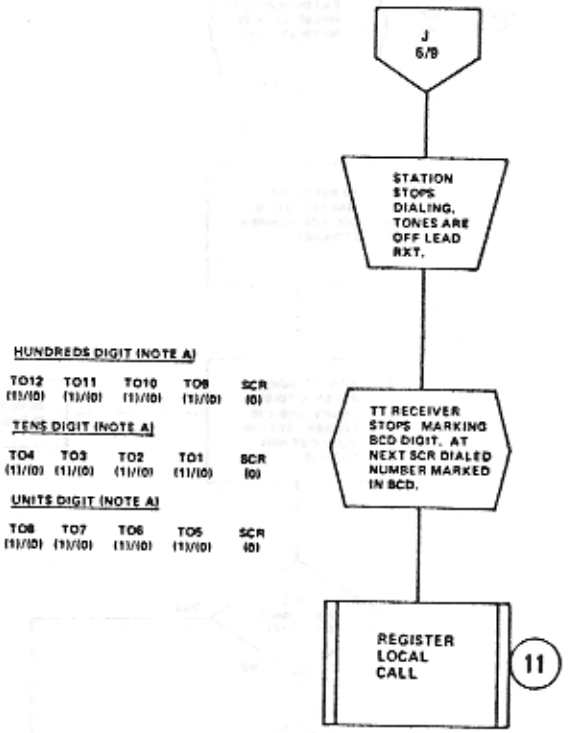


FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 6 of 9)



NOTES:

A. VALUES OF TO9-TO12, TO1-TO4, AND TO5-TO8 CORRESPOND TO BCD EQUIVALENTS OF THE HUNDREDS, TENS, AND UNITS DIGITS, RESPECTIVELY.

FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 7 of 9)

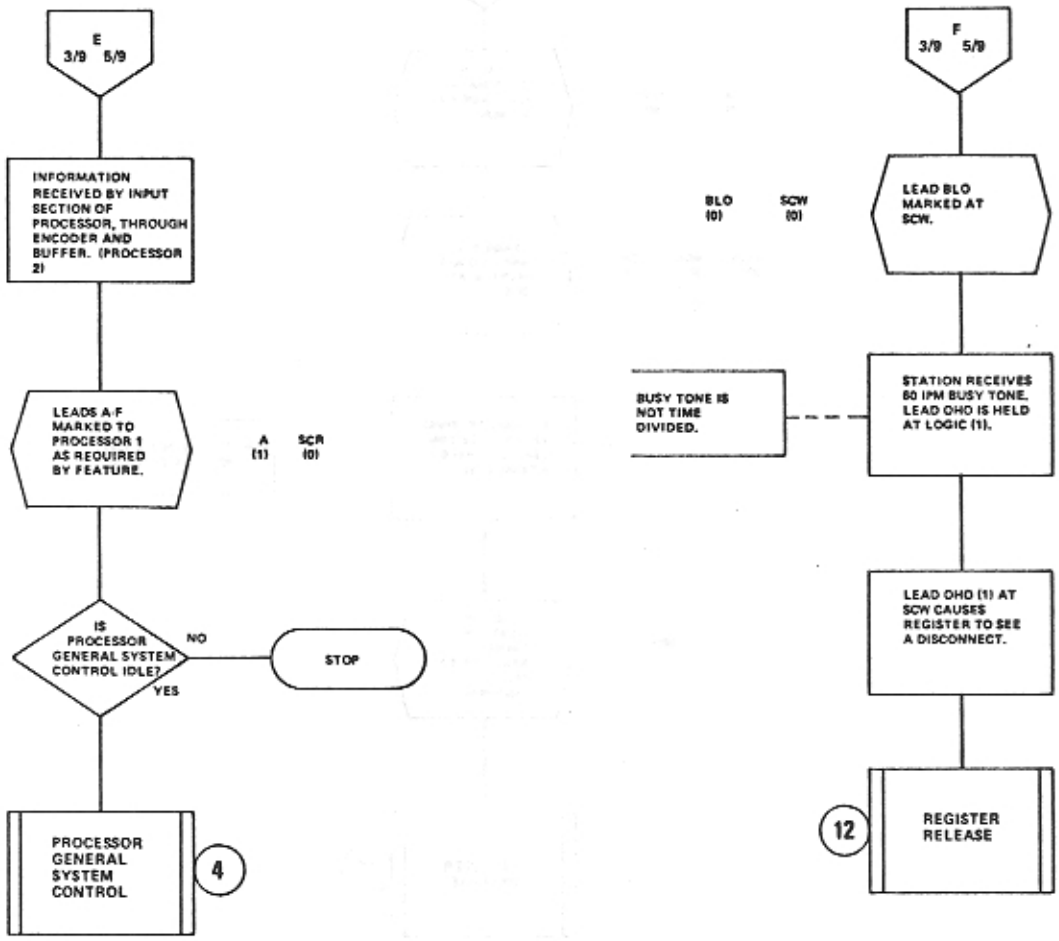


FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 8 of 9)

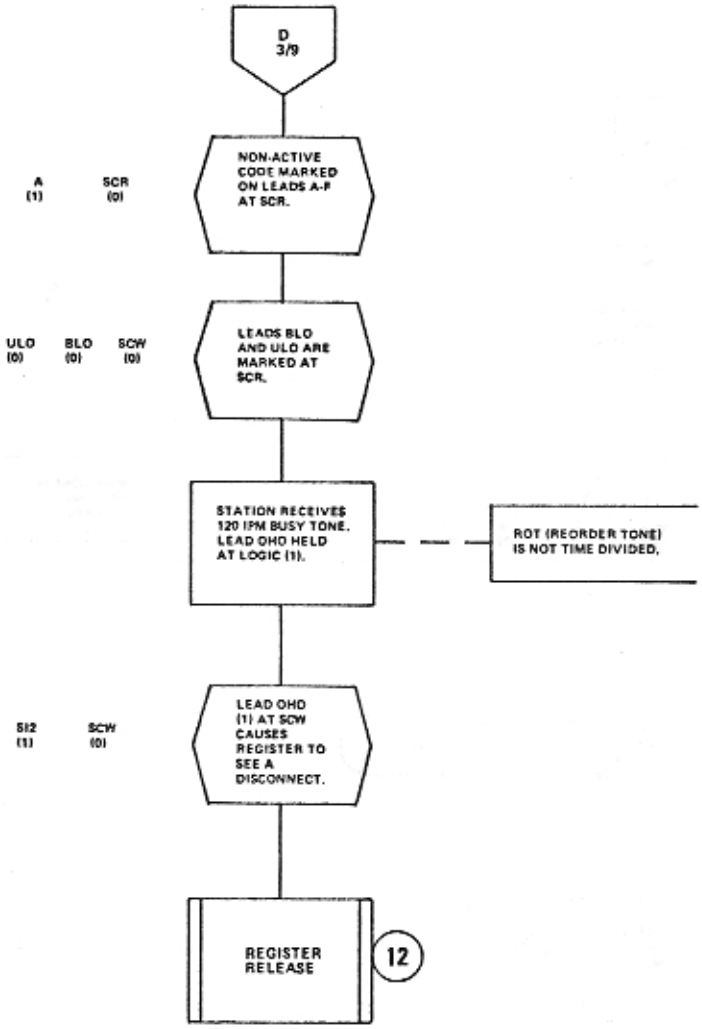
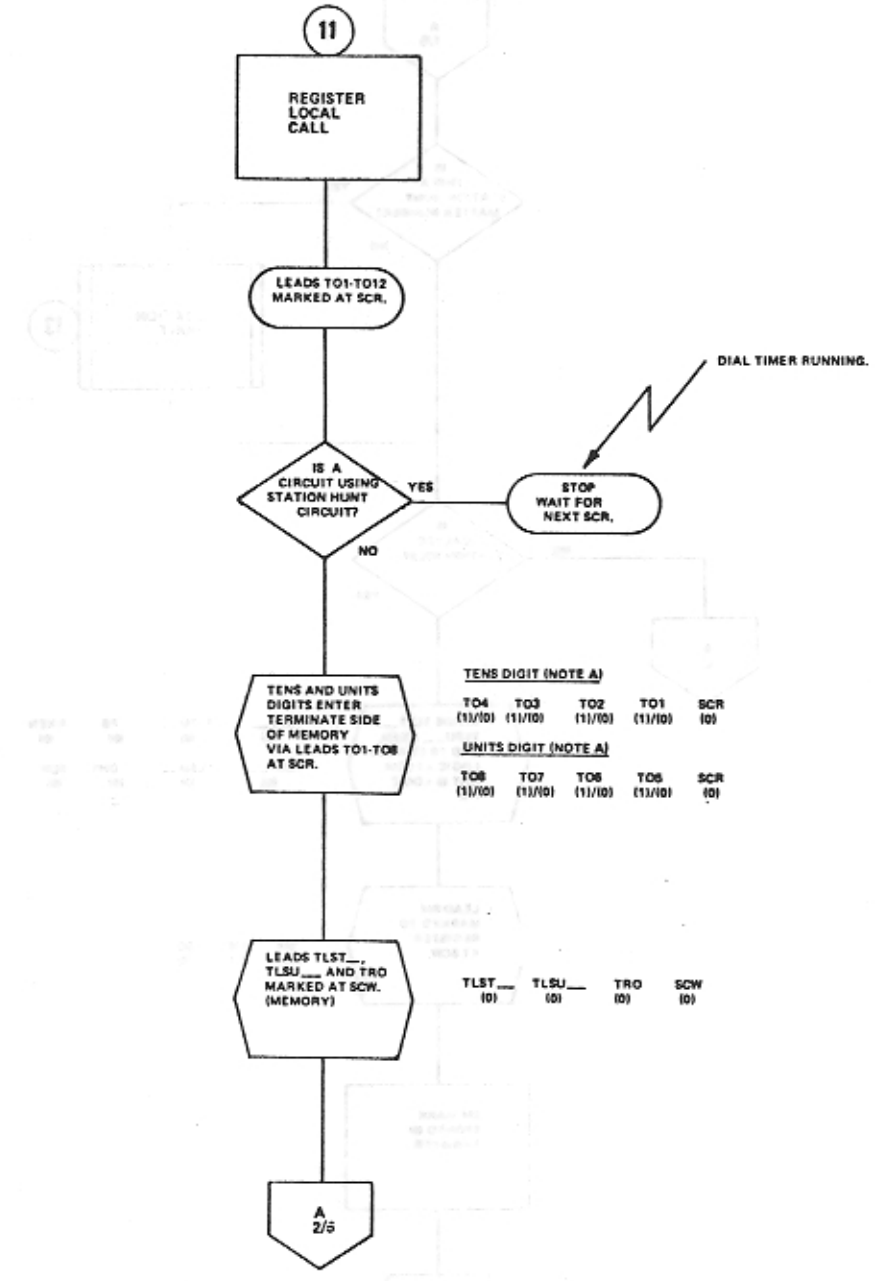


FIGURE A-1.09 Flow Chart 10, Register TT Tone Receiving (Sheet 9 of 9)



NOTES:

A. VALUES FOR TO1-TO4 AND TO5-TO8 CORRESPOND TO BCD EQUIVALENTS OF THE TENS AND UNITS DIGITS.

FIGURE A-1.10 Flow Chart 11, Register Local Call (Sheet 1 of 5)

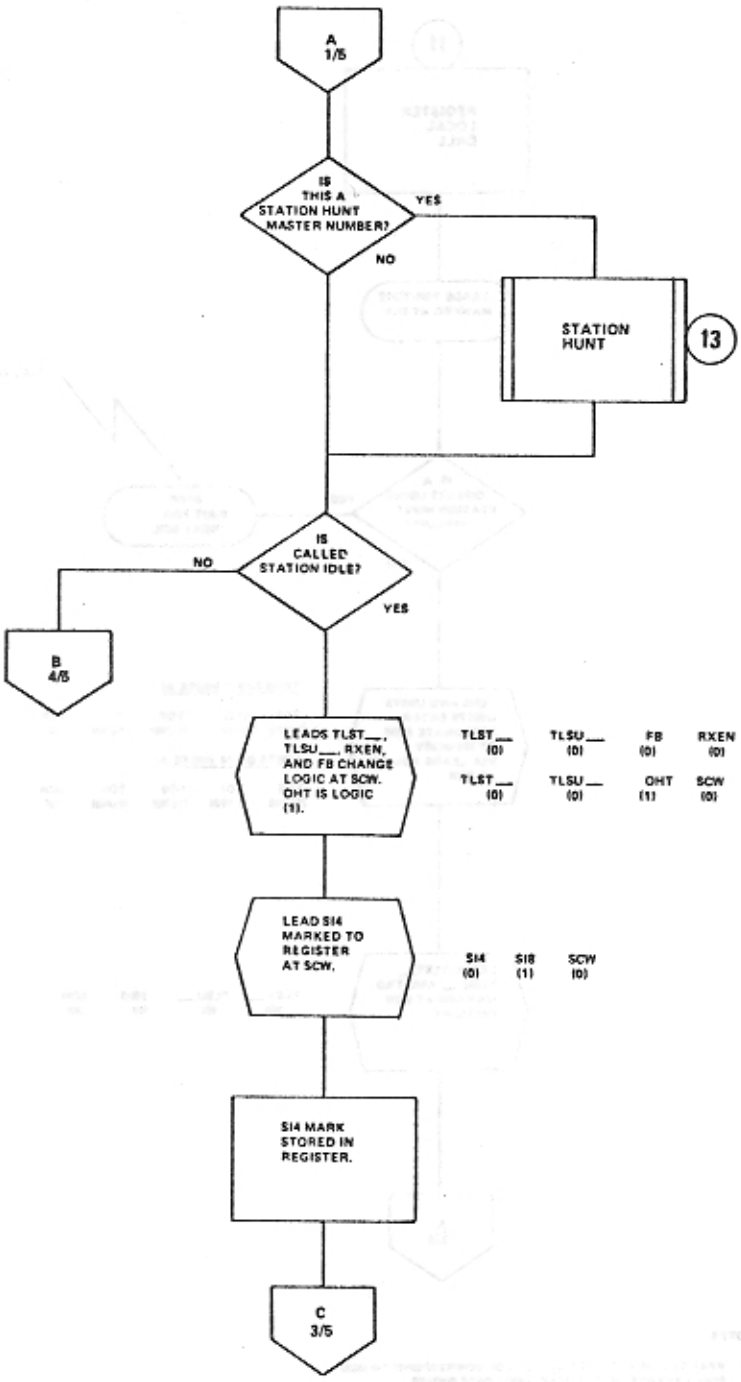
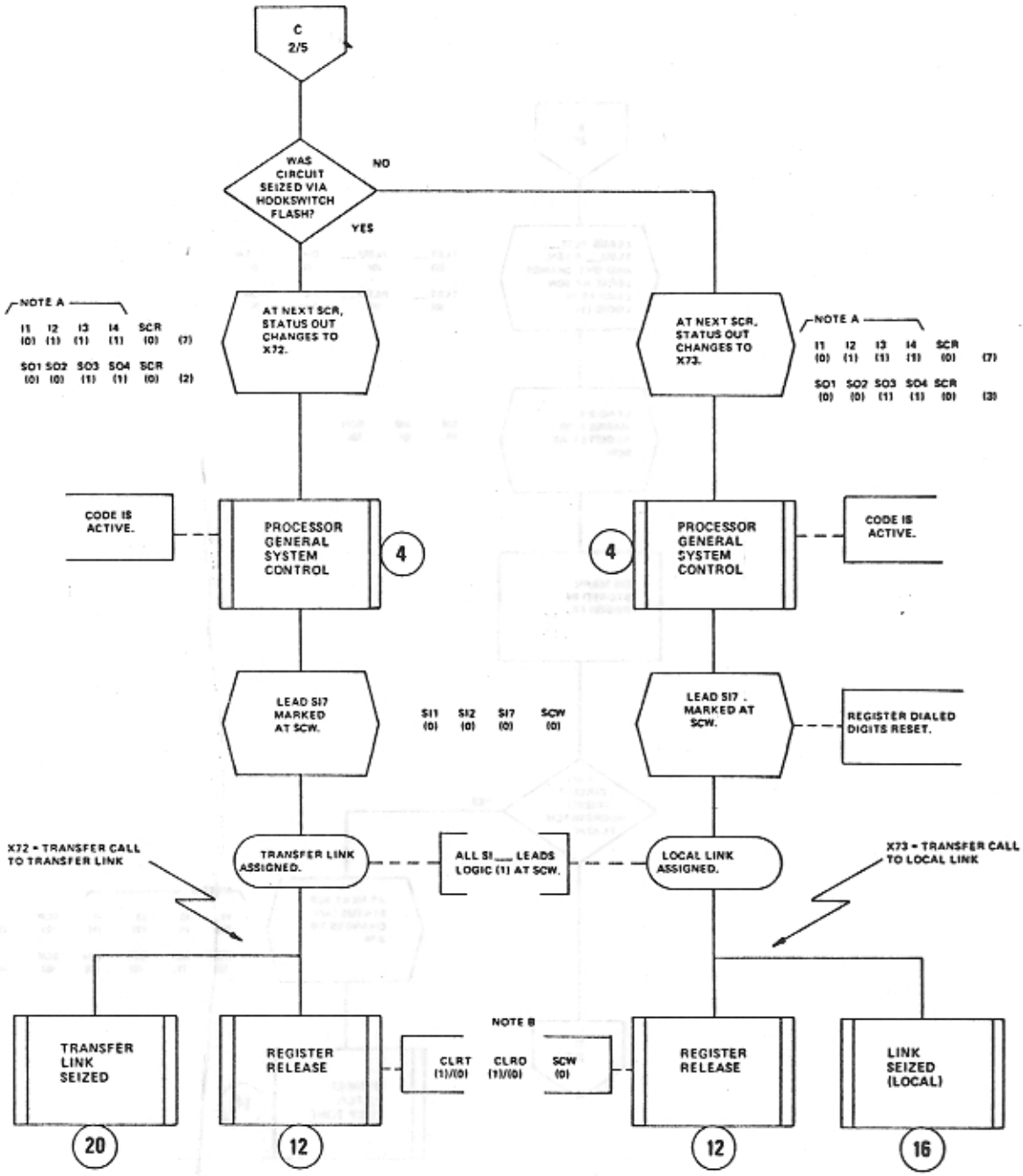


FIGURE A-1.10 Flow Chart 11, Register Local Call (Sheet 2 of 5)

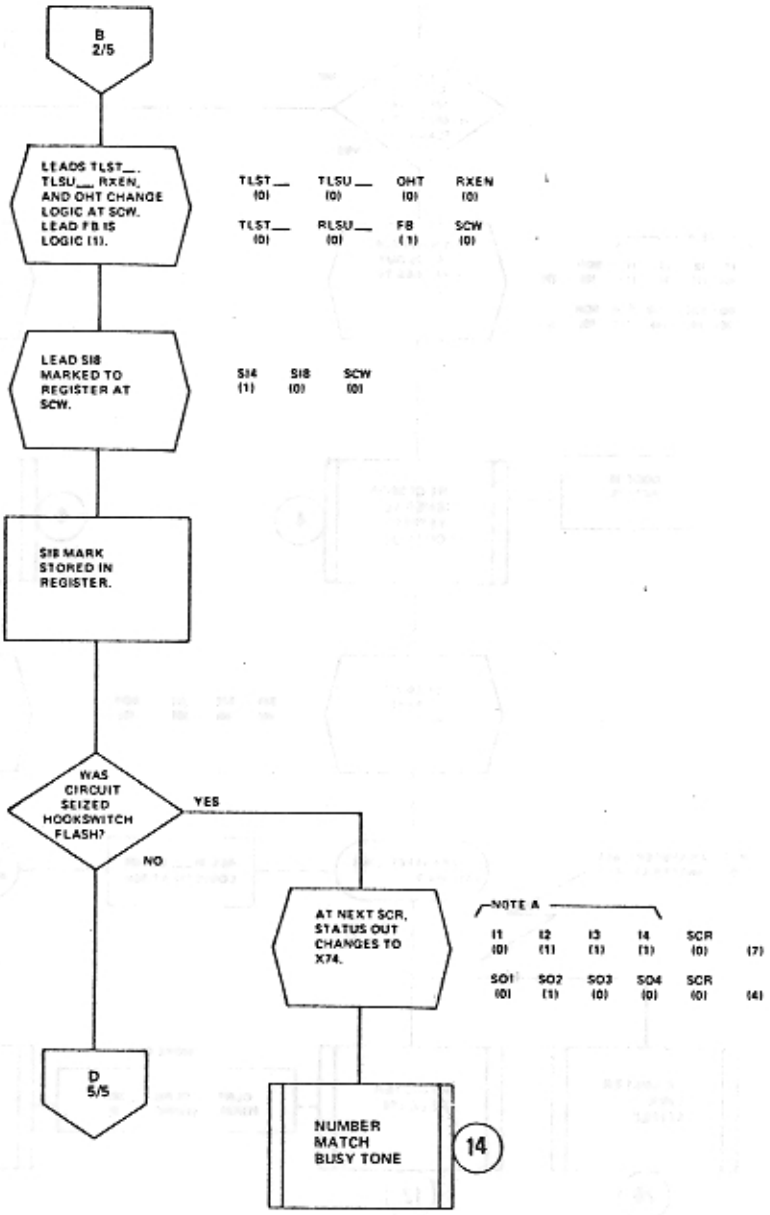


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS 72 AND 73.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

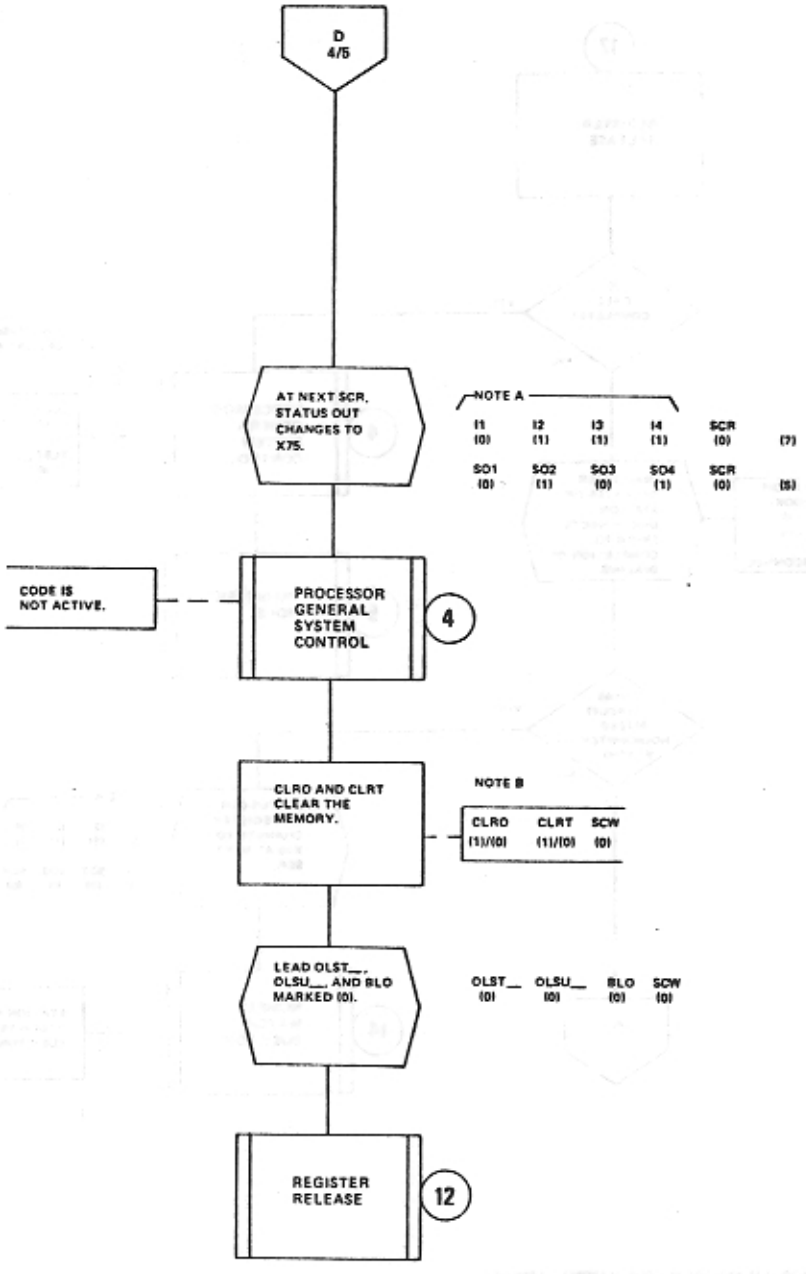
FIGURE A-1.10 Flow Chart 11, Register Local Call (Sheet 3 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 74.

FIGURE A-1.10 Flow Chart 11, Register Local Call (Sheet 4 of 5)

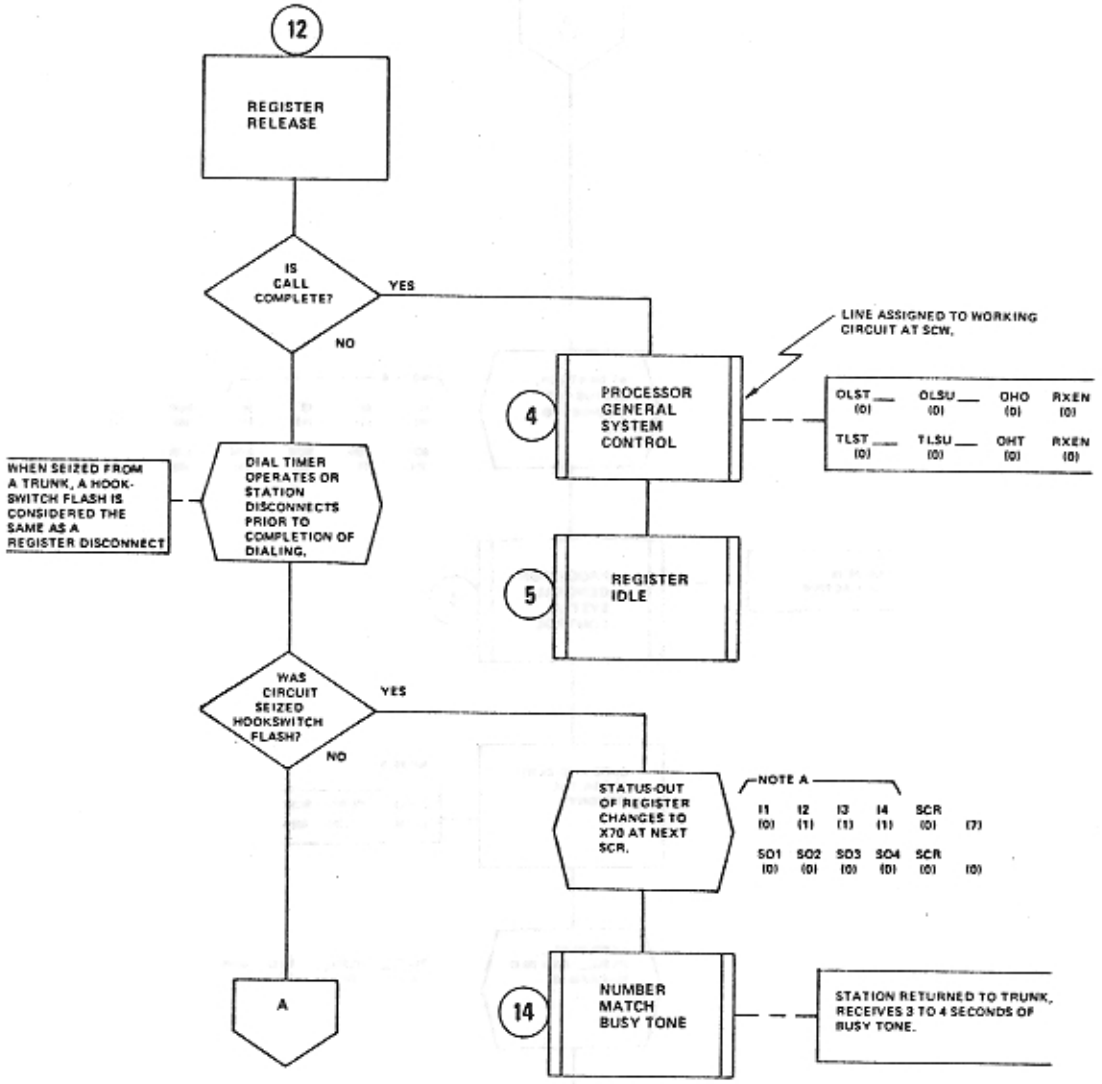


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 7B.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

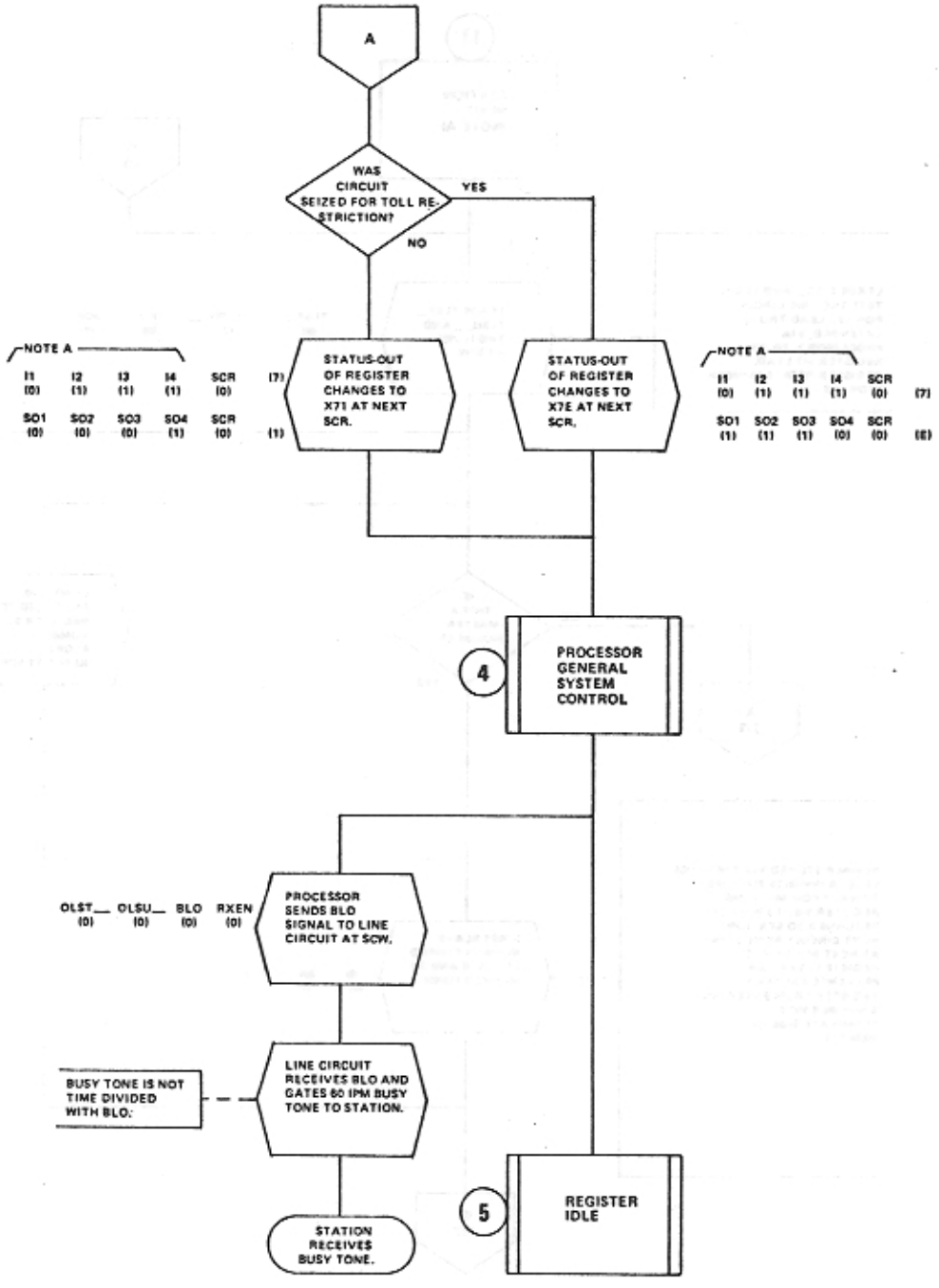
FIGURE A-1.10 Flow Chart 11, Register Local Call (Sheet 5 of 5)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 70.

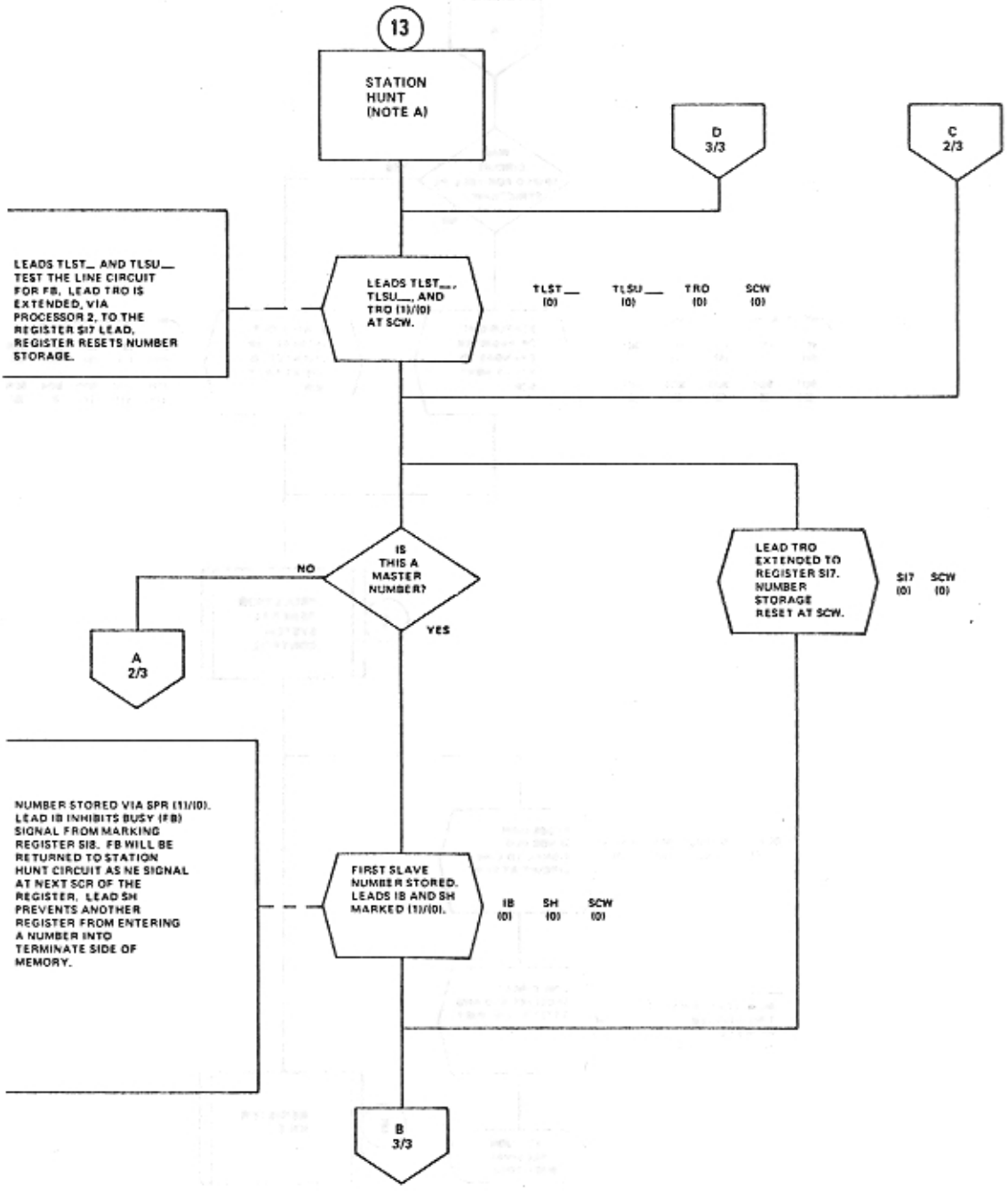
FIGURE A-1.11 Flow Chart 12, Register Release (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 71 AND 7E.

FIGURE A-1.11 Flow Chart 12, Register Release (Sheet 2 of 2)



NOTES:

A. CIRCUIT MAY BE STRAPPED TO PREVENT HUNTING DURING NIGHT SERVICE.

FIGURE A-1.12 Flow Chart 13, Station Hunt (Sheet 1 of 3)

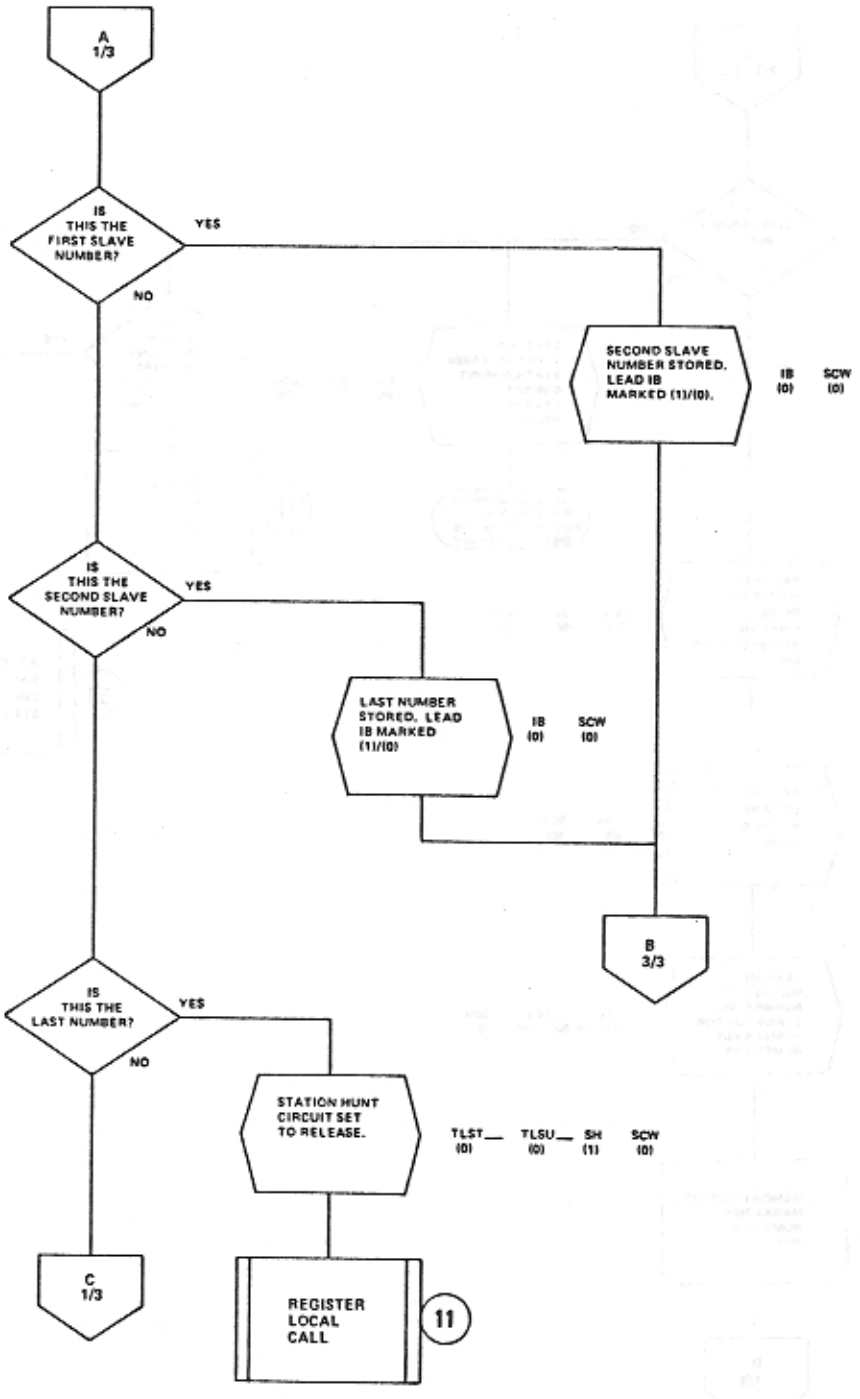


FIGURE A-1.12 Flow Chart 13, Station Hunt (Sheet 2 of 3)

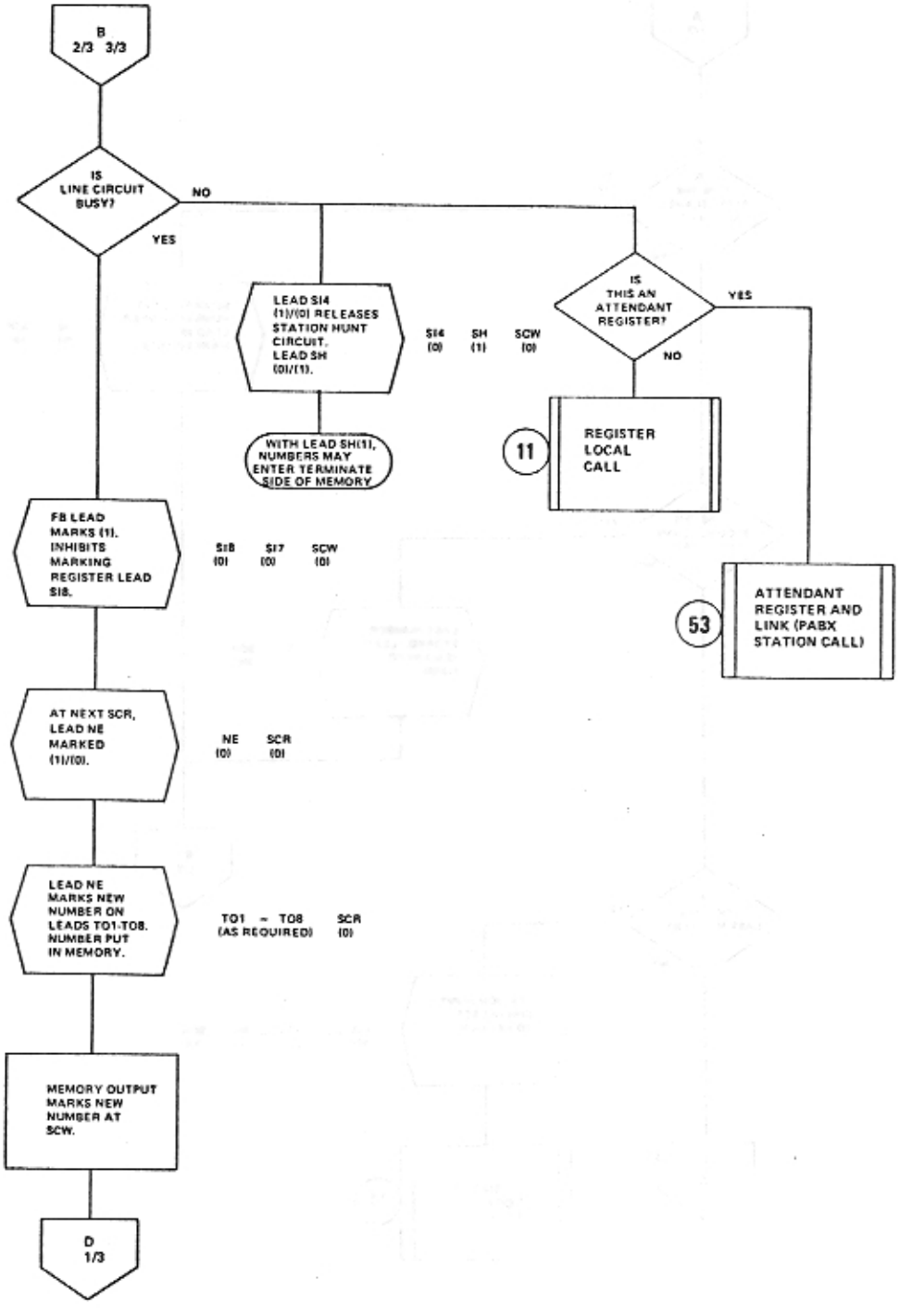
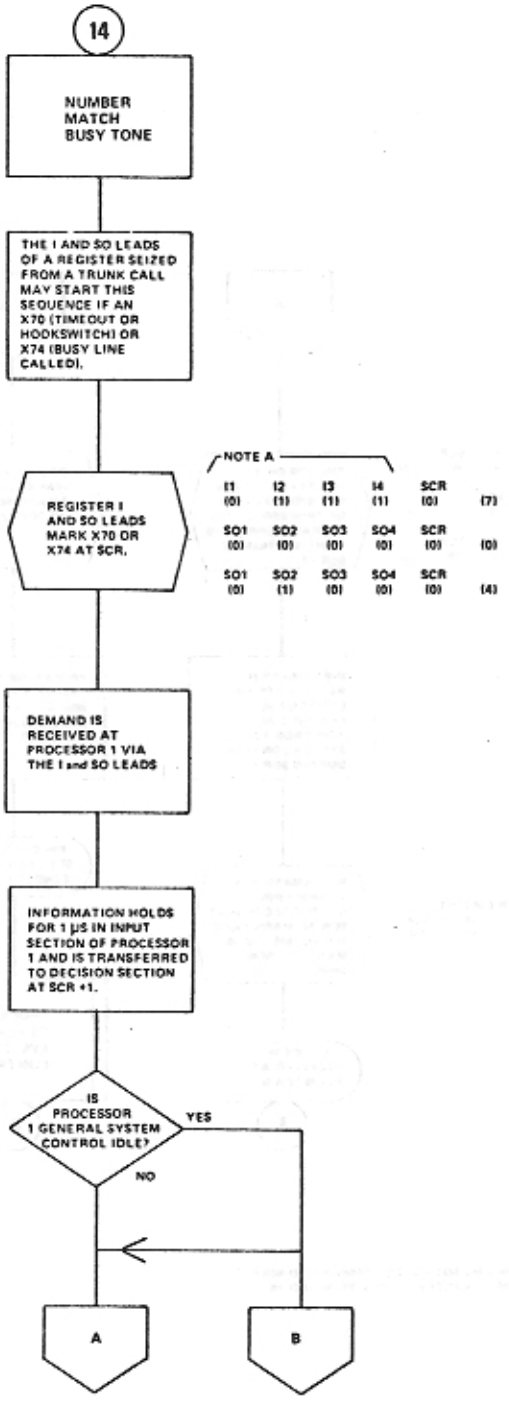


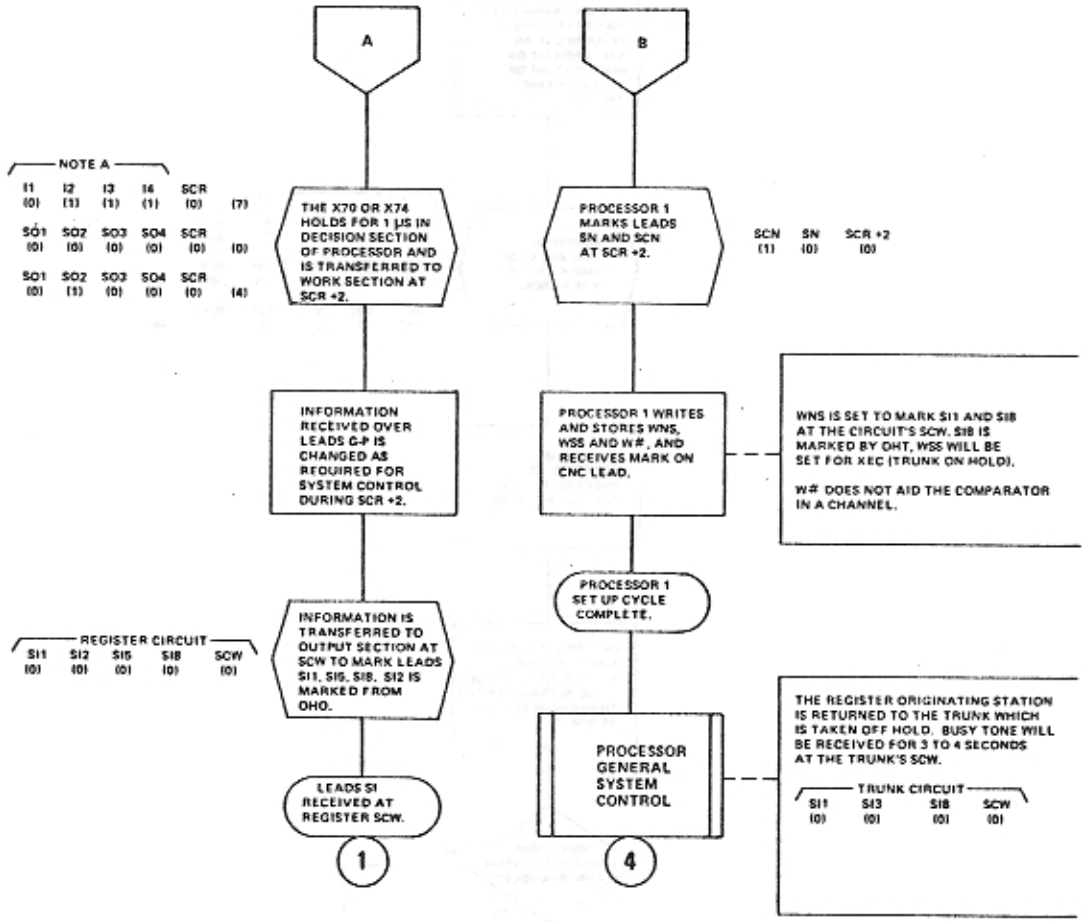
FIGURE A-1.12 Flow Chart 13, Station Hunt (Sheet 3 of 3)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 70 AND 74.

FIGURE A-1.13 Flow Chart 14, Number Match Busy Tone (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 70 AND 74.

FIGURE A-1.13 Flow Chart 14, Number Match Busy Tone (Sheet 2 of 2)

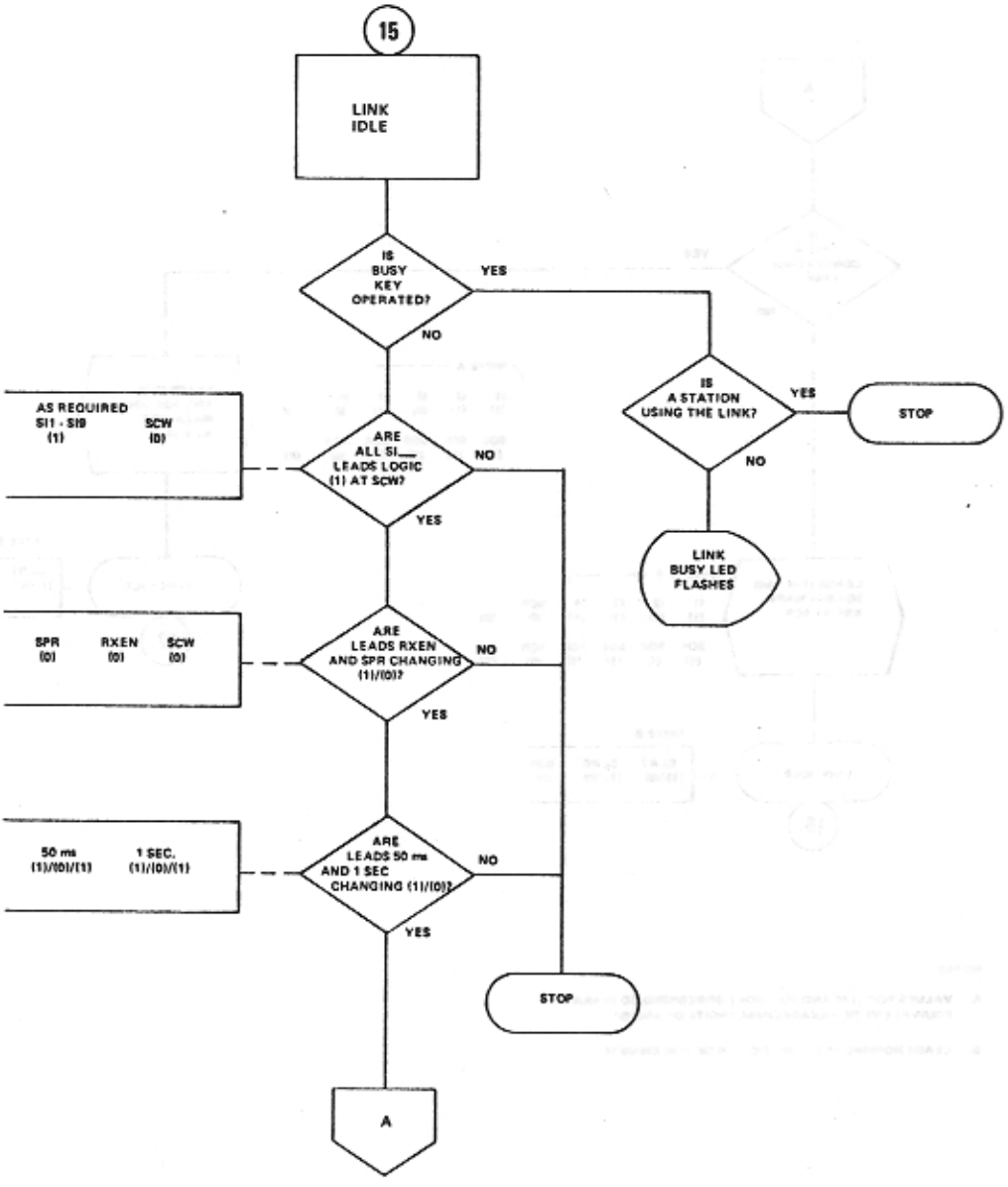
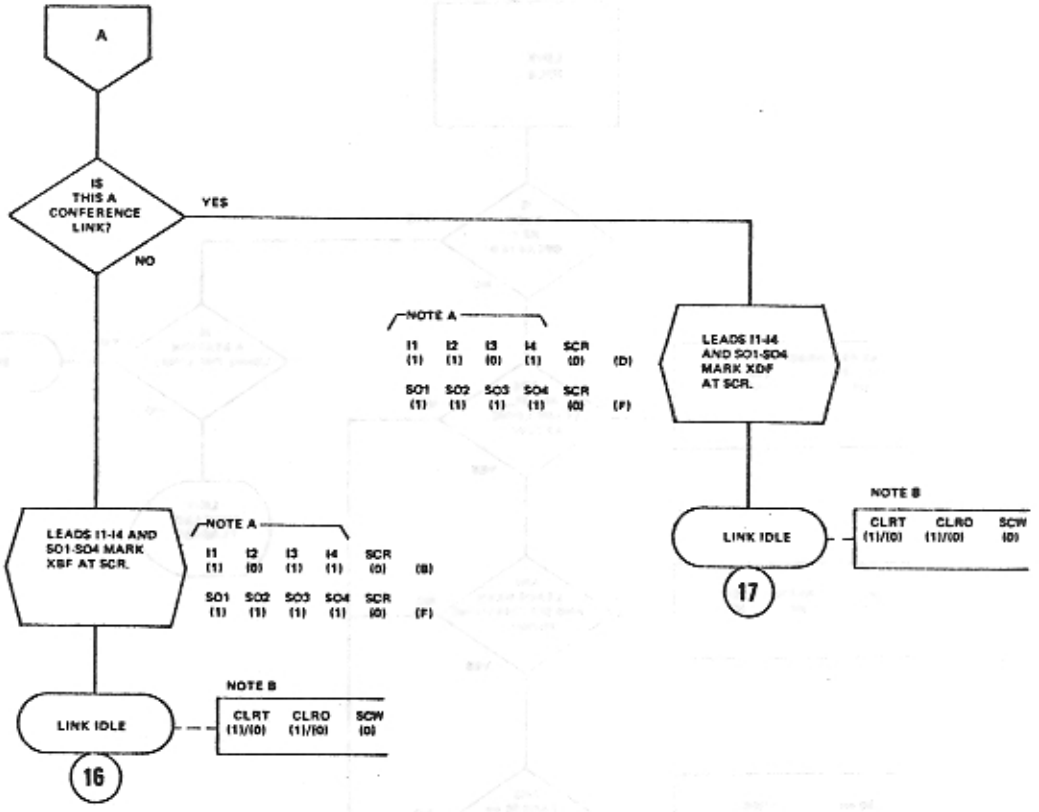


FIGURE A-1.14 Flow Chart 15, Link Idle (Sheet 1 of 2)

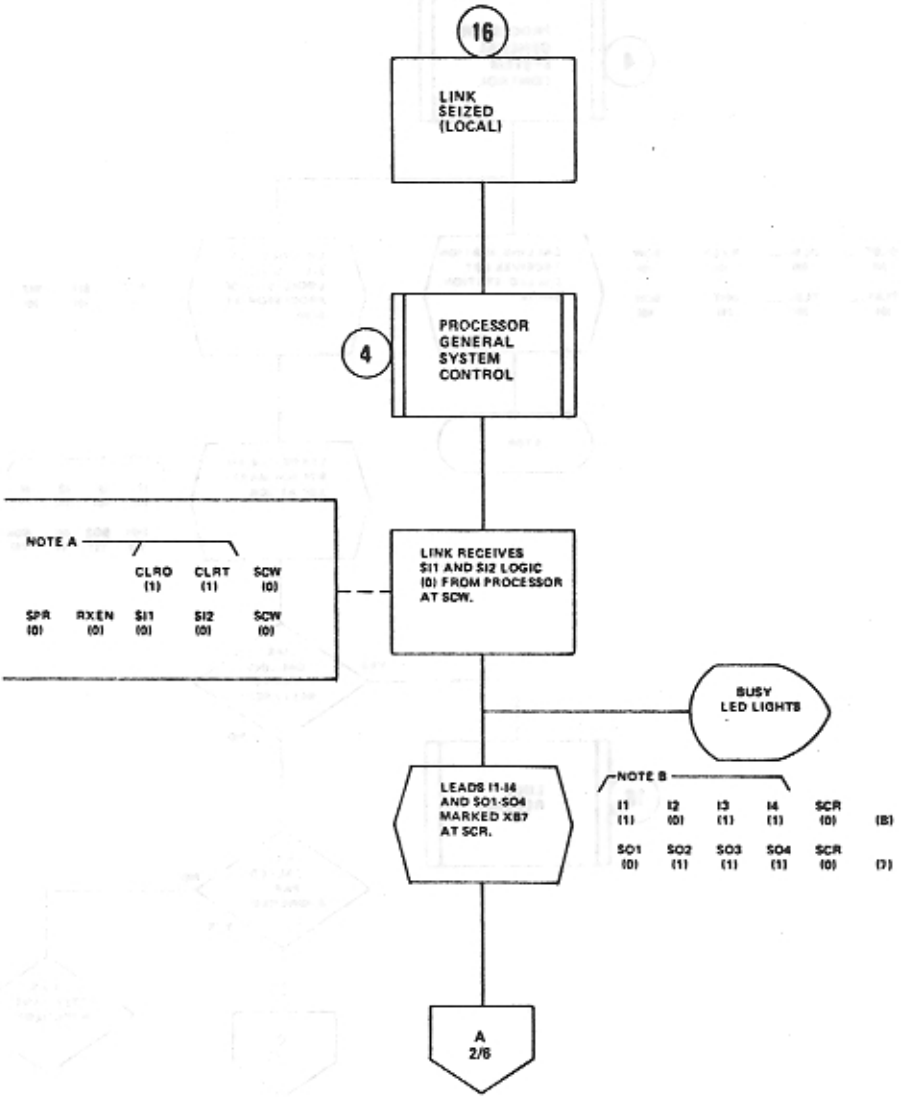


NOTES:

A. VALUES FOR I1-I4 AND SO1–SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS DF AND BF.

B. LEADS NORMALLY CHANGING, CHECK FOR CHANGE.

FIGURE A-1.14 Flow Chart 15, Link Idle (Sheet 2 of 2)

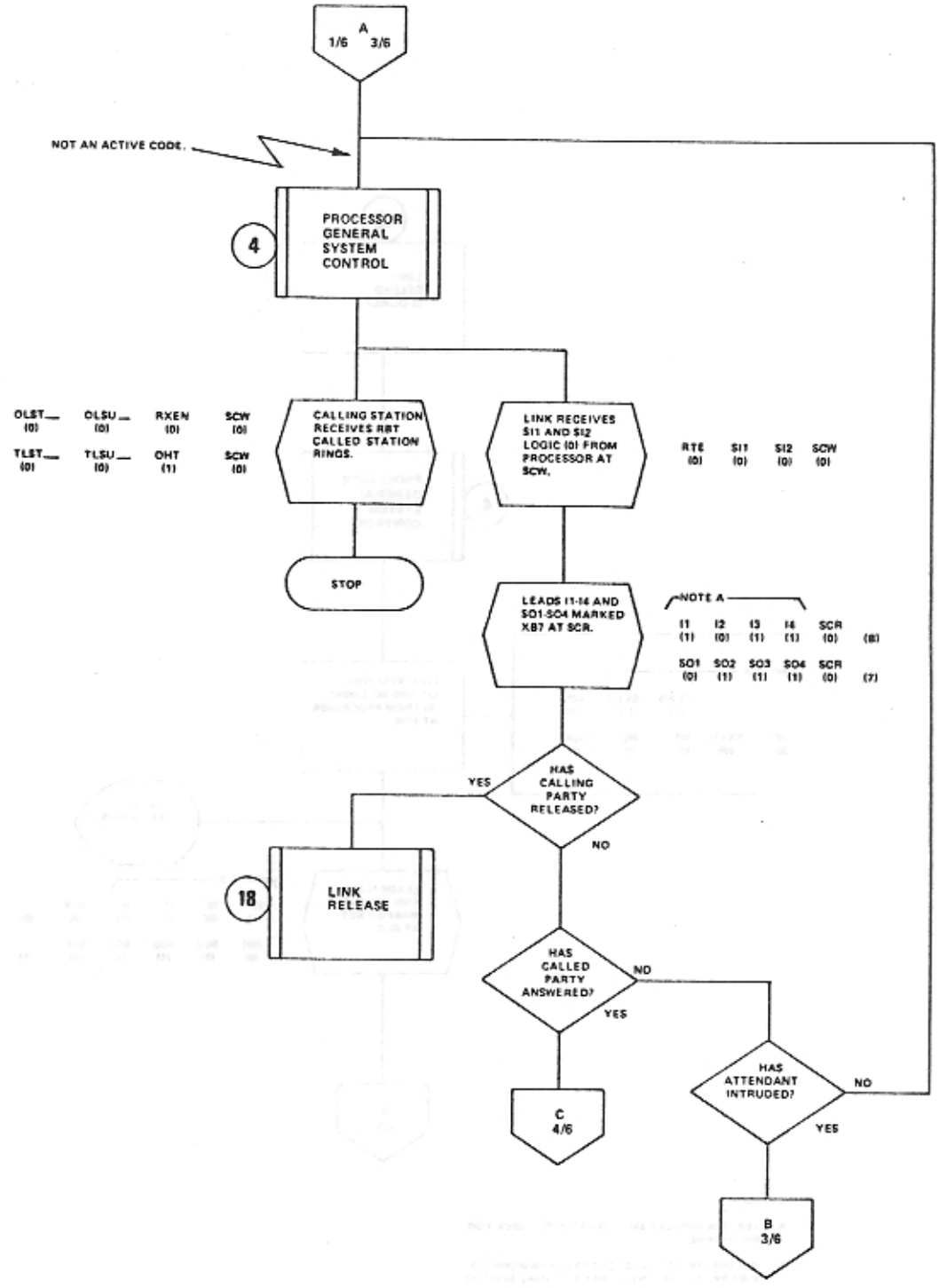


NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

B. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B7.

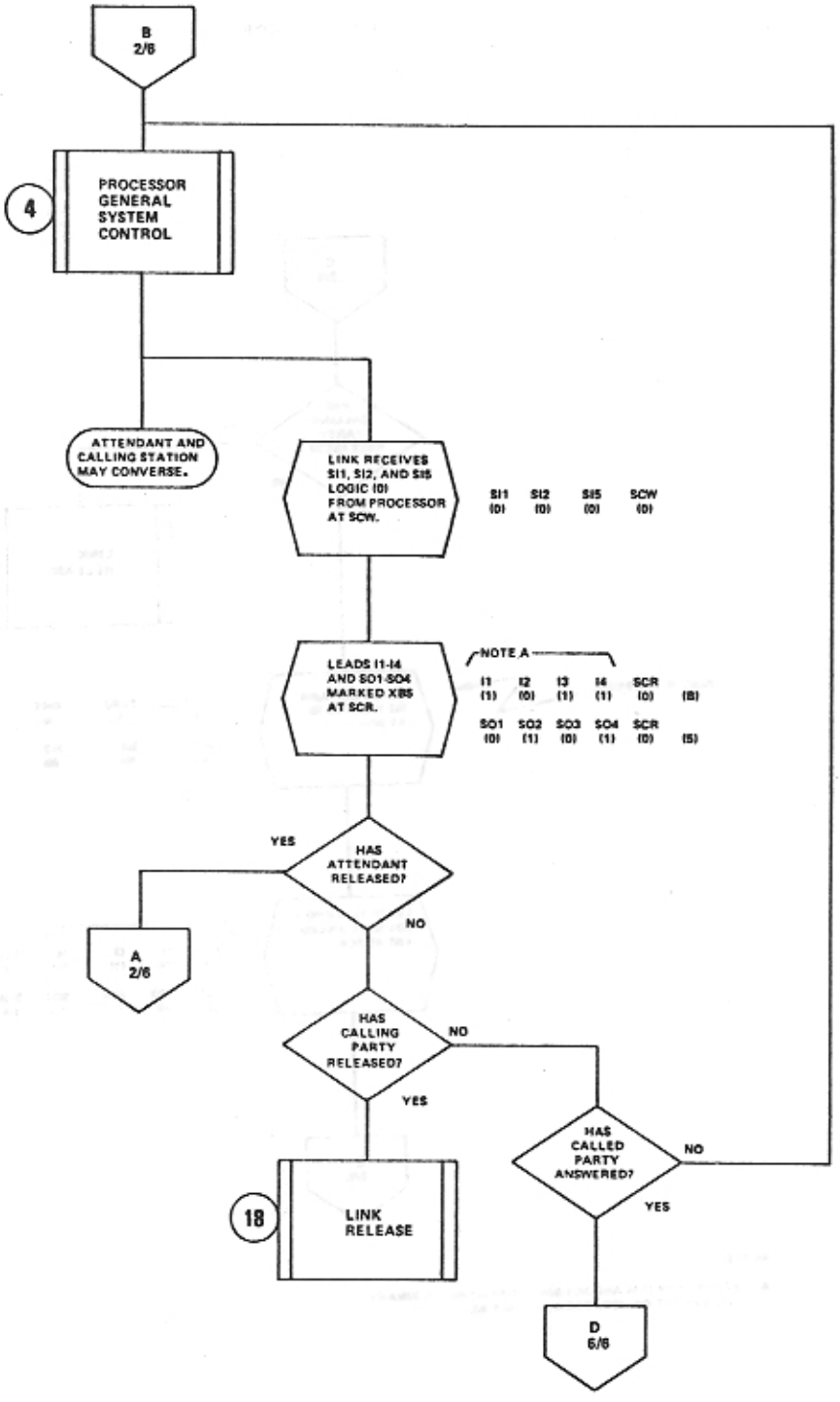
FIGURE A-1.15 Flow Chart 16, Link Seized Local (Sheet 1 of 6)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADEMICAL DIGIT XB7.

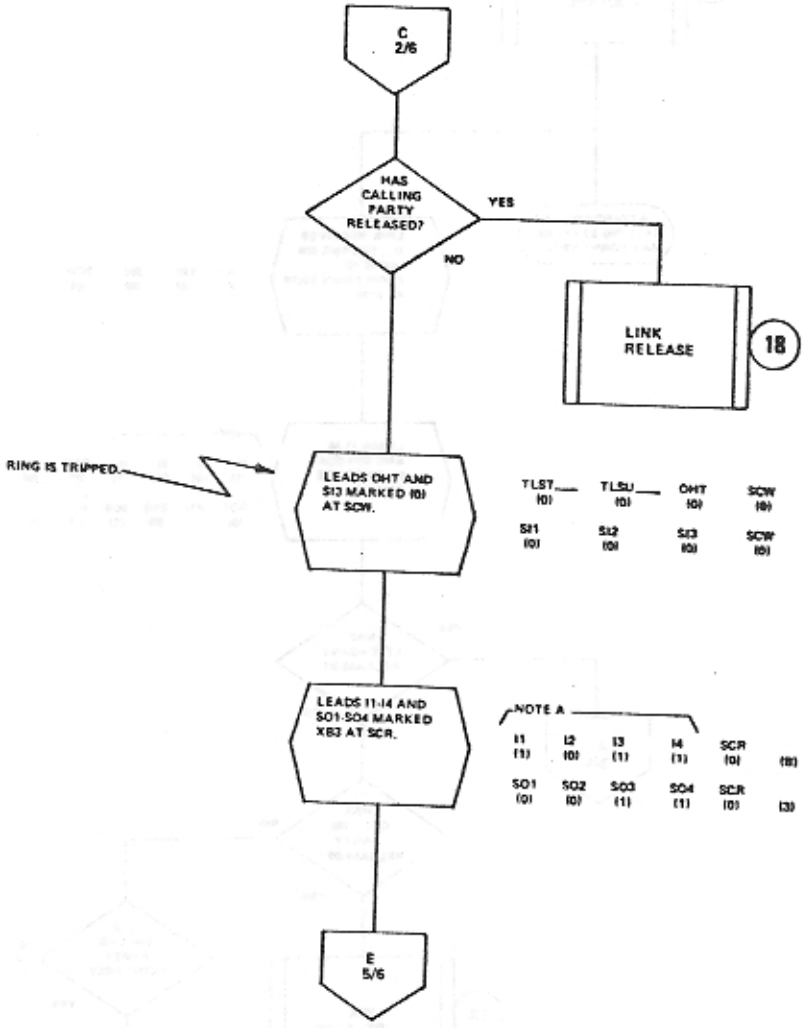
FIGURE A-1.15 Flow Chart 16, Link Seized (Local) (Sheet 2 of 6)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT BS.

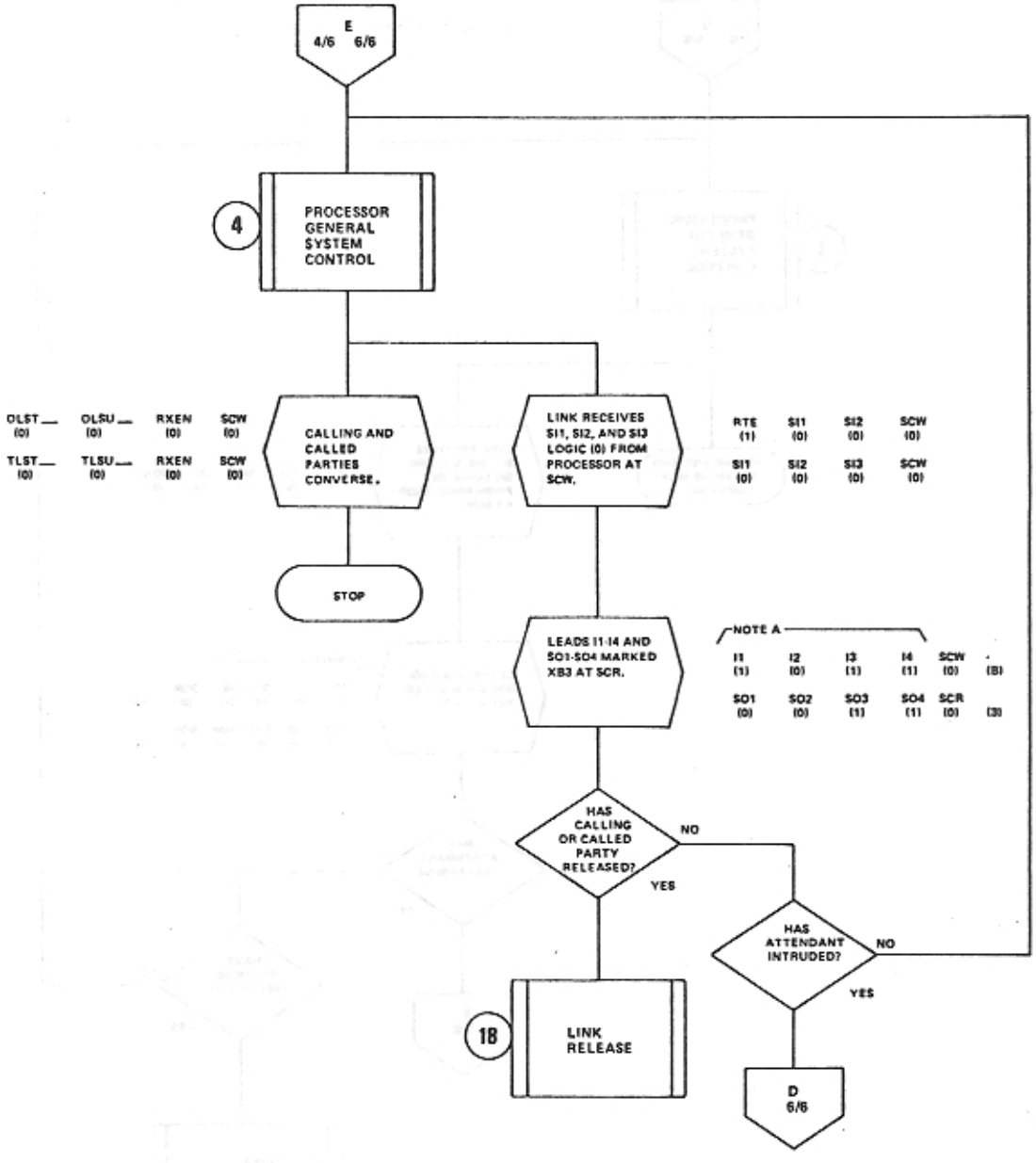
FIGURE A-1.15 Flow Chart 16, Link Seized (Local) (Sheet 3 of 6)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B3.

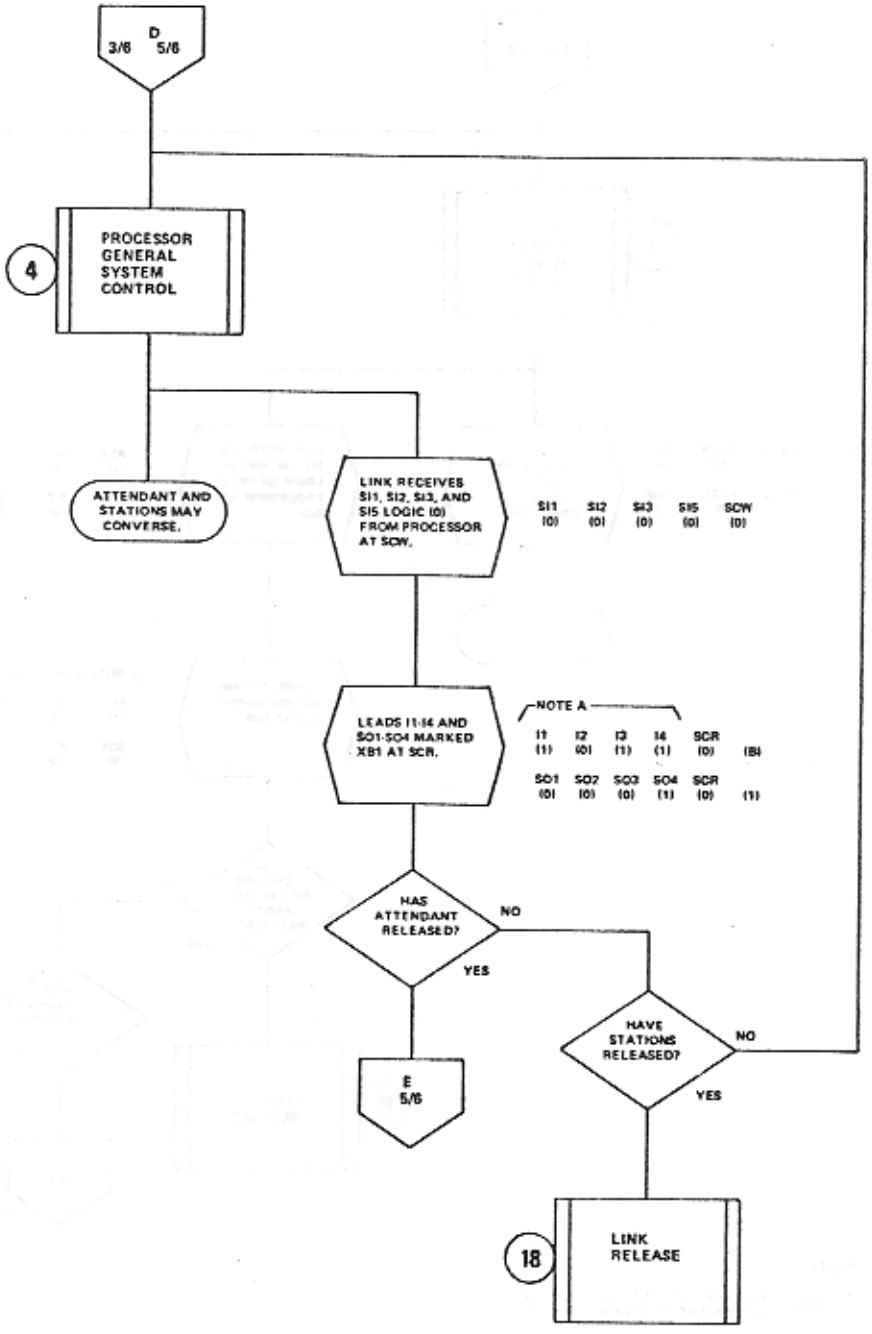
FIGURE A—1.15 Flow Chart 16, Link Seized (Local) (Sheet 4 of 6)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B3.

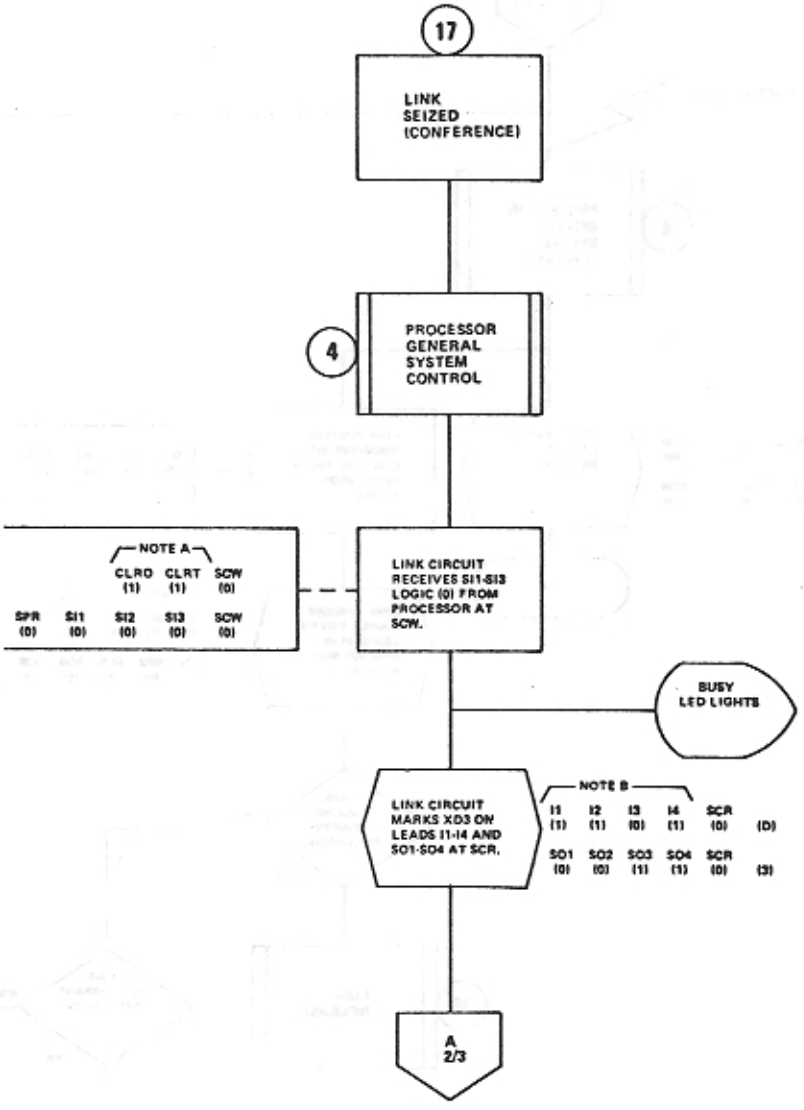
FIGURE A-1.15 Flow Chart 16, Link Seized (Local) (Sheet 5 of 6)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B1.

FIGURE A-1.15 Flow Chart 16, Link Seized (Local) (Sheet 6 of 6)

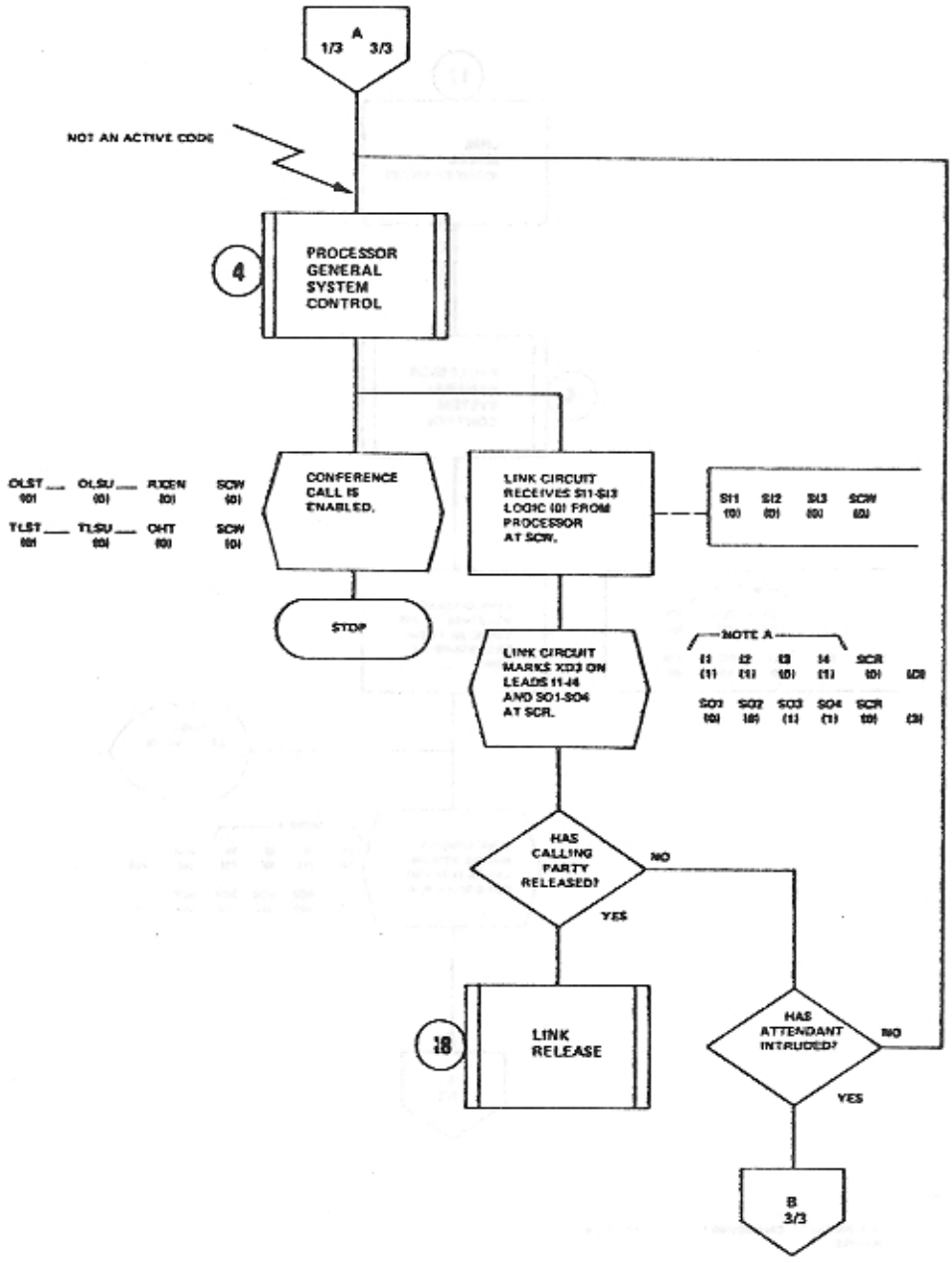


NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

B. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT D3.

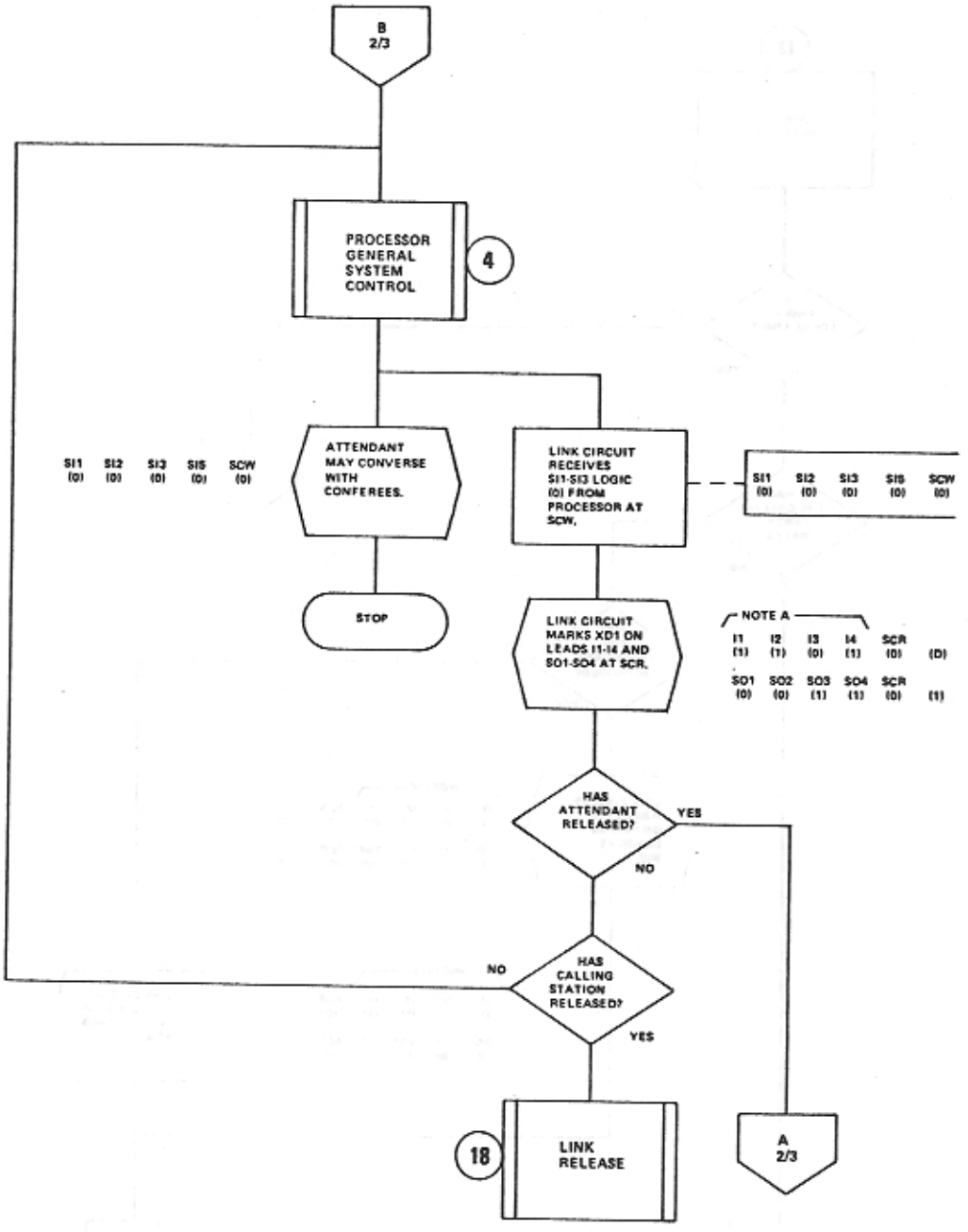
FIGURE A-1.16 Flow Chart 17, Link Seized (Conference) (Sheet 1 of 3)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT D3.

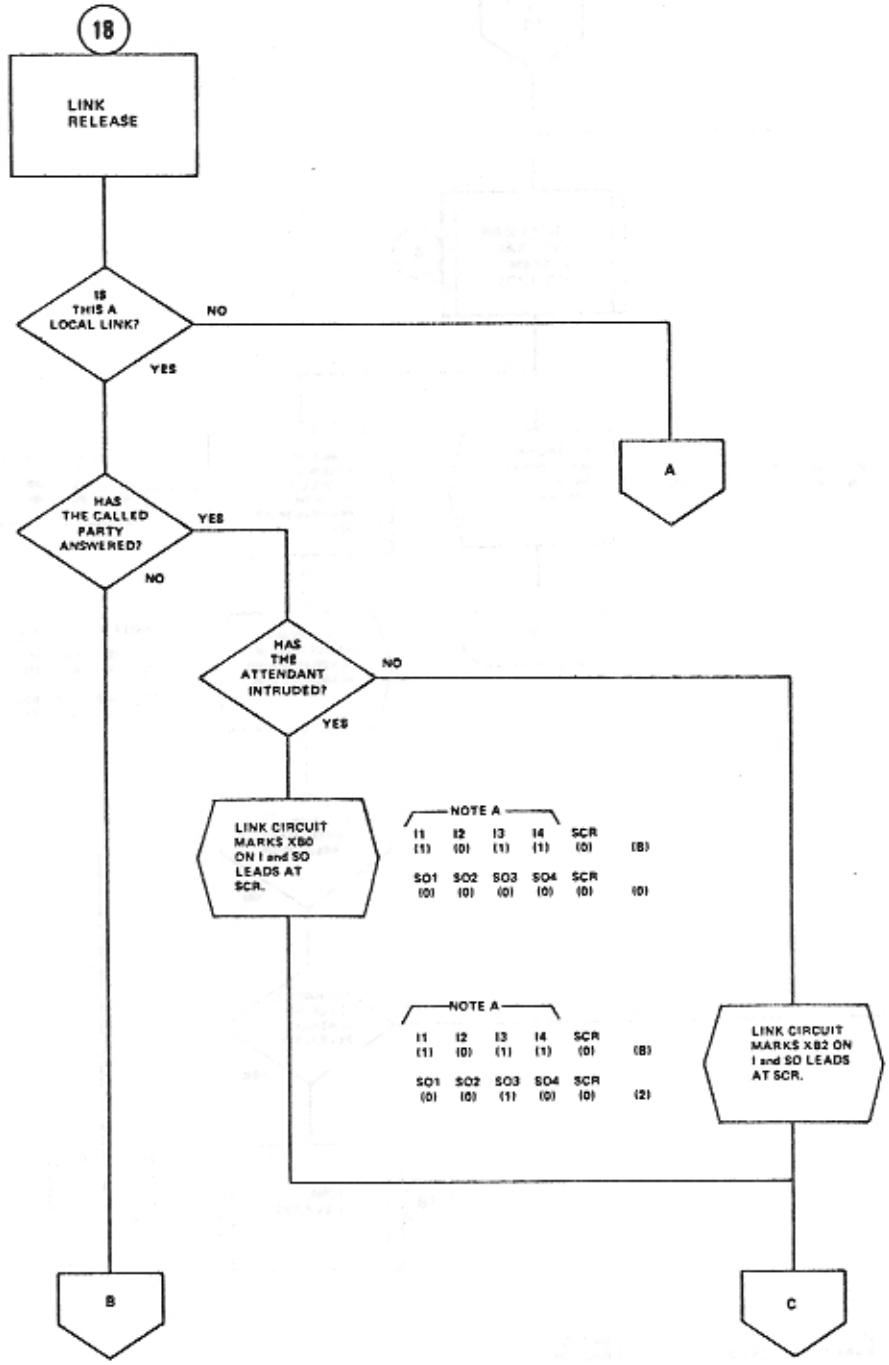
FIGURE A-1.16 Flow Chart 17, Link Seized (Conference) (Sheet 2 of 3)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT D1.

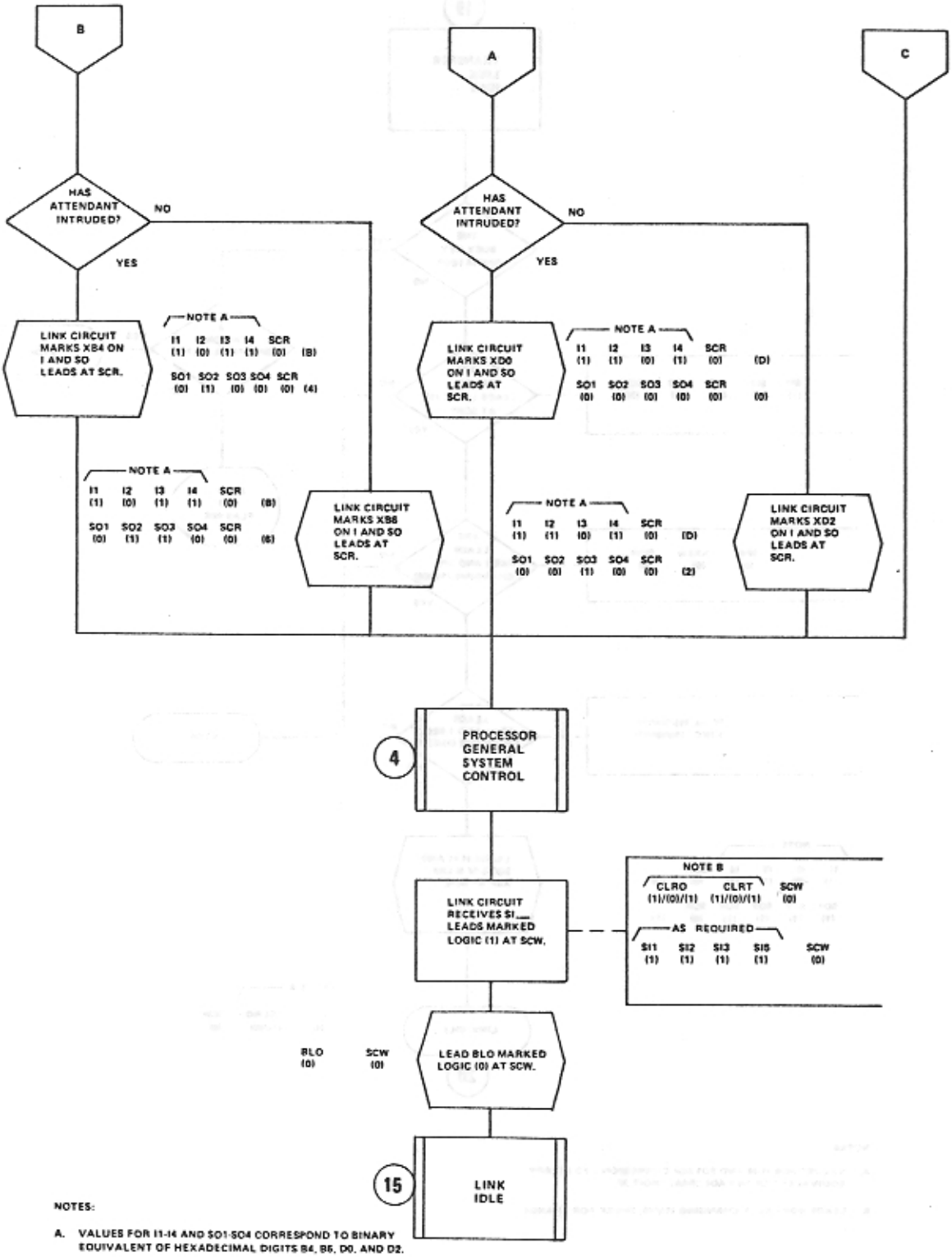
FIGURE A-1.16 Flow Chart 17, Link Seized (Conference) (Sheet 3 of 3)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS B0 AND B2.

FIGURE A-1.17 Flow Chart 18, Link Release (Sheet 1 of 2)

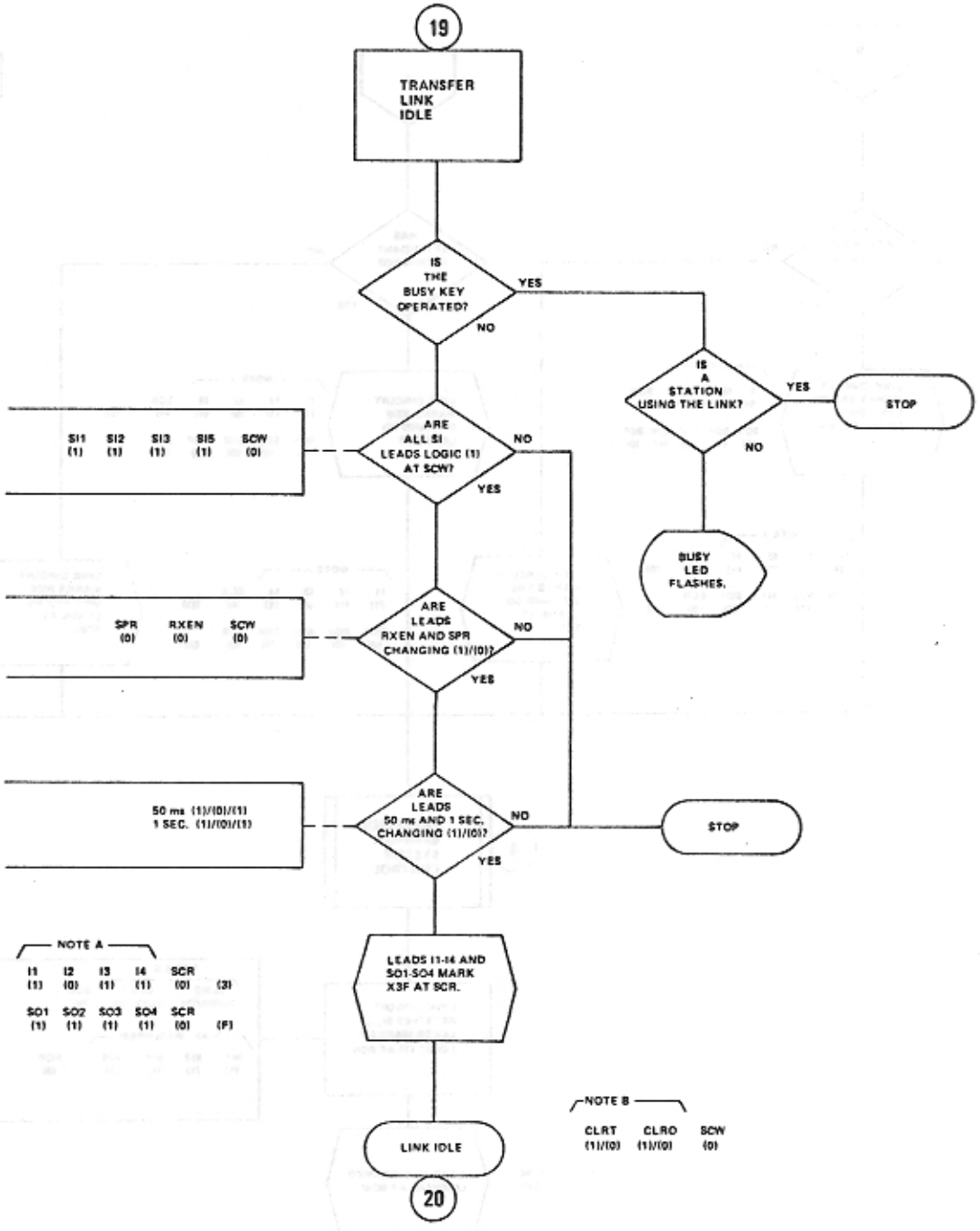


NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS B4, B6, D0, AND D2.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.17 Flow Chart 18, Link Release (Sheet 2 of 2)



NOTES:

A. VALUES FOR I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 3F.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.18 Flow Chart 19, Transfer Link Idle

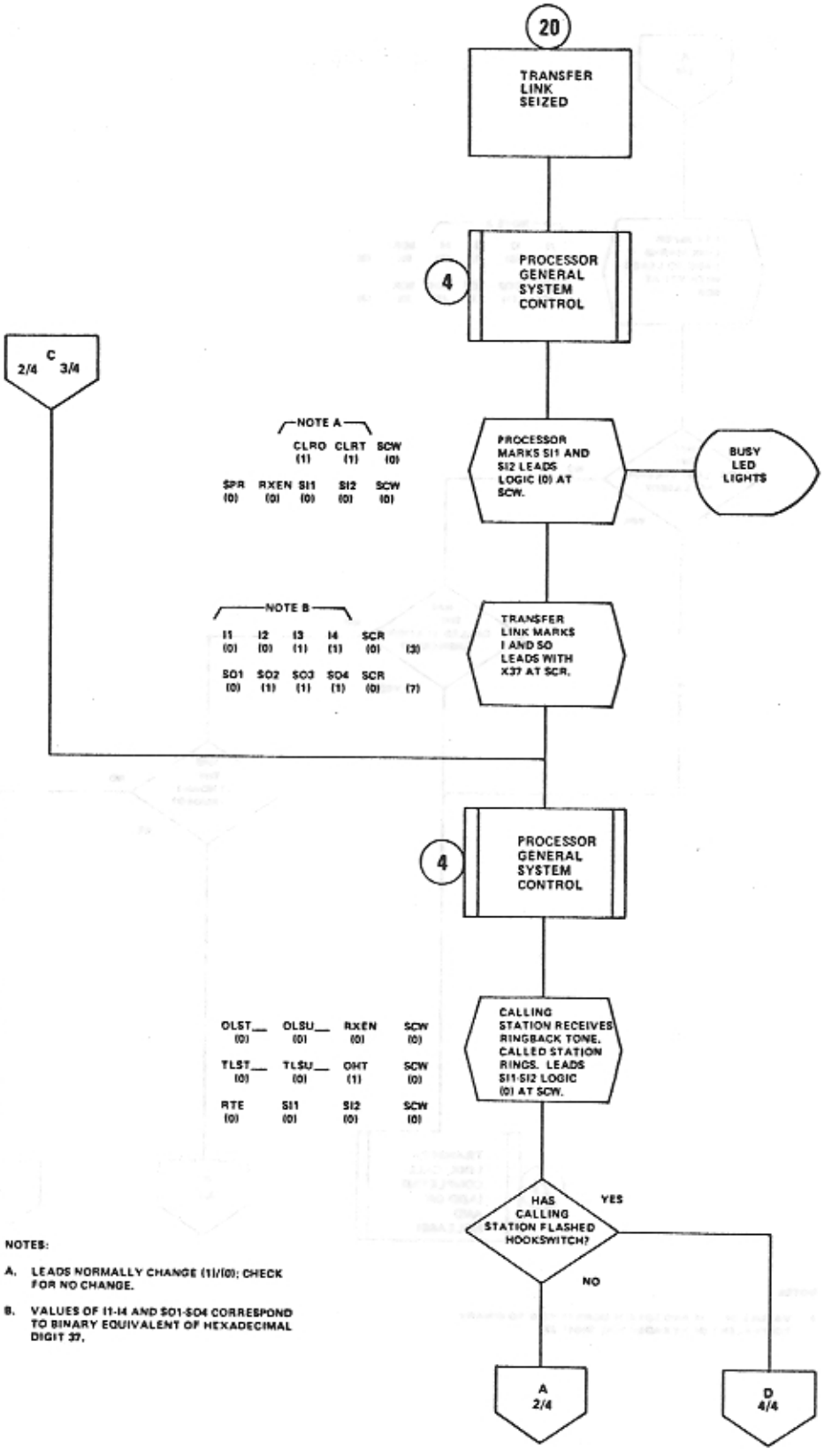
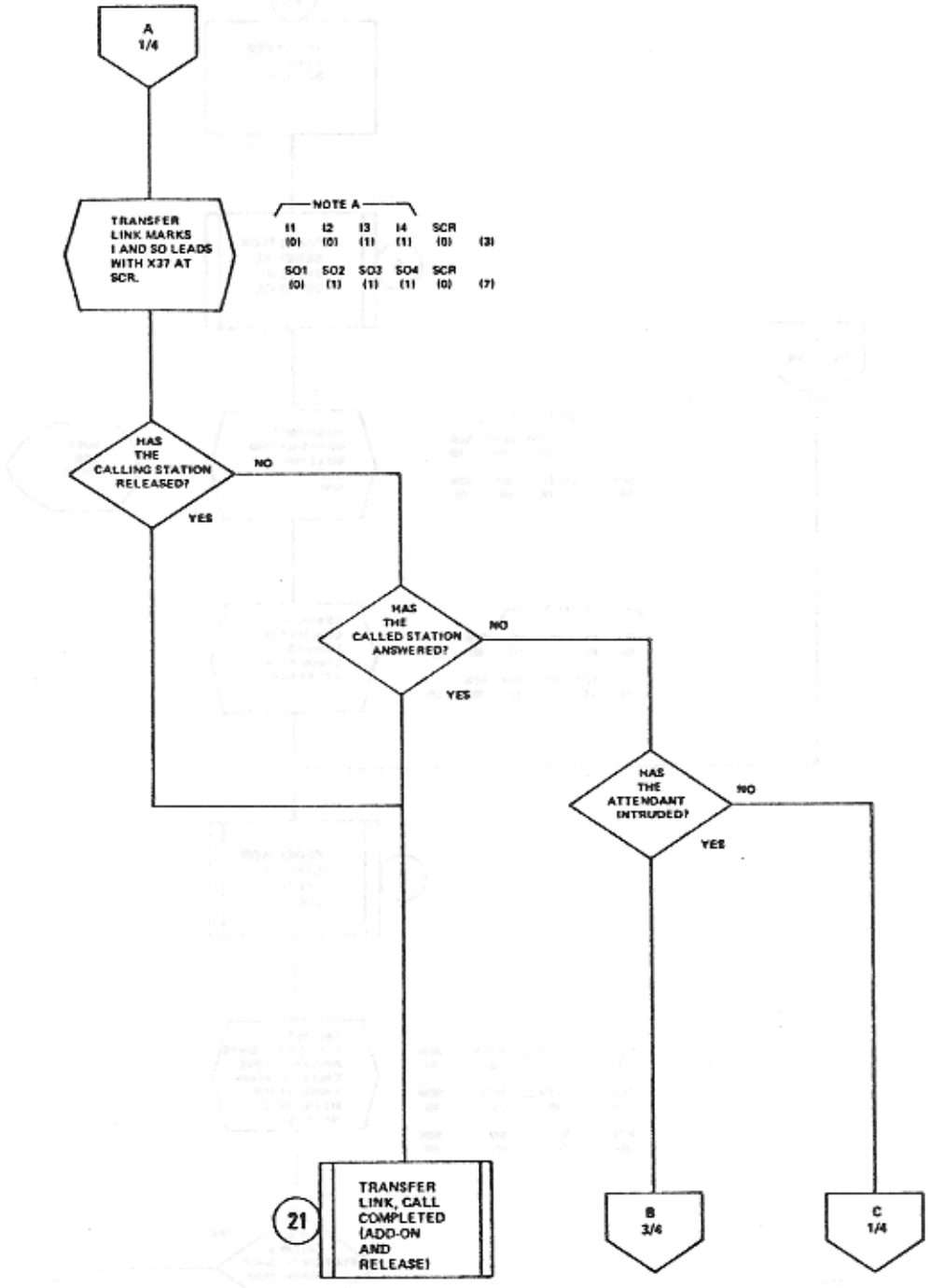


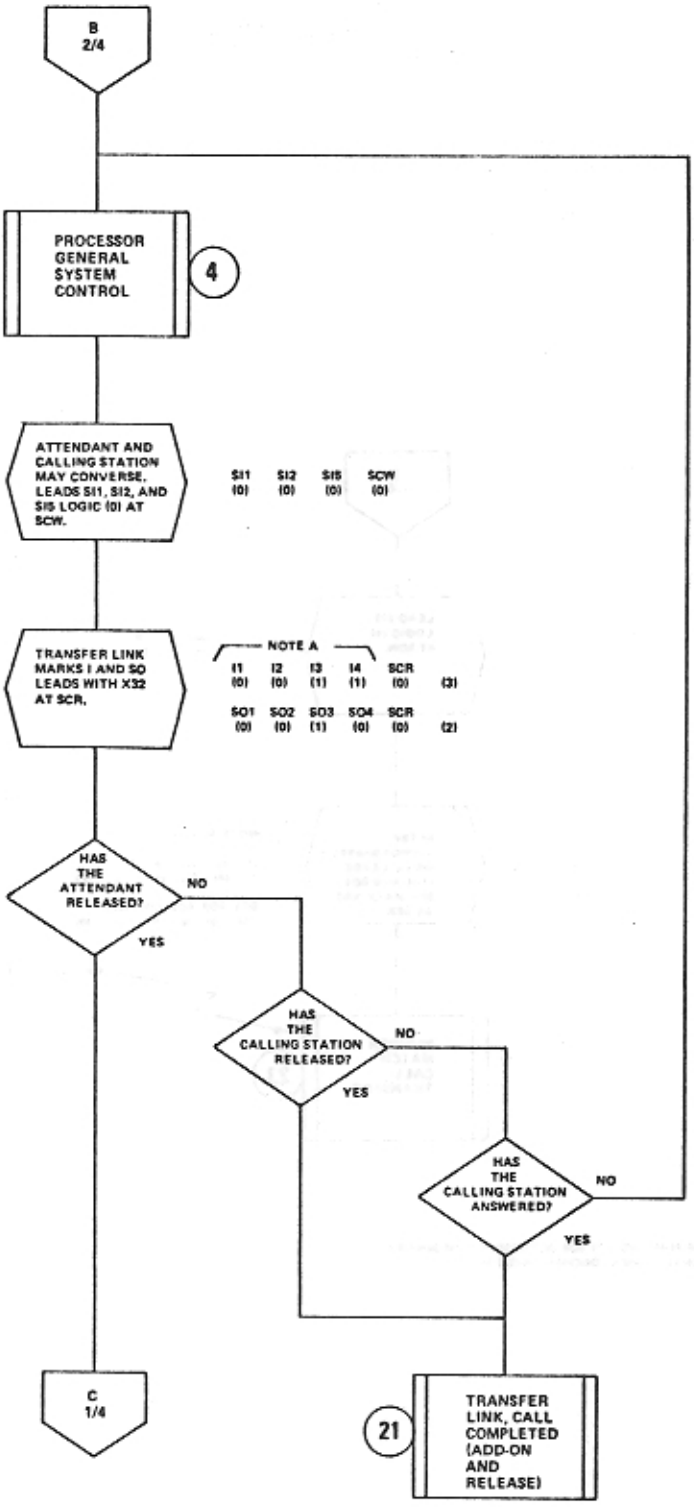
FIGURE A-1.19 Flow Chart 20, Transfer Link Seized (Sheet 1 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 37.

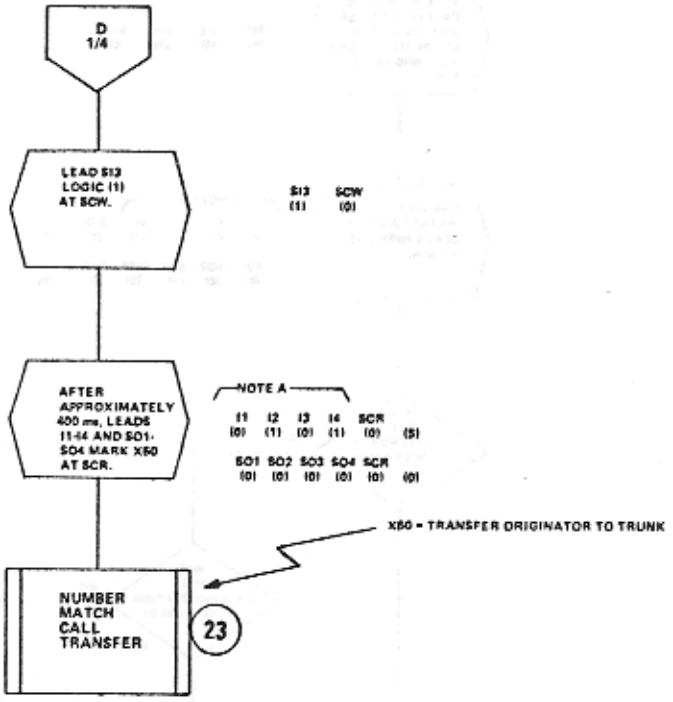
FIGURE A-1.19 Flow Chart 20, Transfer Link Seized (Sheet 2 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 32.

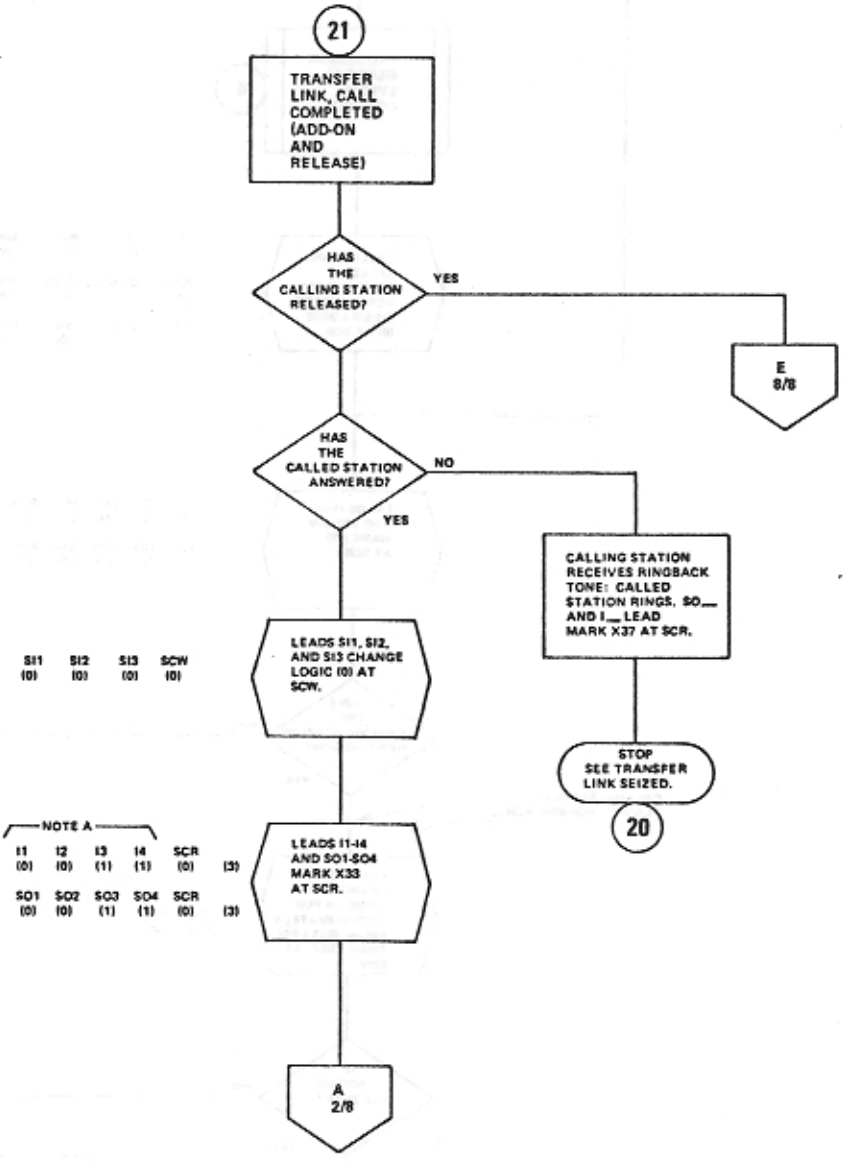
FIGURE A-1.19 Flow Chart 20, Transfer Link Seized (Sheet 3 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 50.

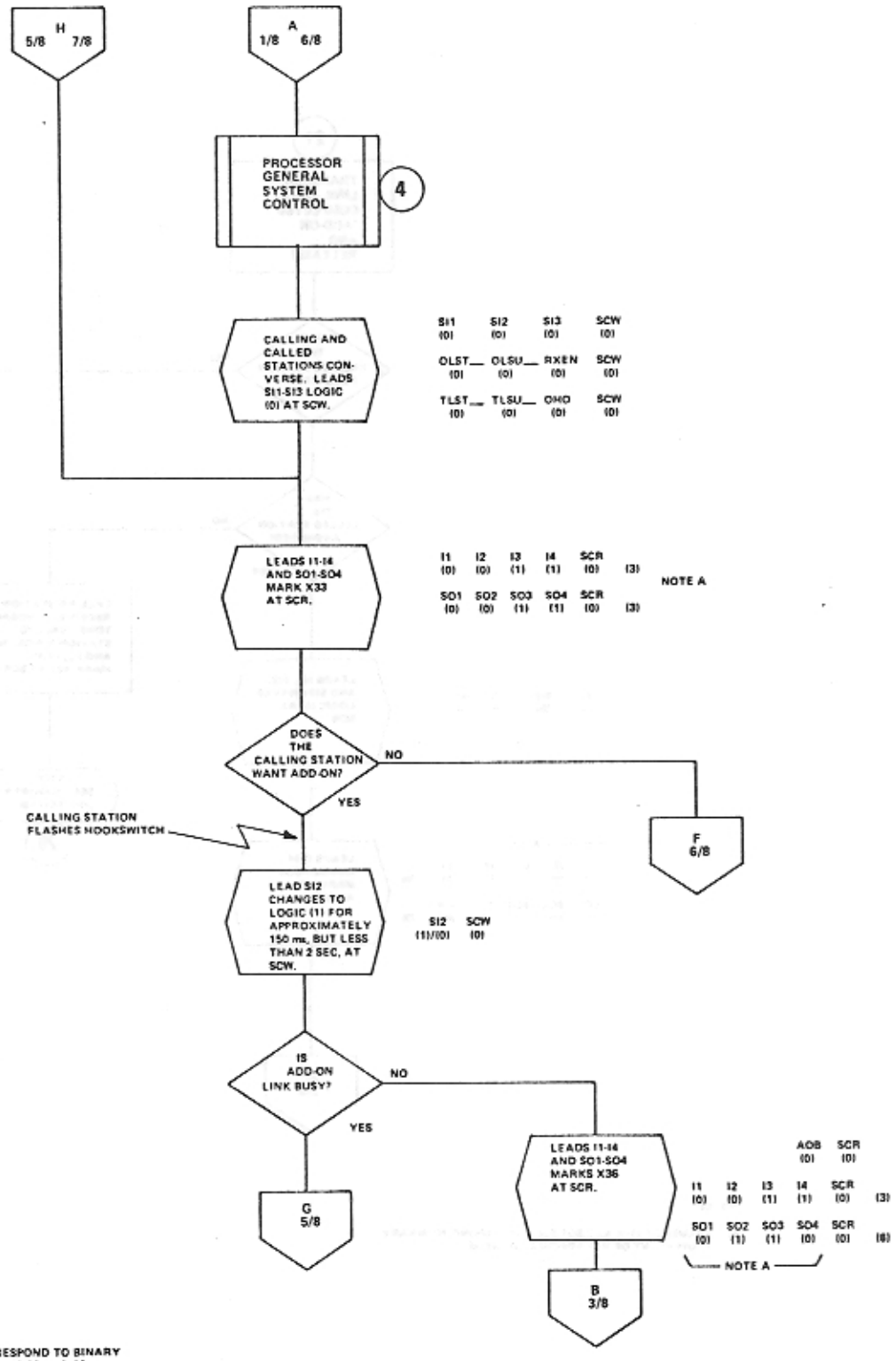
FIGURE A-1.19 Flow Chart 20, Transfer Link Seized (Sheet 4 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 33.

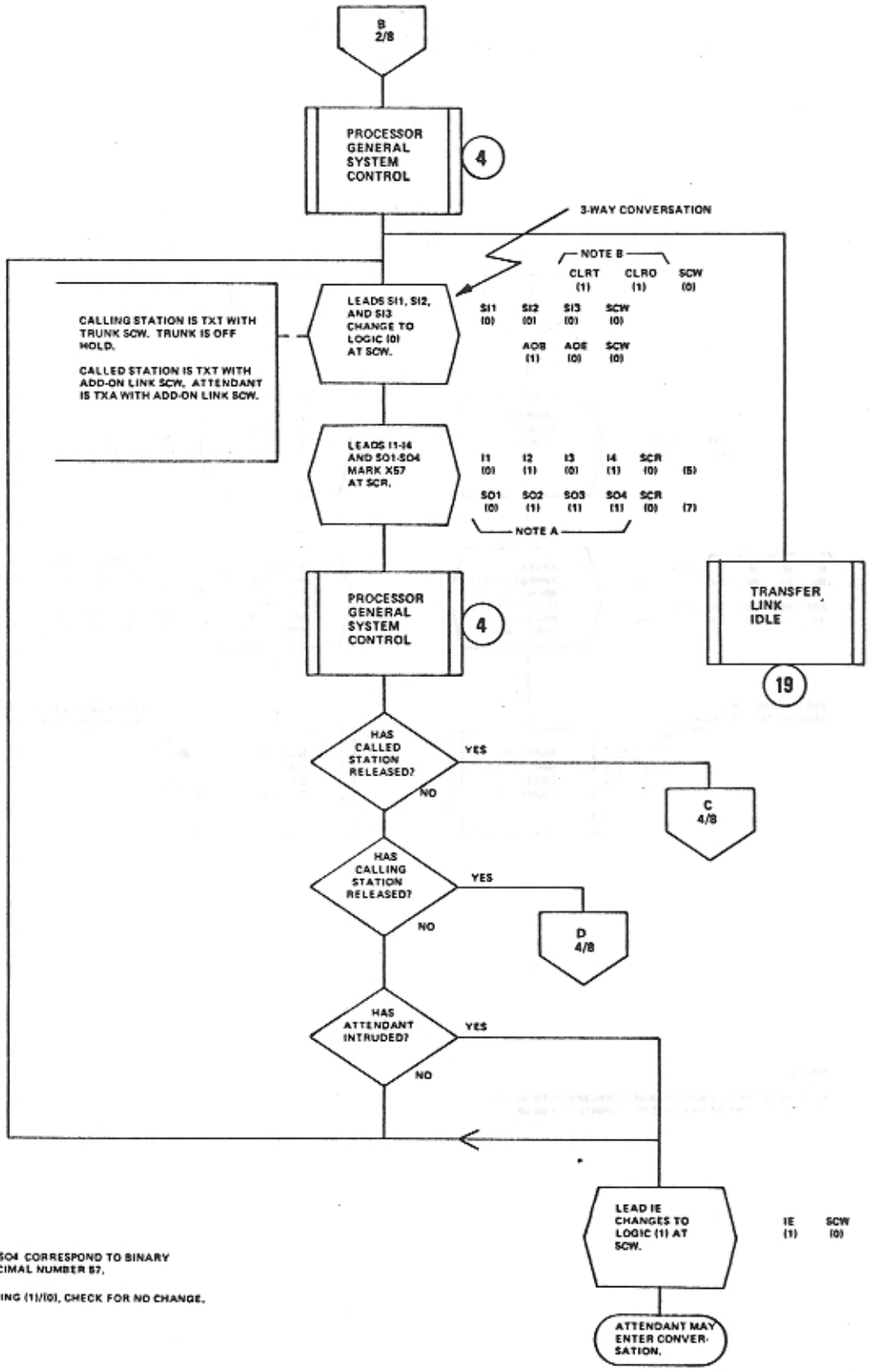
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 1 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 33 AND 36.

FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 2 of 8)

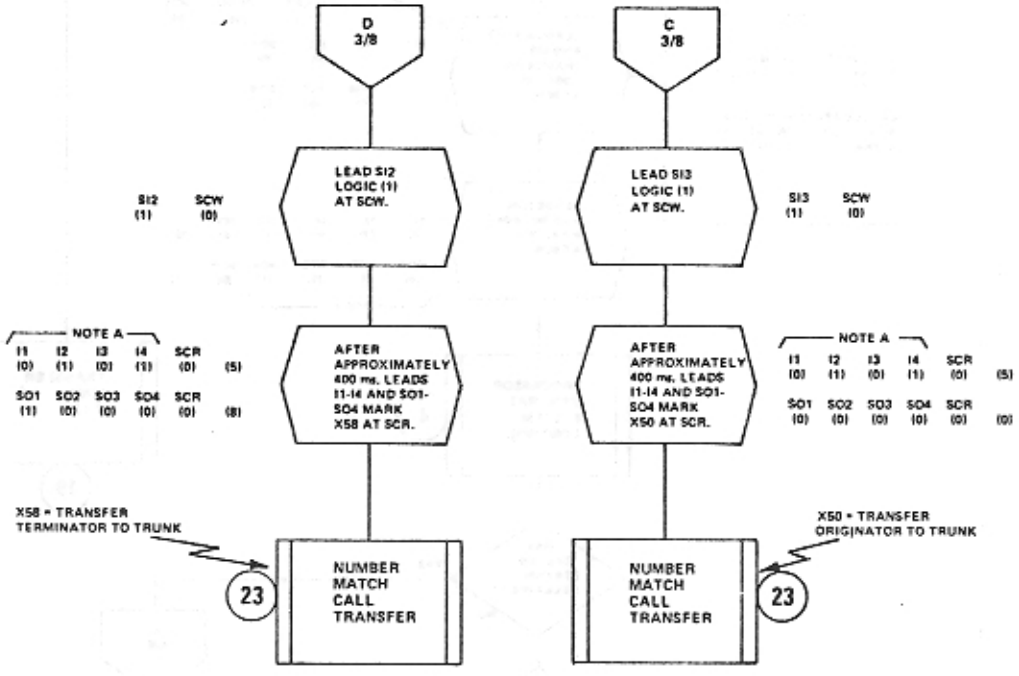


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL NUMBER 57.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

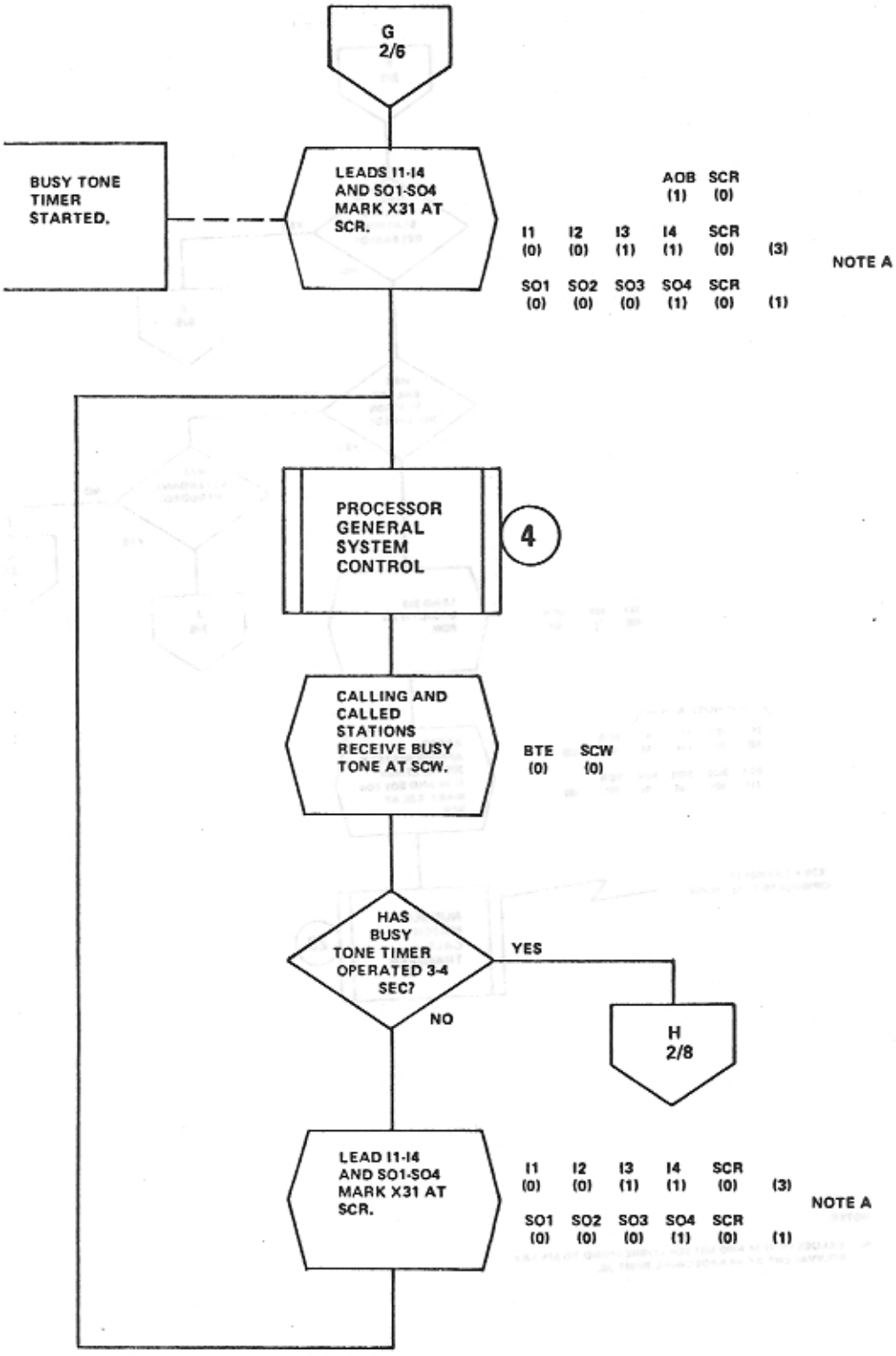
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 3 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 58 AND 50.

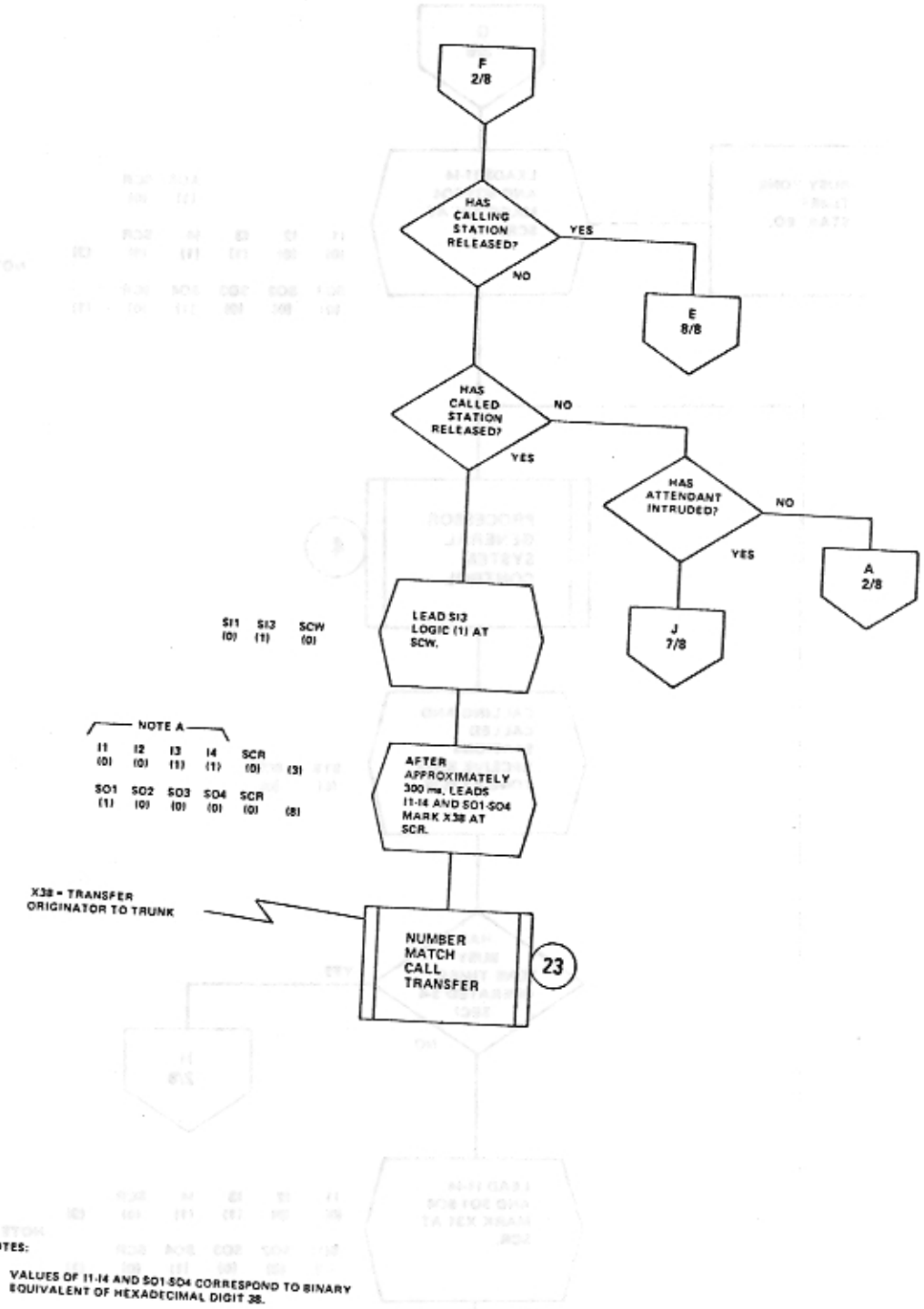
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 4 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 31.

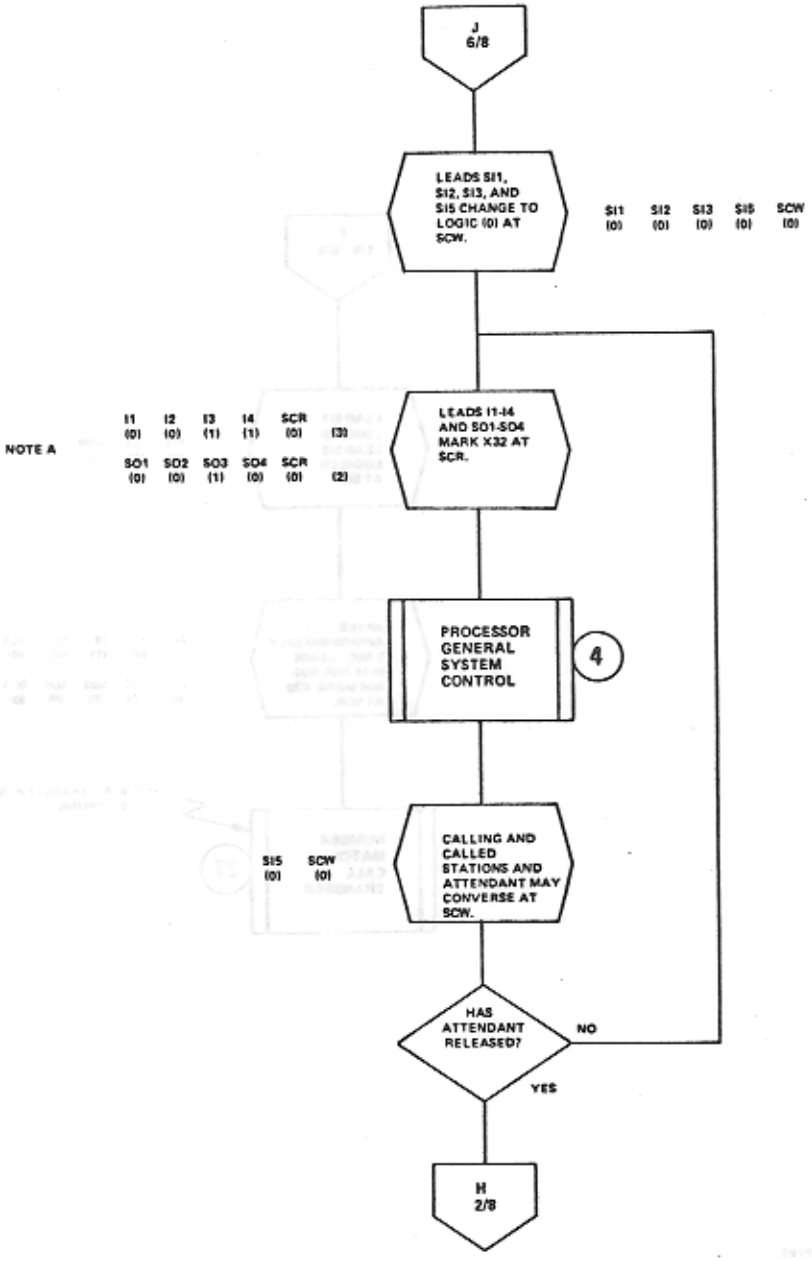
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 5 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 38.

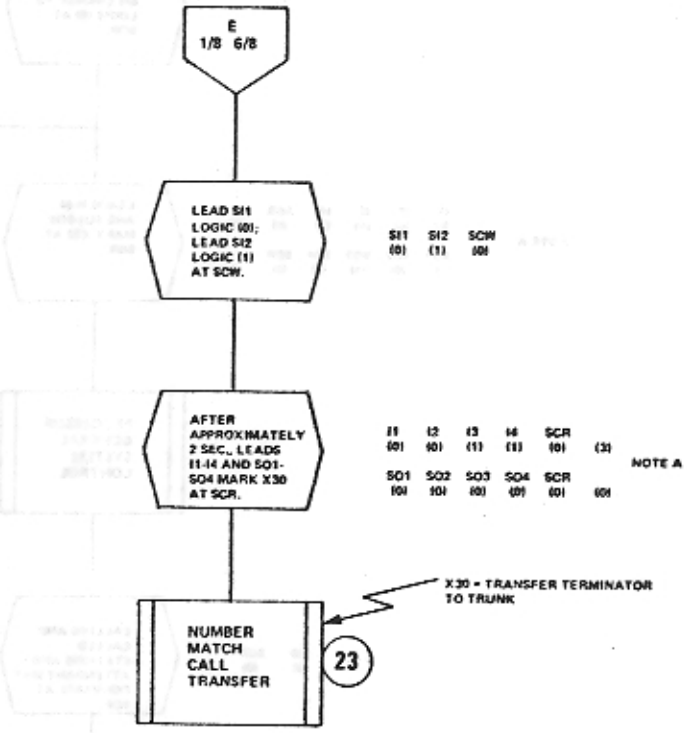
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 6 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 32.

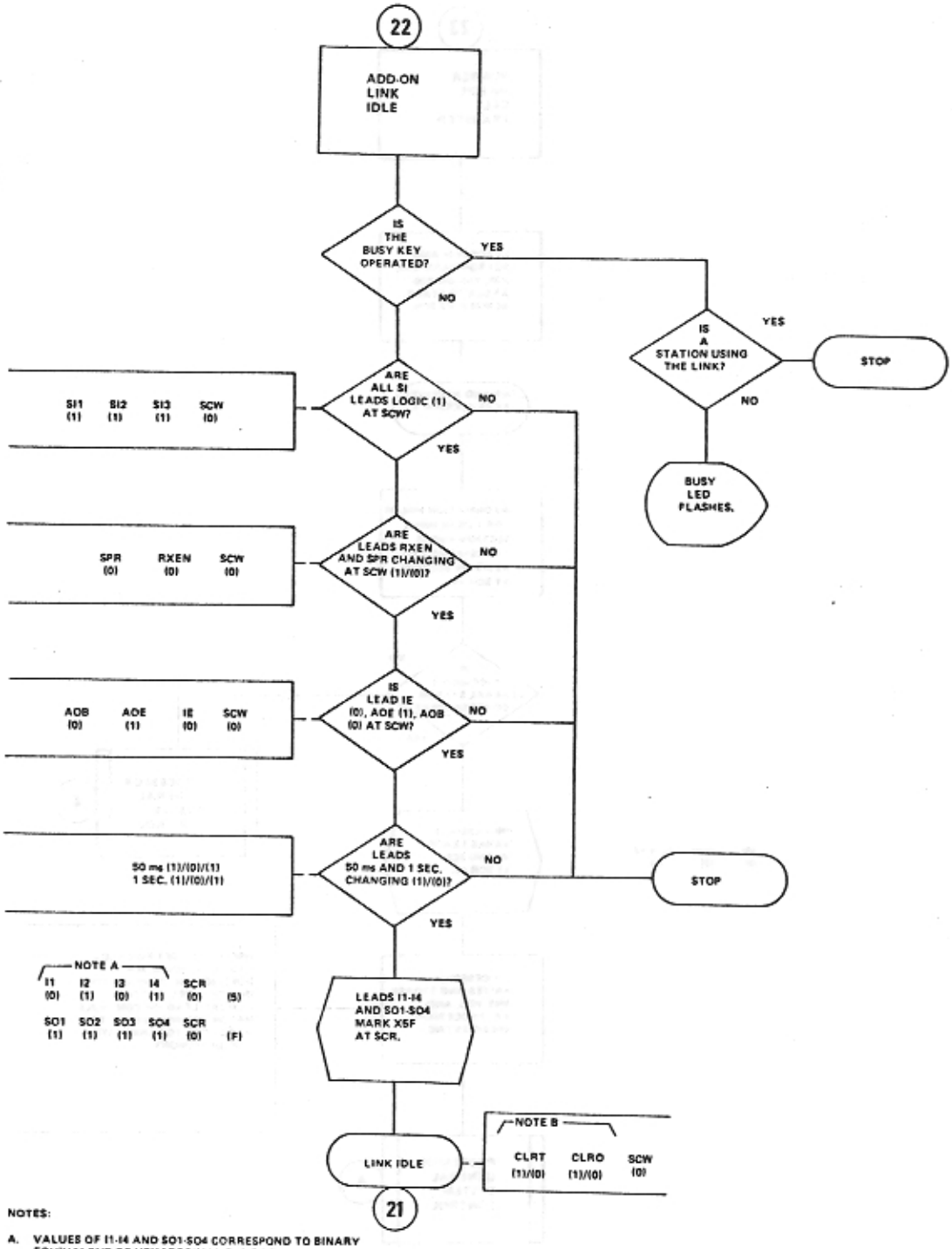
FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 7 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 30.

FIGURE A-1.20 Flow Chart 21, Transfer Link, Call Completed (Add-on and Release) (Sheet 8 of 8)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 5F.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.21 Flow Chart 22, Add-on Link Idle

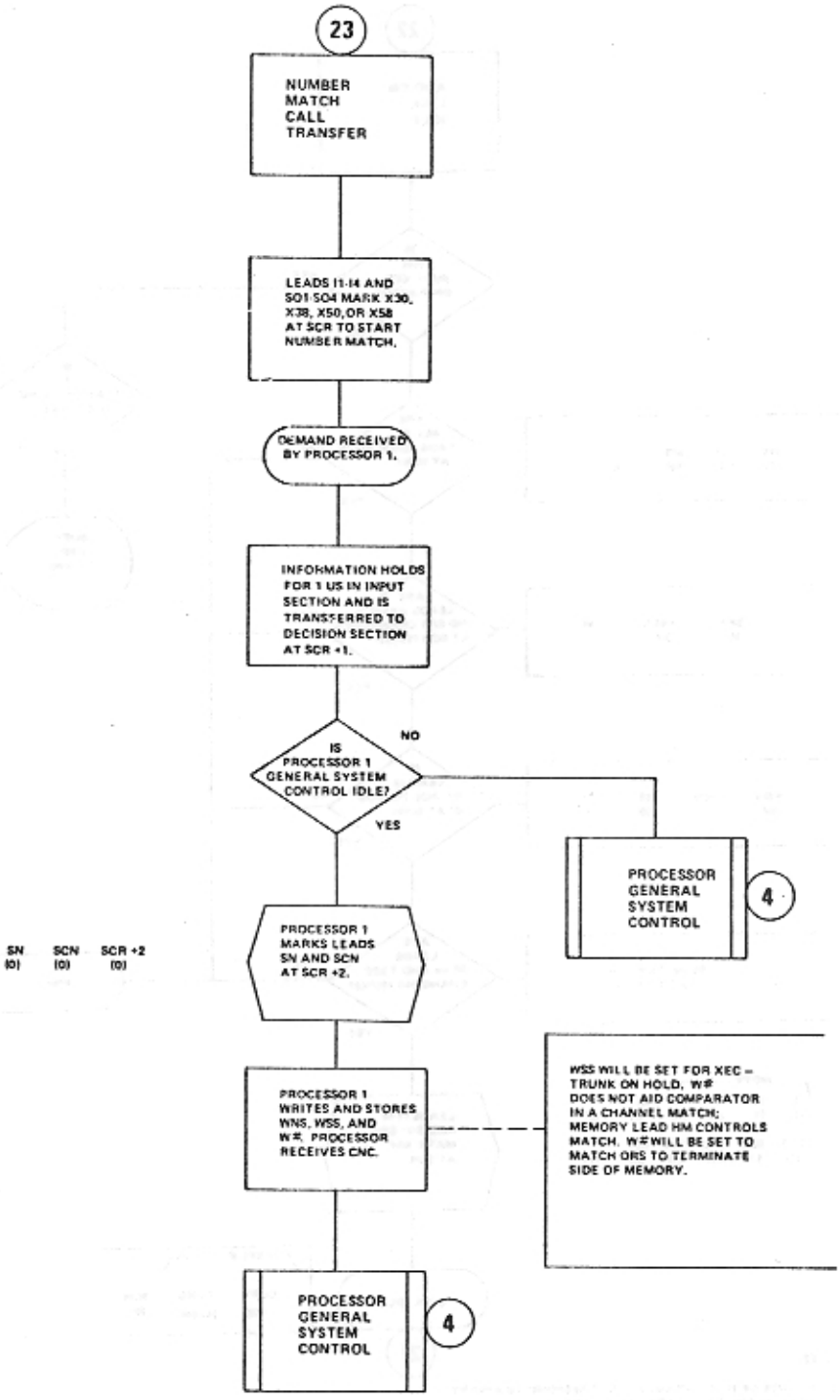
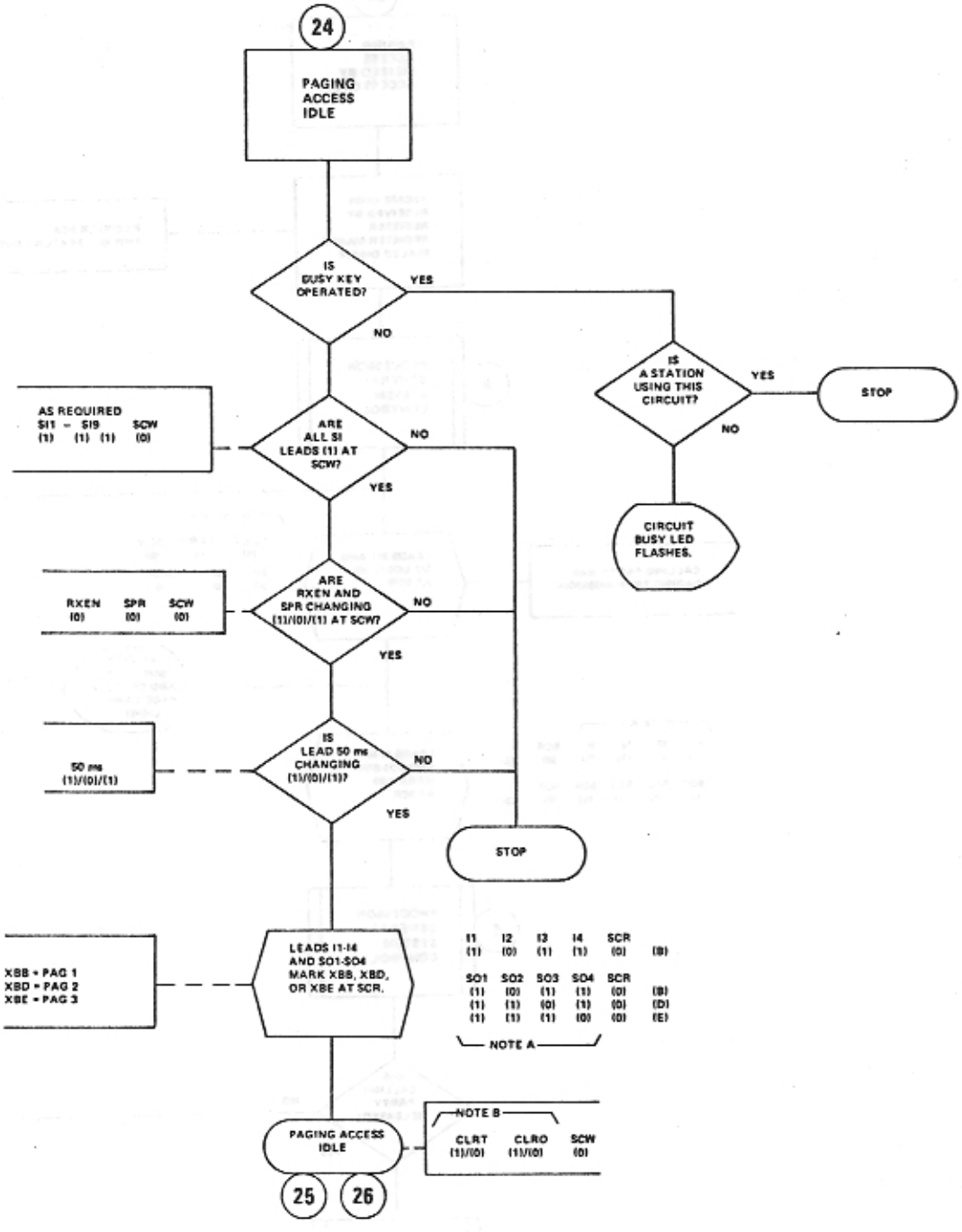


FIGURE A-1.22 Flow Chart 23, Number Match Call Transfer

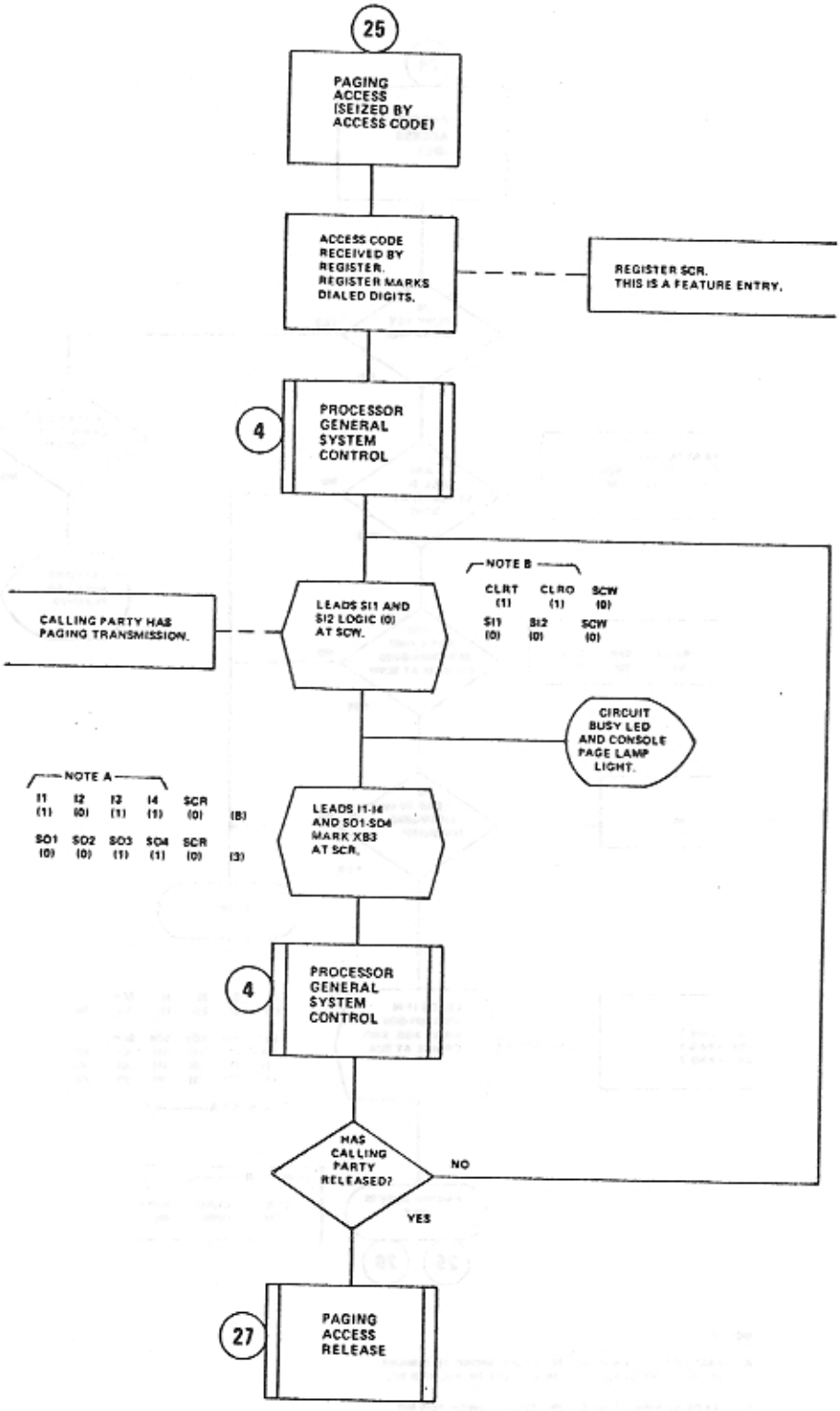


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT BB, BD, AND BE.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

FIGURE A-1.23 Flow Chart 24, Paging Access Idle

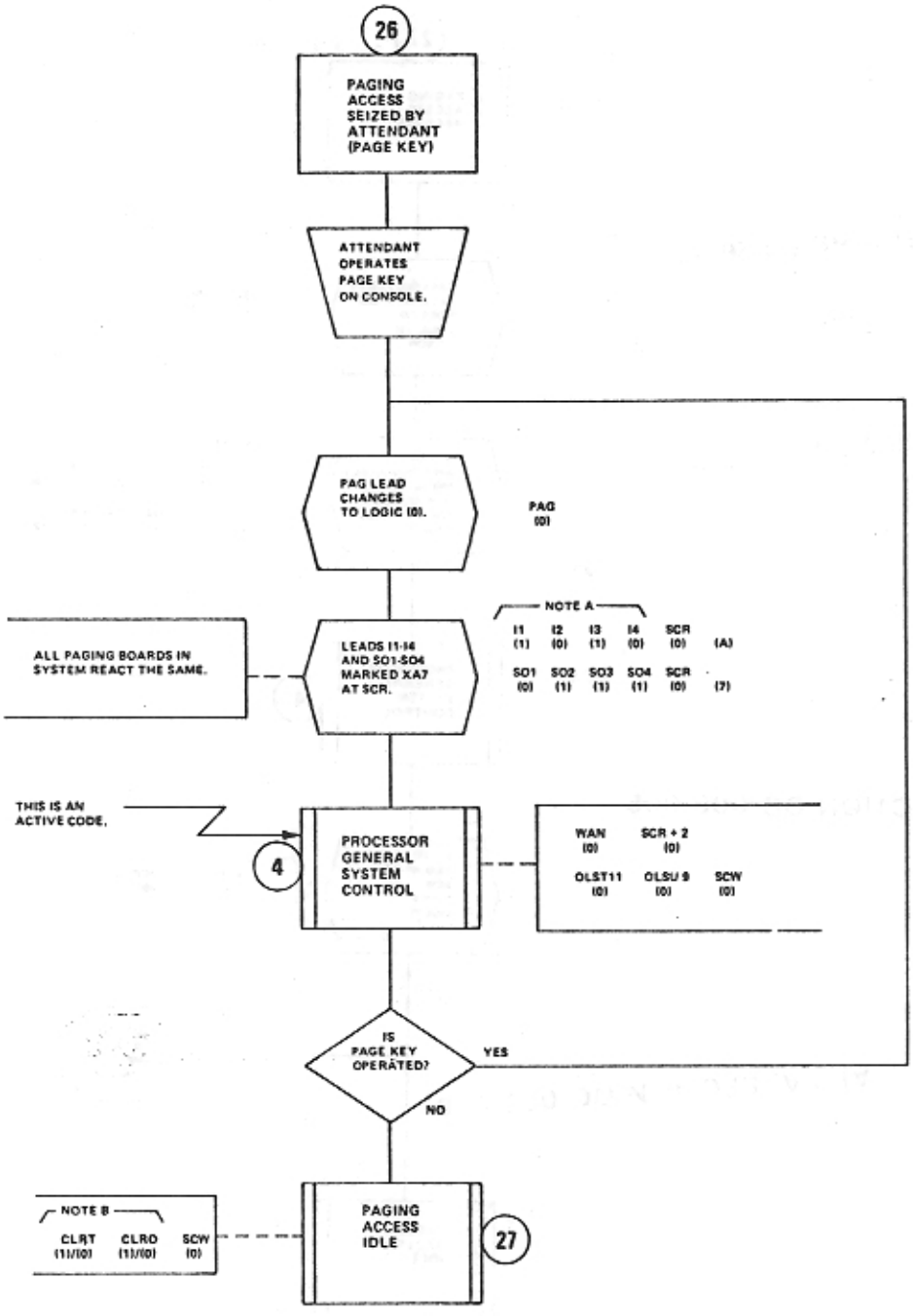


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B3.

B. LEADS NORMALLY CHANGING (1)/(01), CHECK FOR NO CHANGE.

FIGURE A-1.24 Flow Chart 25, Paging Access (Seized by Access Code)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT A7.

B. LEADS USUALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

FIGURE A-1.25 Flow Chart 26, Paging Access Seized by Attendant (PAGE Key)

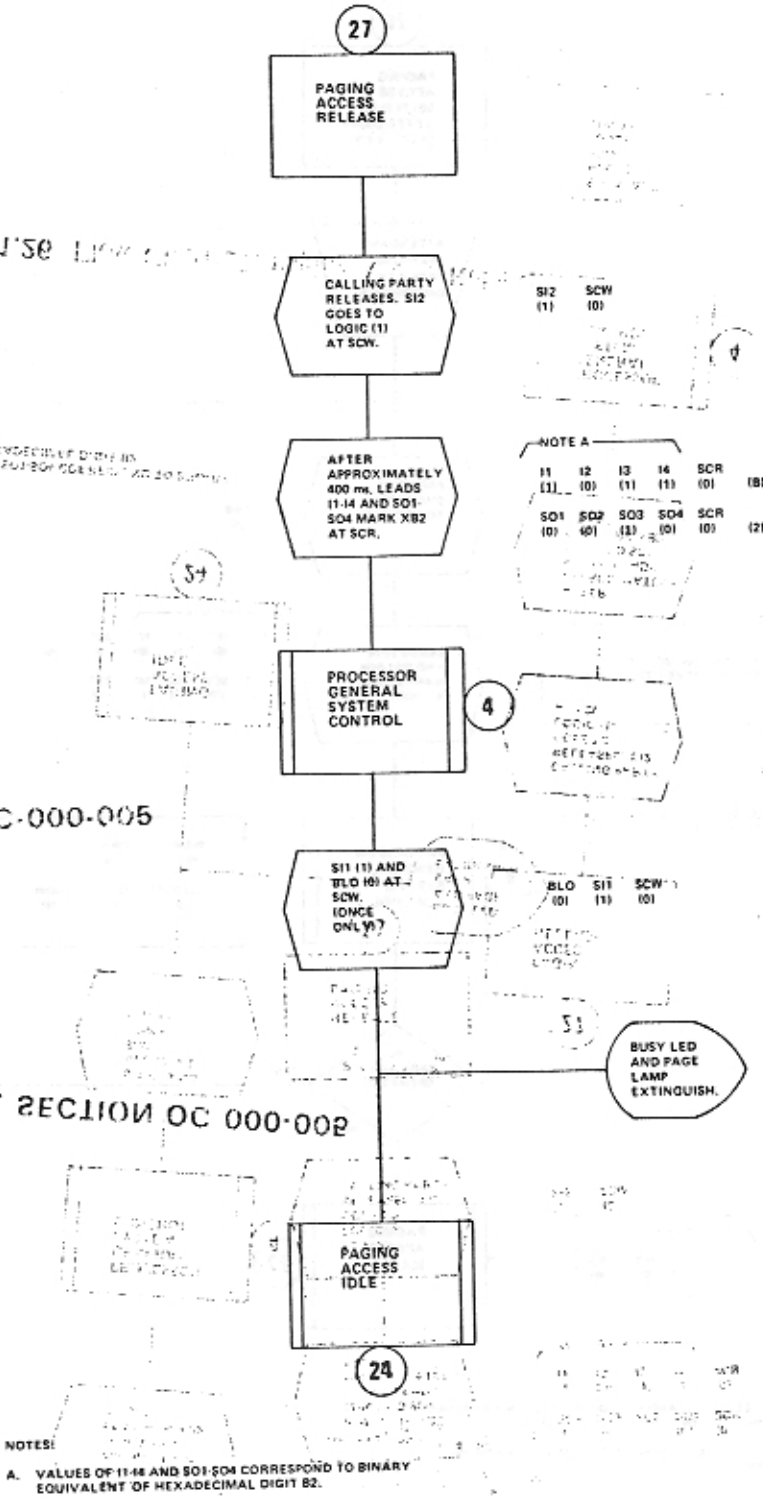
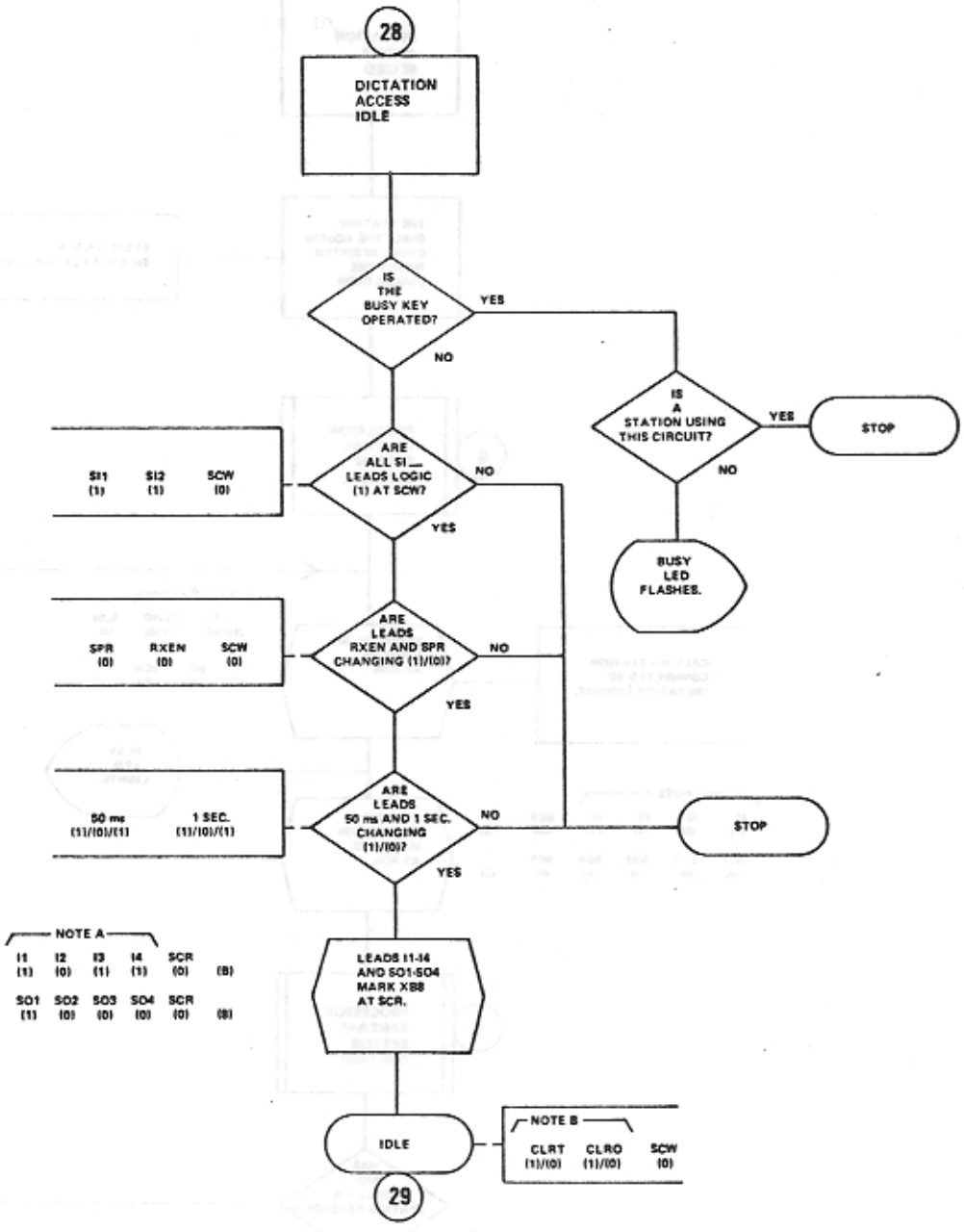


FIGURE A-1.26 Flow Chart 27, Paging Access Release

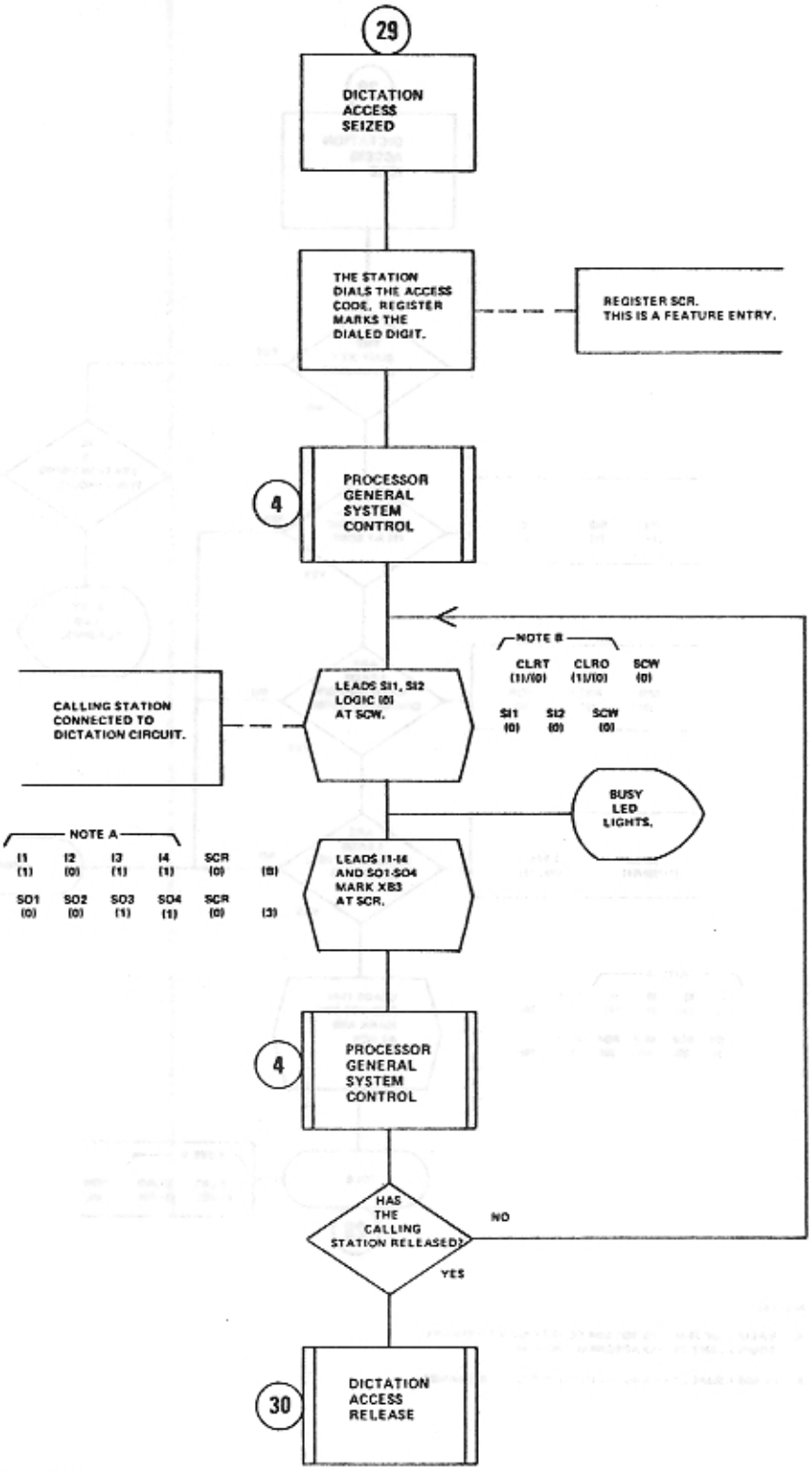


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B8.

B. LEADS USUALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.27 Flow Chart 28, Dictation Access Idle

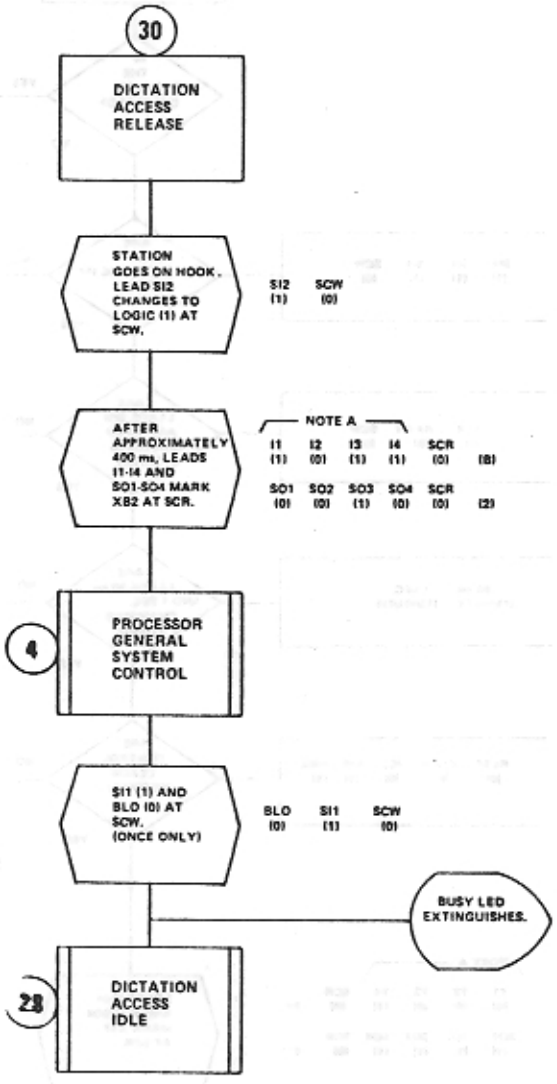


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B3.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

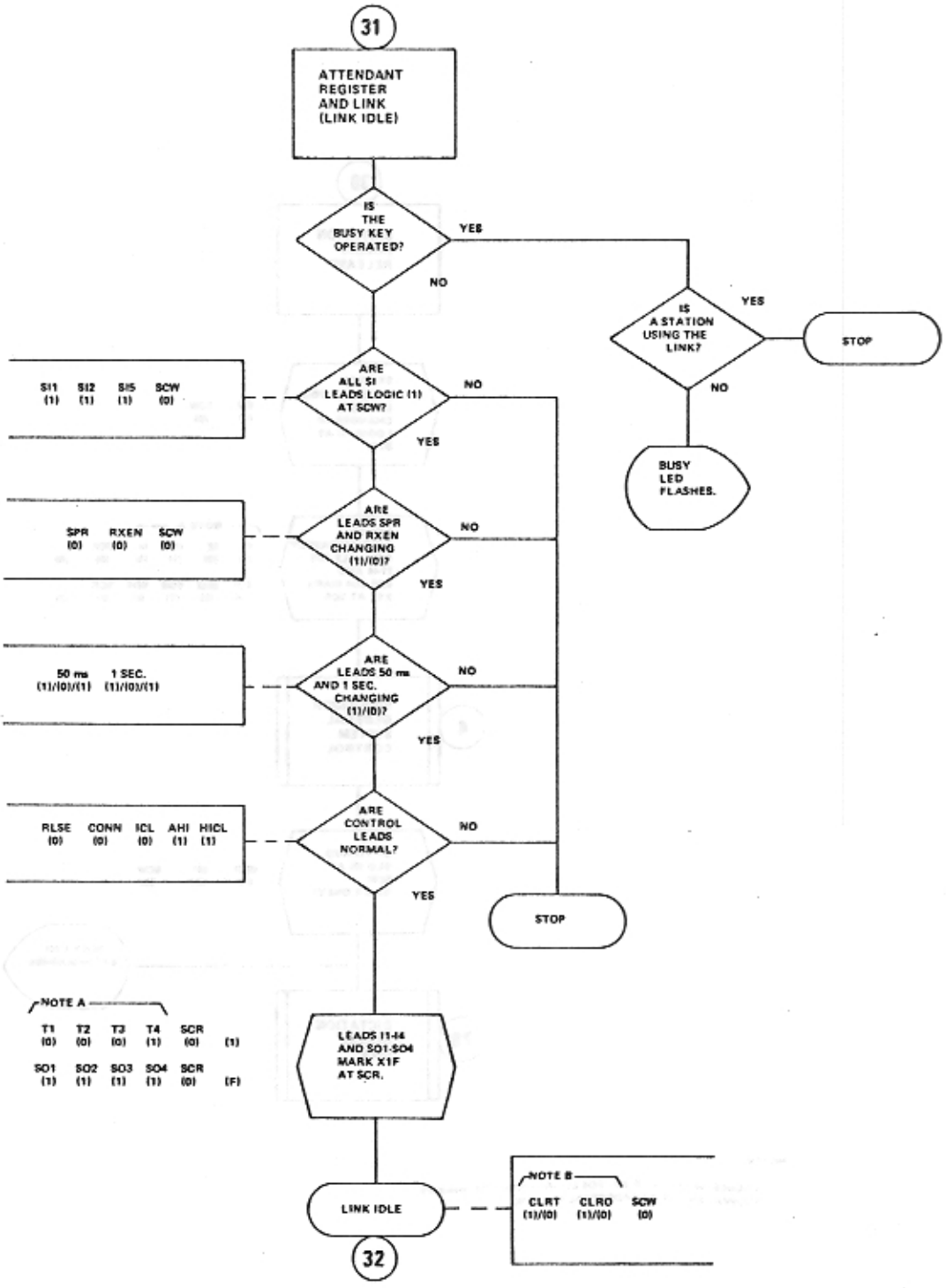
FIGURE A-1.28 Flow Chart 29, Dictation Access Seized



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT B.

FIGURE A-1.29 Flow Chart 30, Dictation Access Release

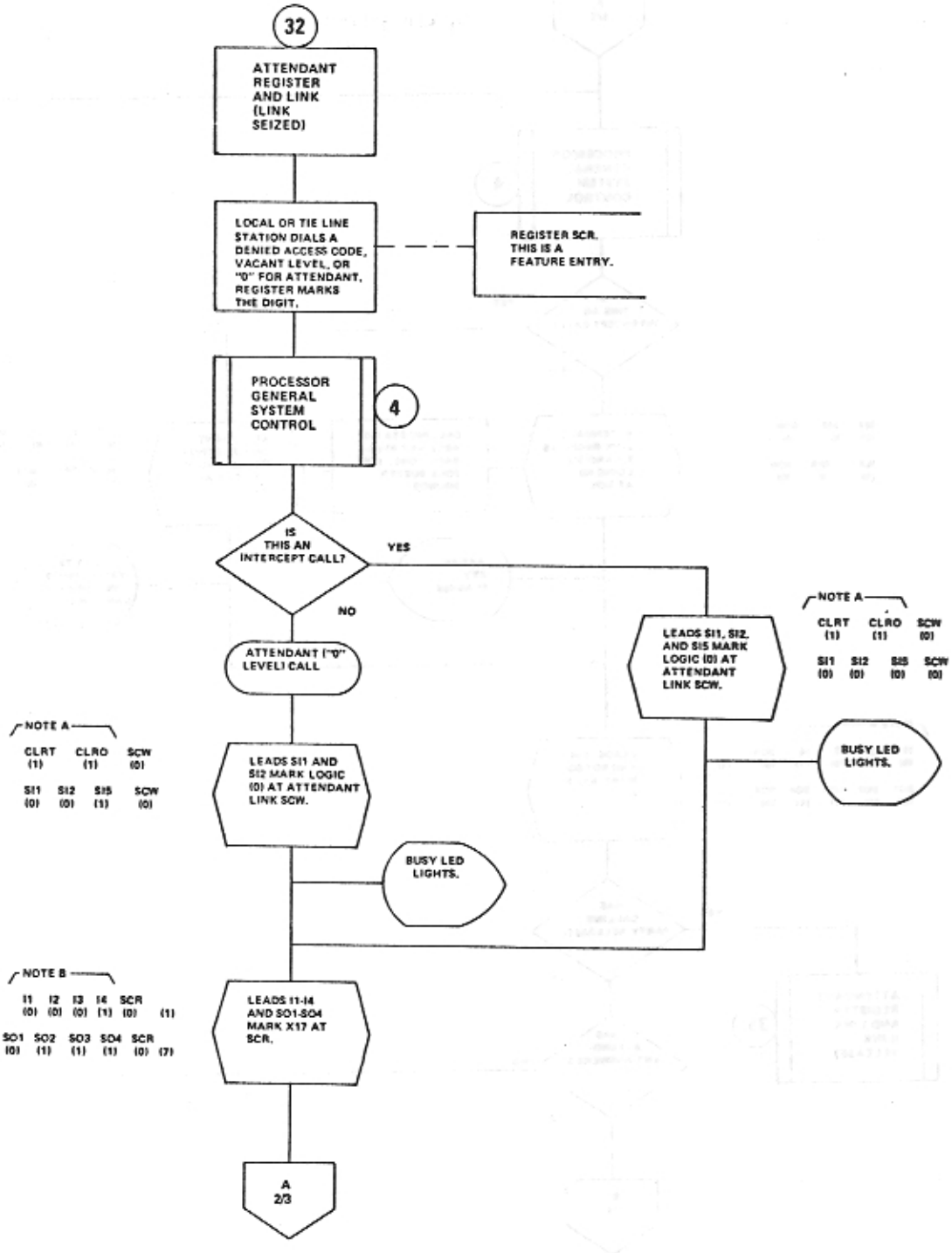


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 1F.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.30 Flow Chart 31, Attendant Register and Link (Link Idle)

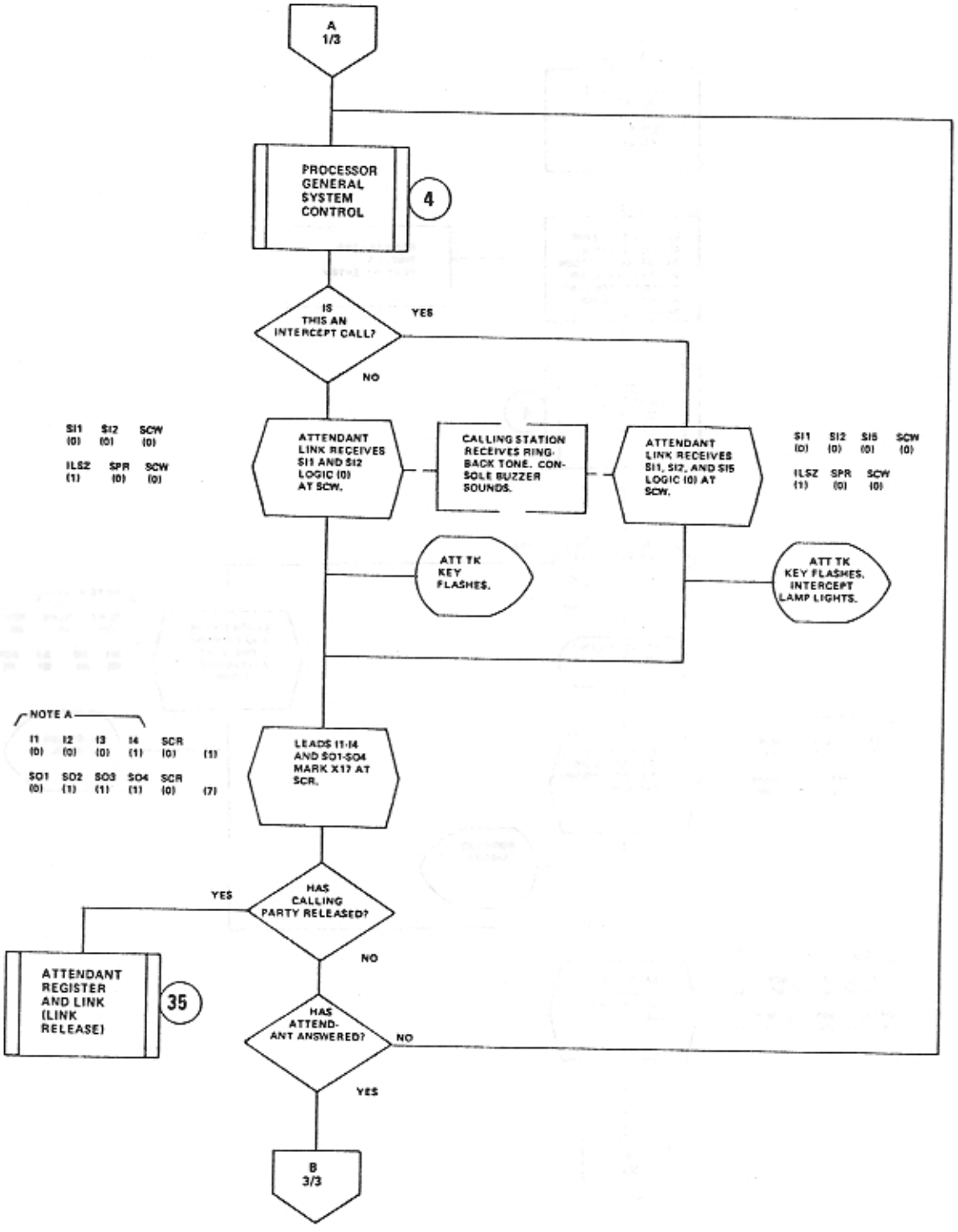


NOTES:

A. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

B. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 17.

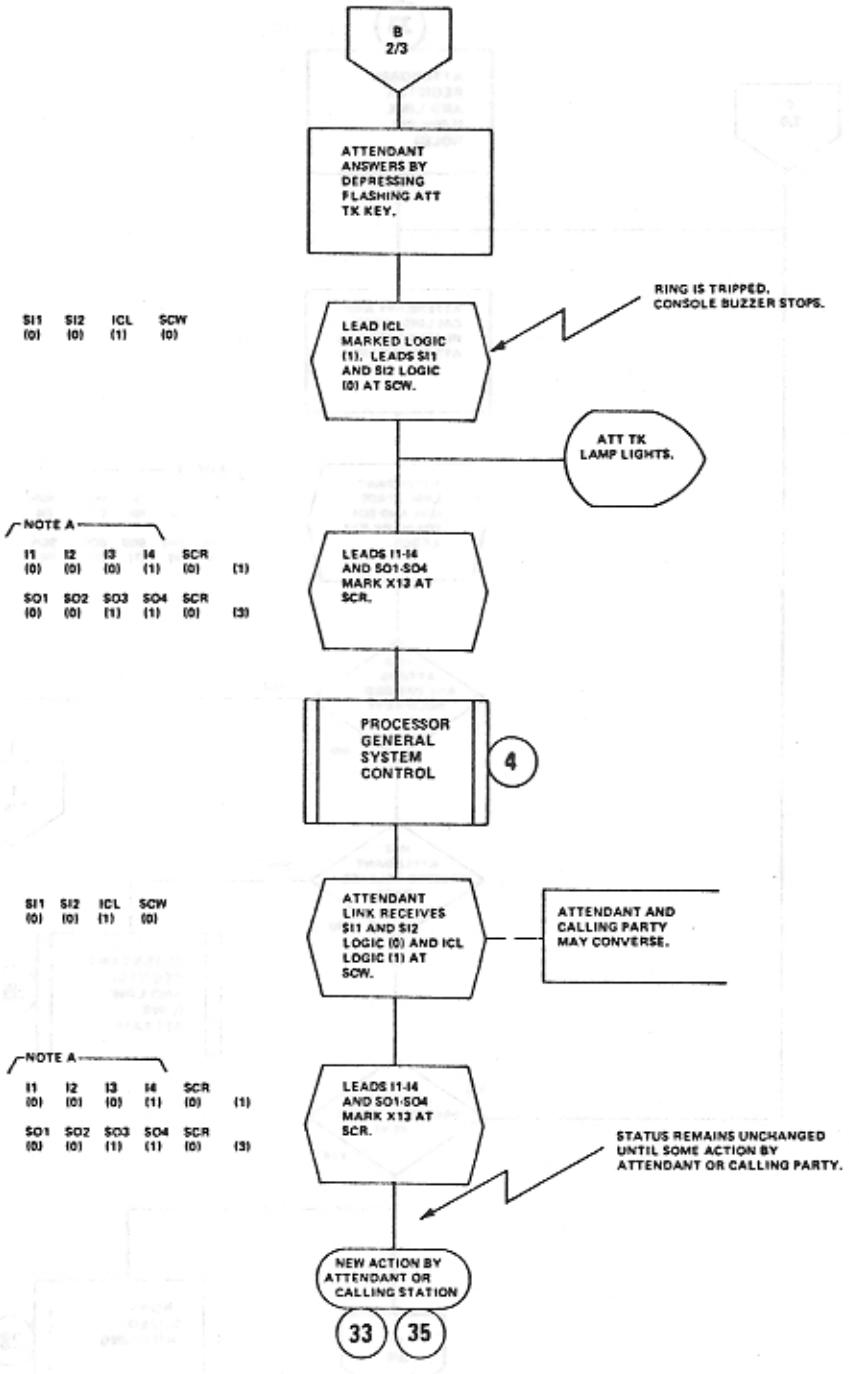
FIGURE A-1.31 Flow Chart 32, Attendant Register and Link (Link Seized) (Sheet 1 of 3)



NOTES:

A. VALUES OF I1 I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 17.

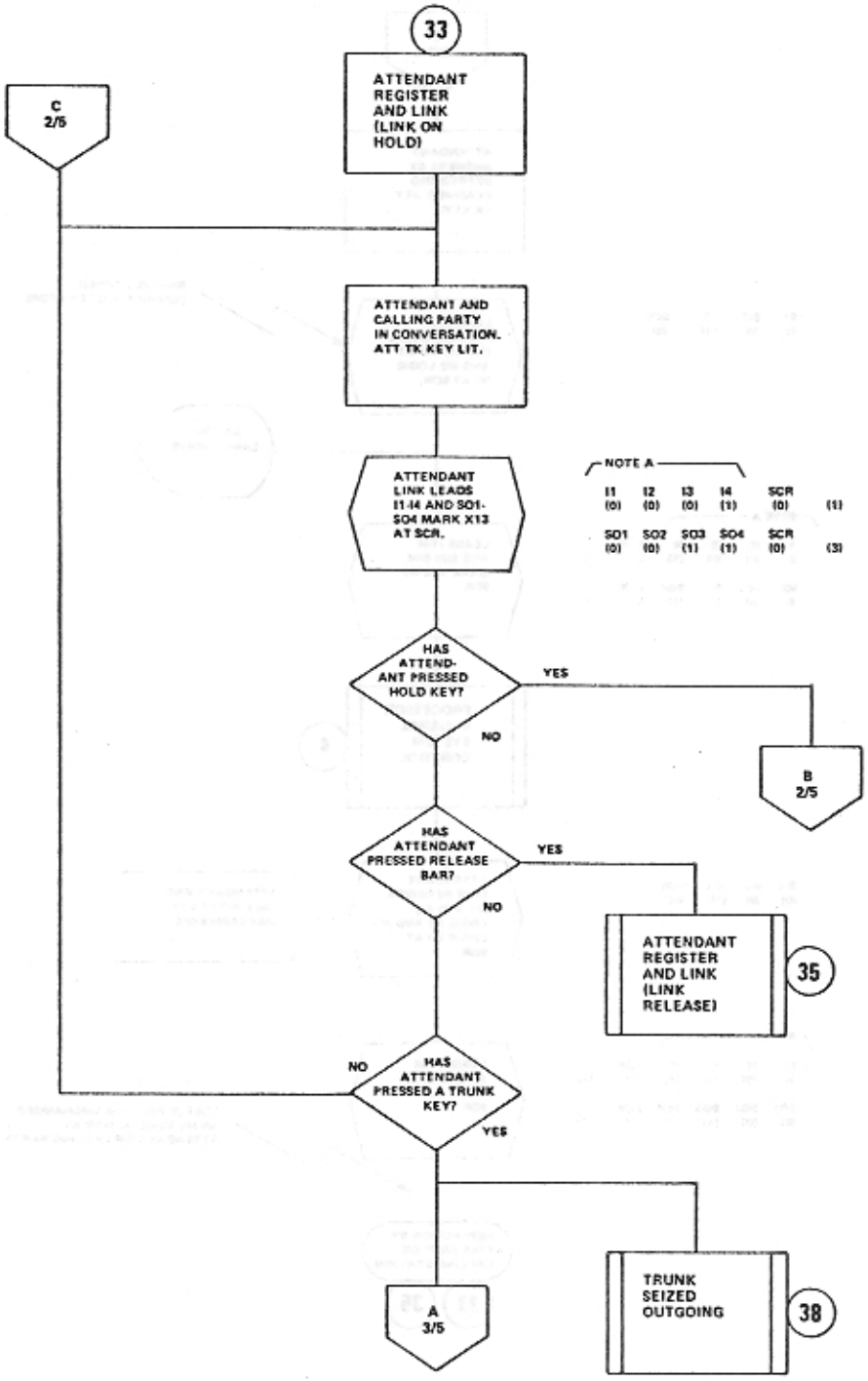
FIGURE A-1.31 Flow Chart 32, Attendant Register and Link (Link Seized) (Sheet 2 of 3)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 13.

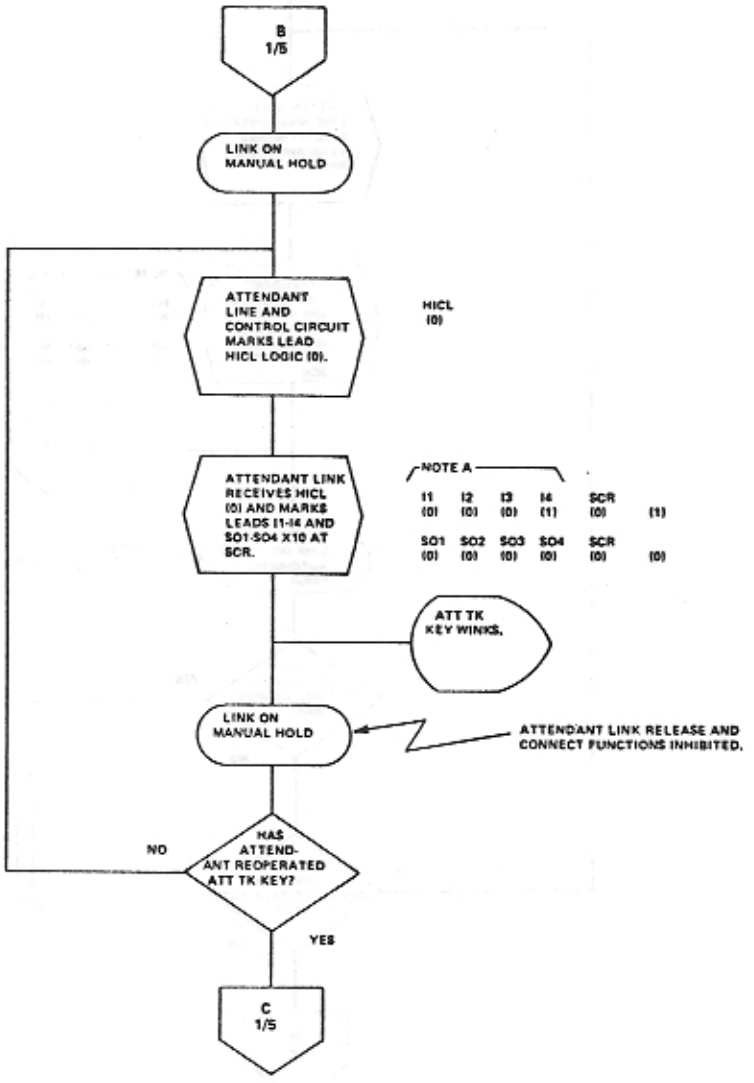
FIGURE A-1.31 Flow Chart 32, Attendant Register and Link (Link Seized) (Sheet 3 of 3)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 13.

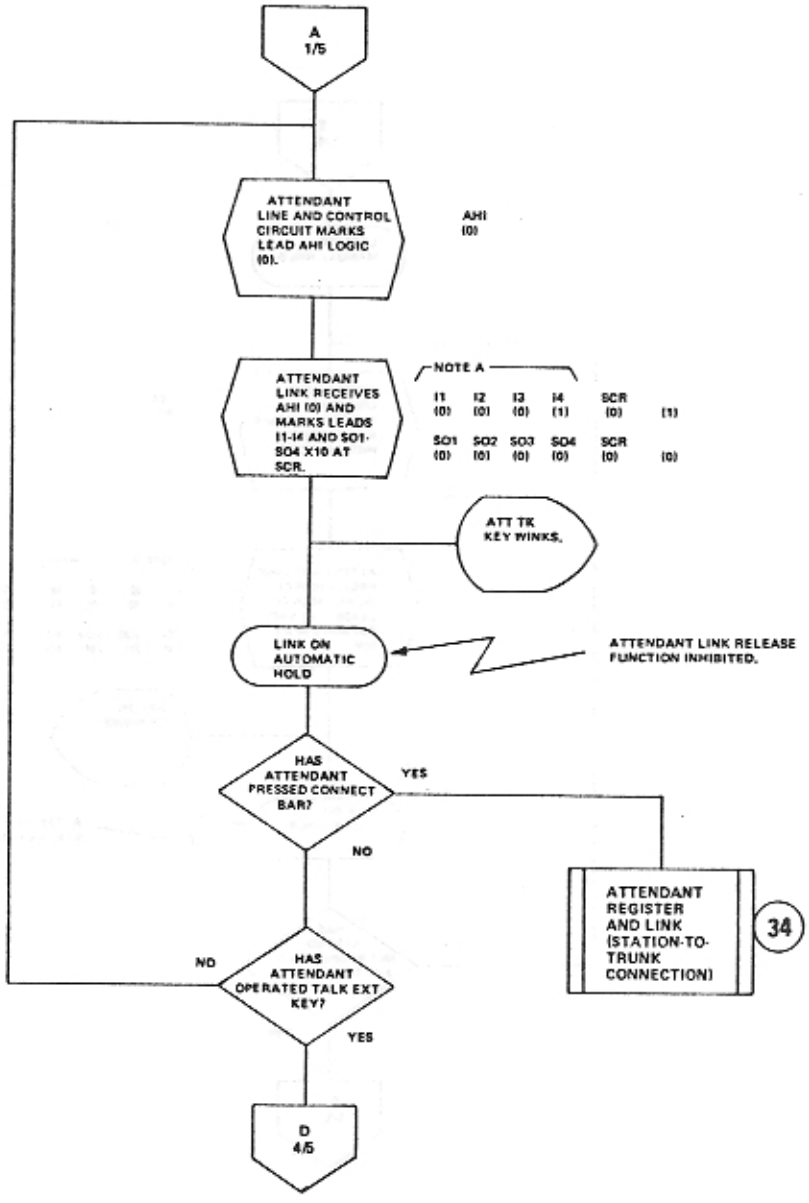
FIGURE A-1.32 Flow Chart 33, Attendant Register and Link (Link on Hold) (Sheet 1 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 10.

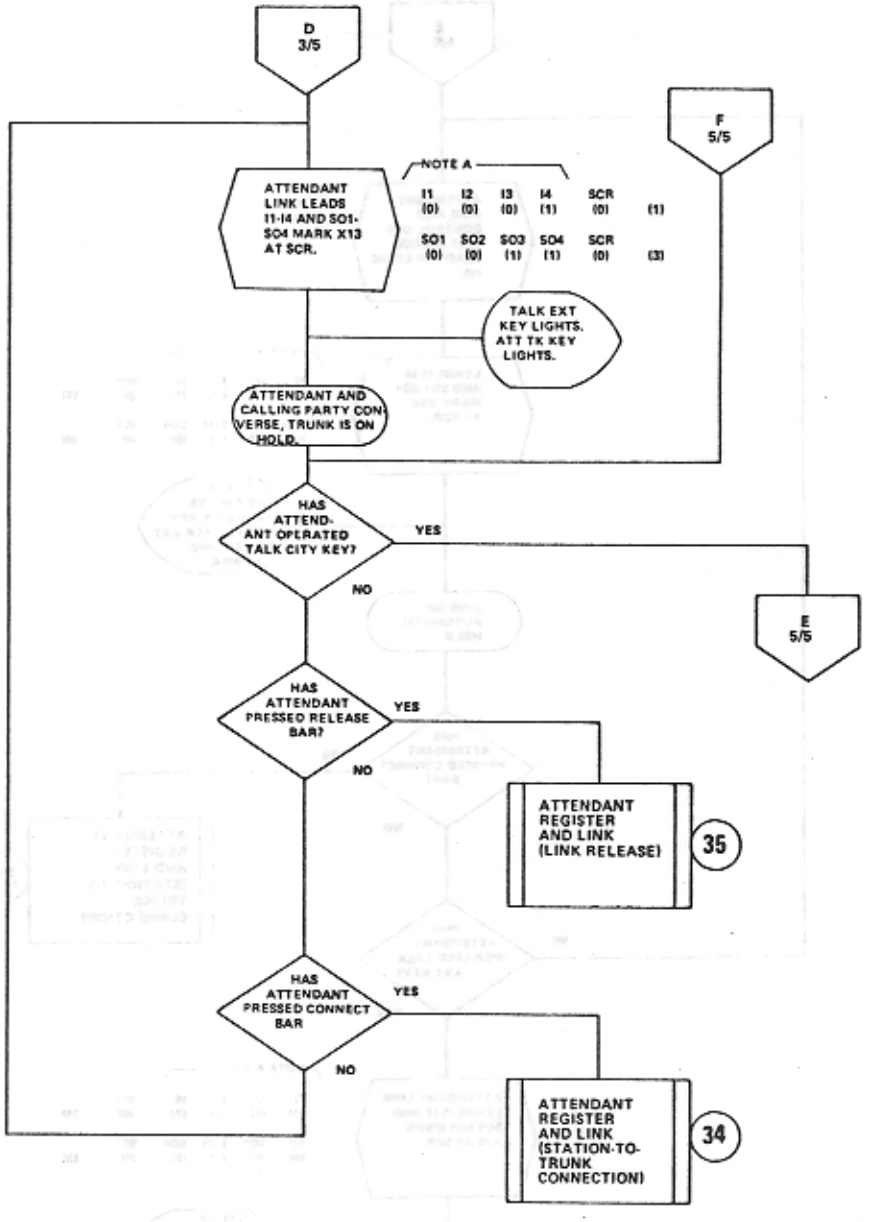
FIGURE A-1.32 Flow Chart 33, Attendant Register and Link (Link on Hold) (Sheet 2 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 10.

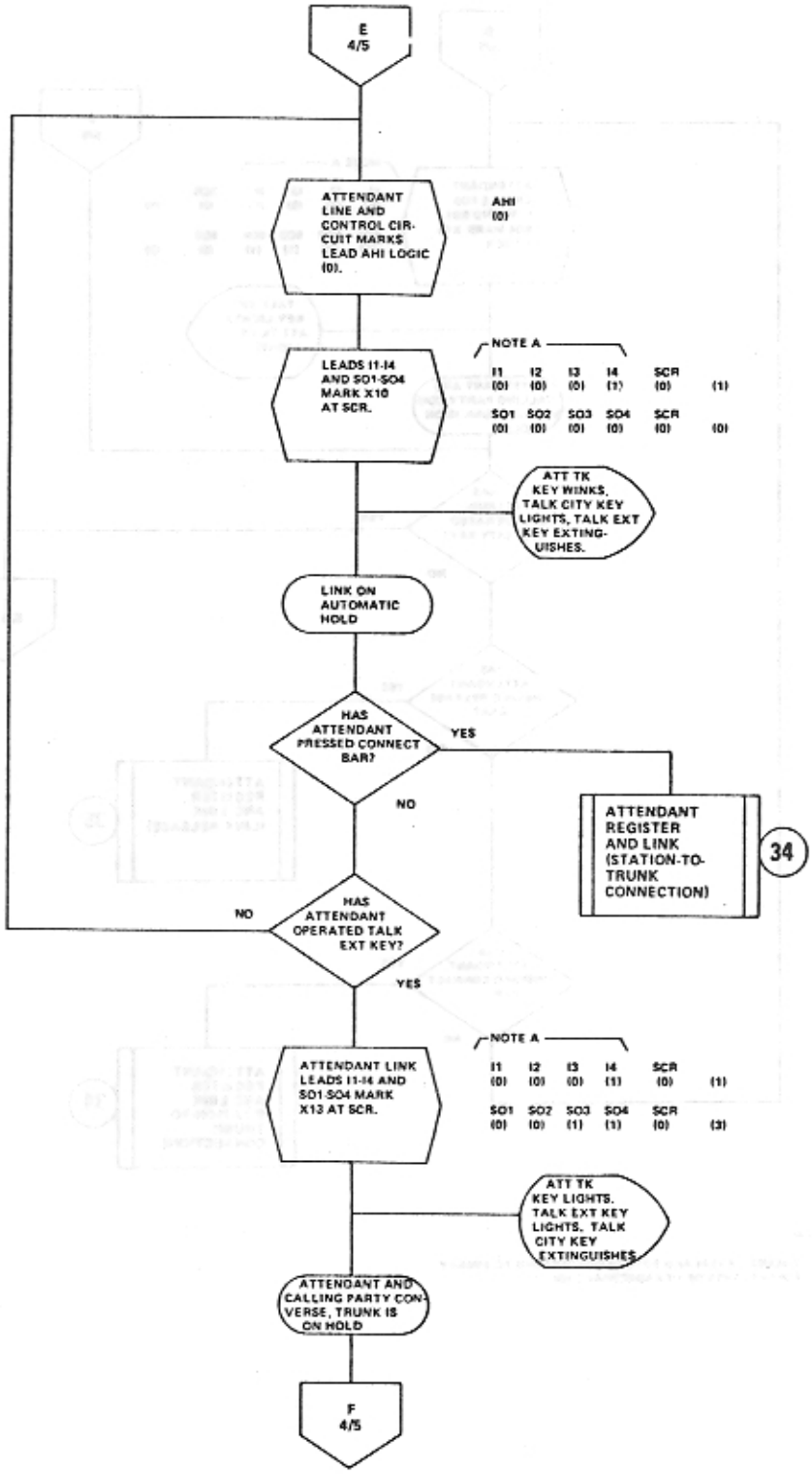
FIGURE A-1.32 Flow Chart 33, Attendant Register and Link (Link on Hold) (Sheet 3 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 13.

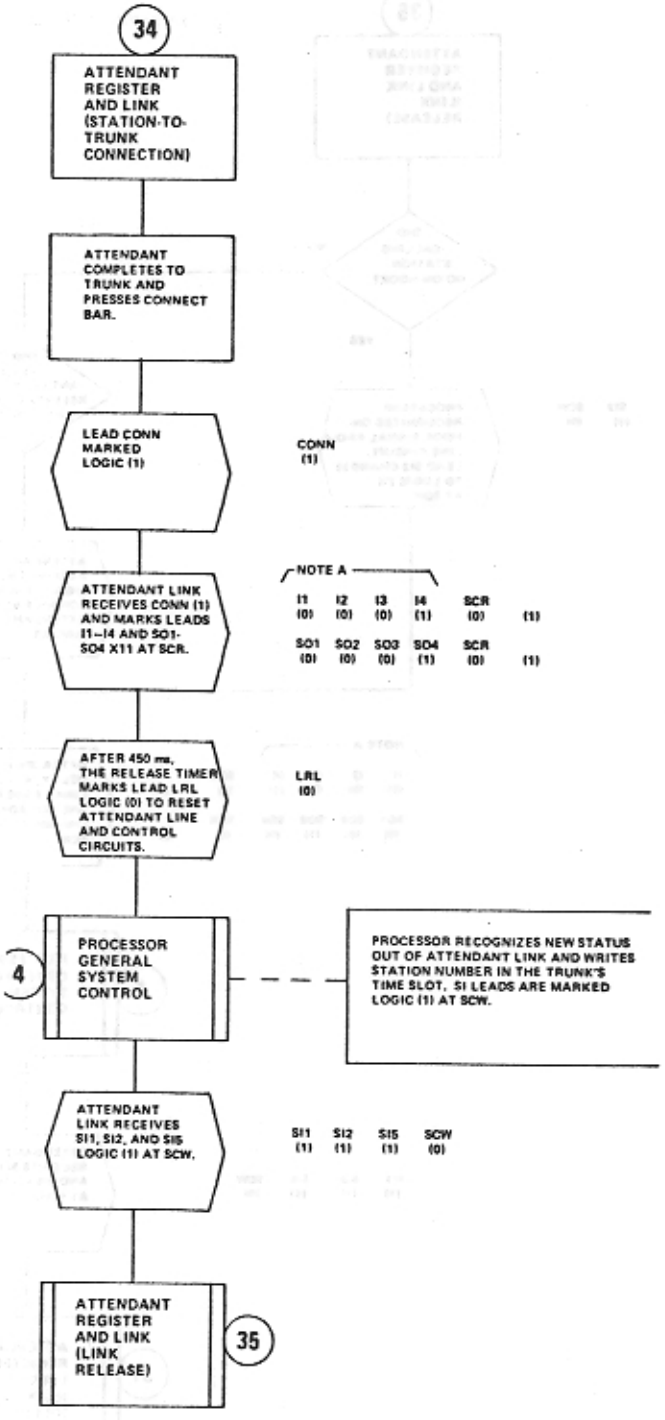
FIGURE A-1.32 Flow Chart 33, Attendant Register and Link (Link on Hold) (Sheet 4 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 10 AND 13.

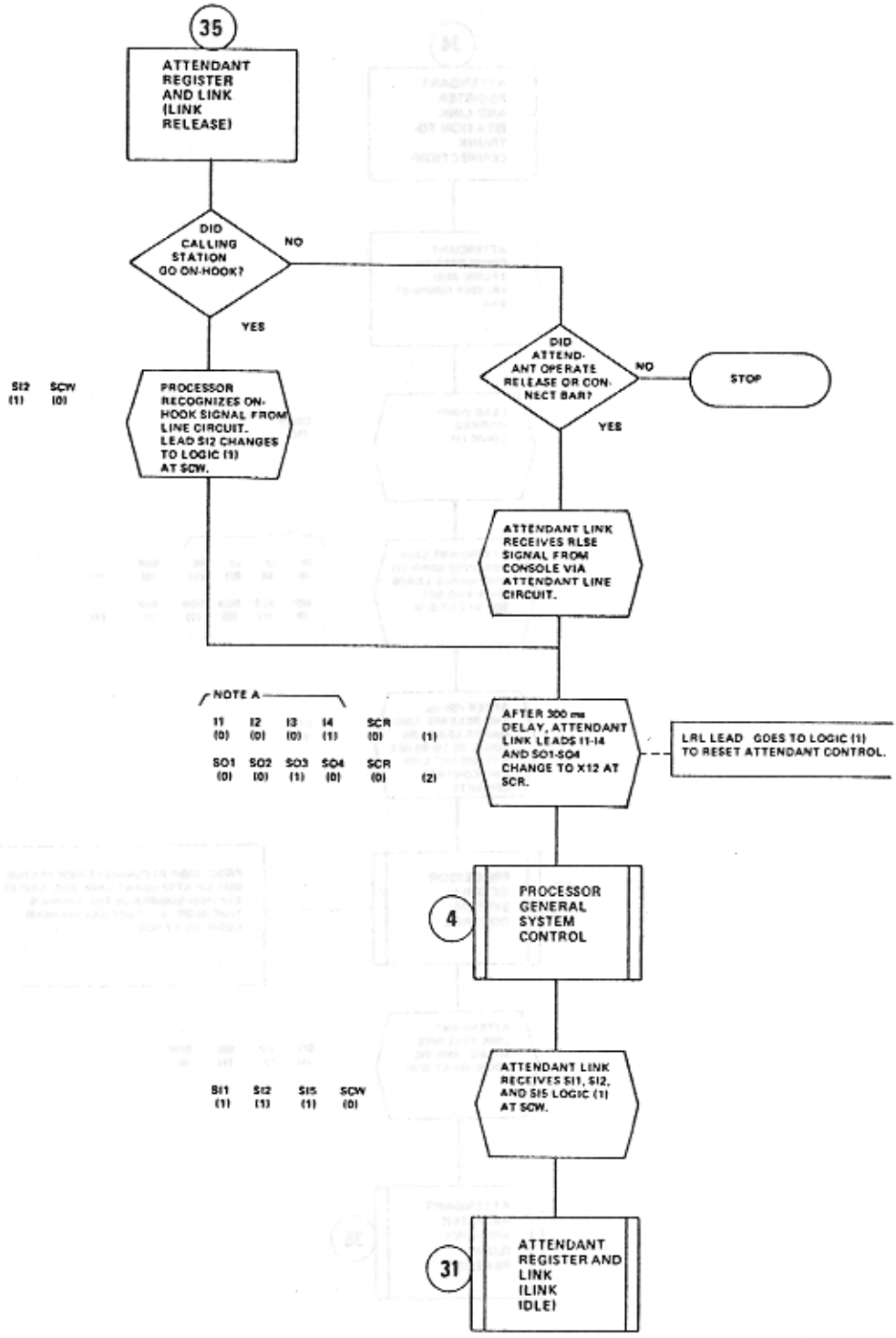
FIGURE A-1.32 Flow Chart 33, Attendant Register and Link (Link on Hold) (Sheet 5 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 11.

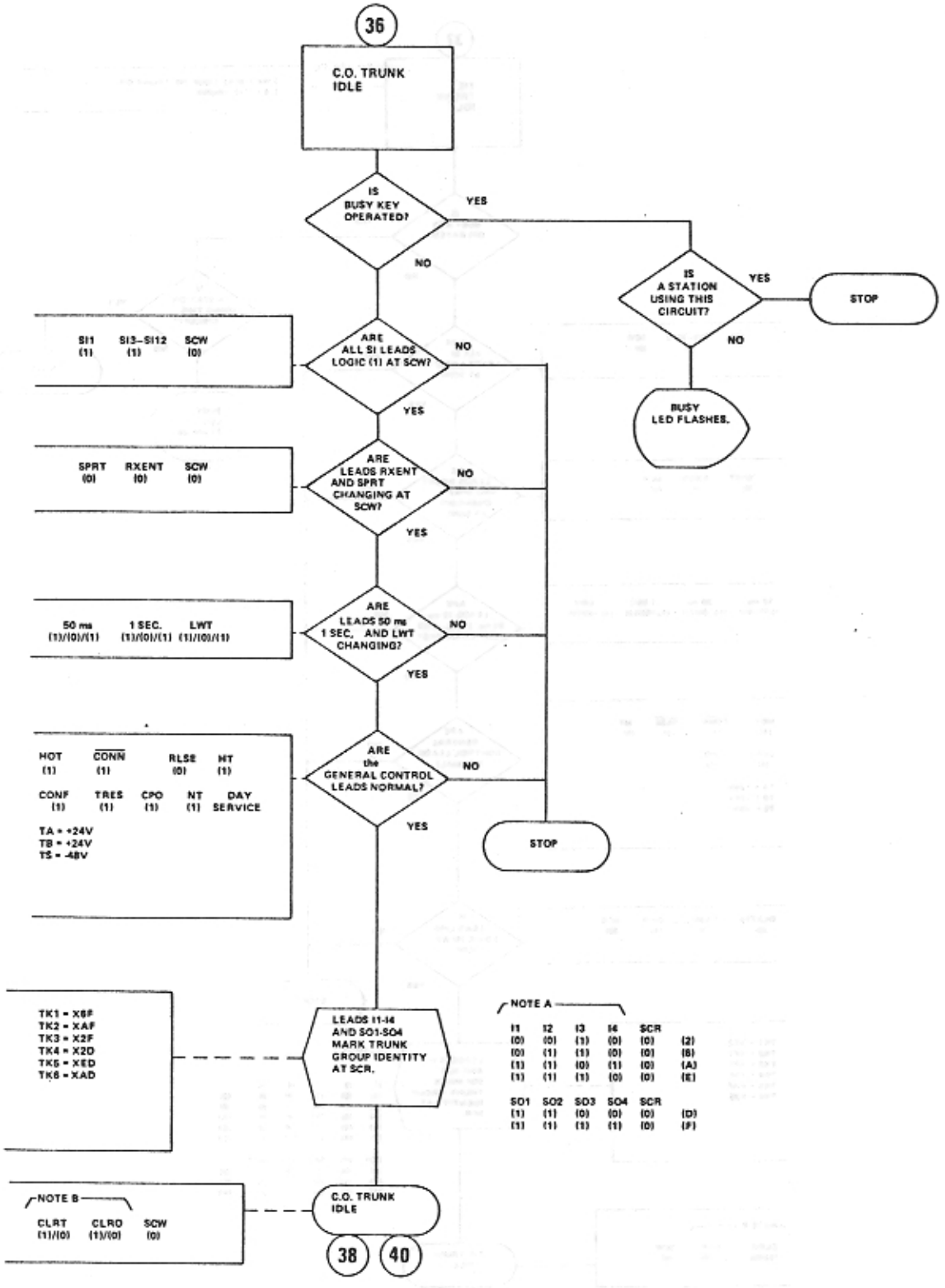
FIGURE A-1.33 Flow Chart 34, Attendant Register and Link (Station-to-Trunk Connection)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 12.

FIGURE A-1.34 Flow Chart 35, Attendant Register and Link (Link Release)

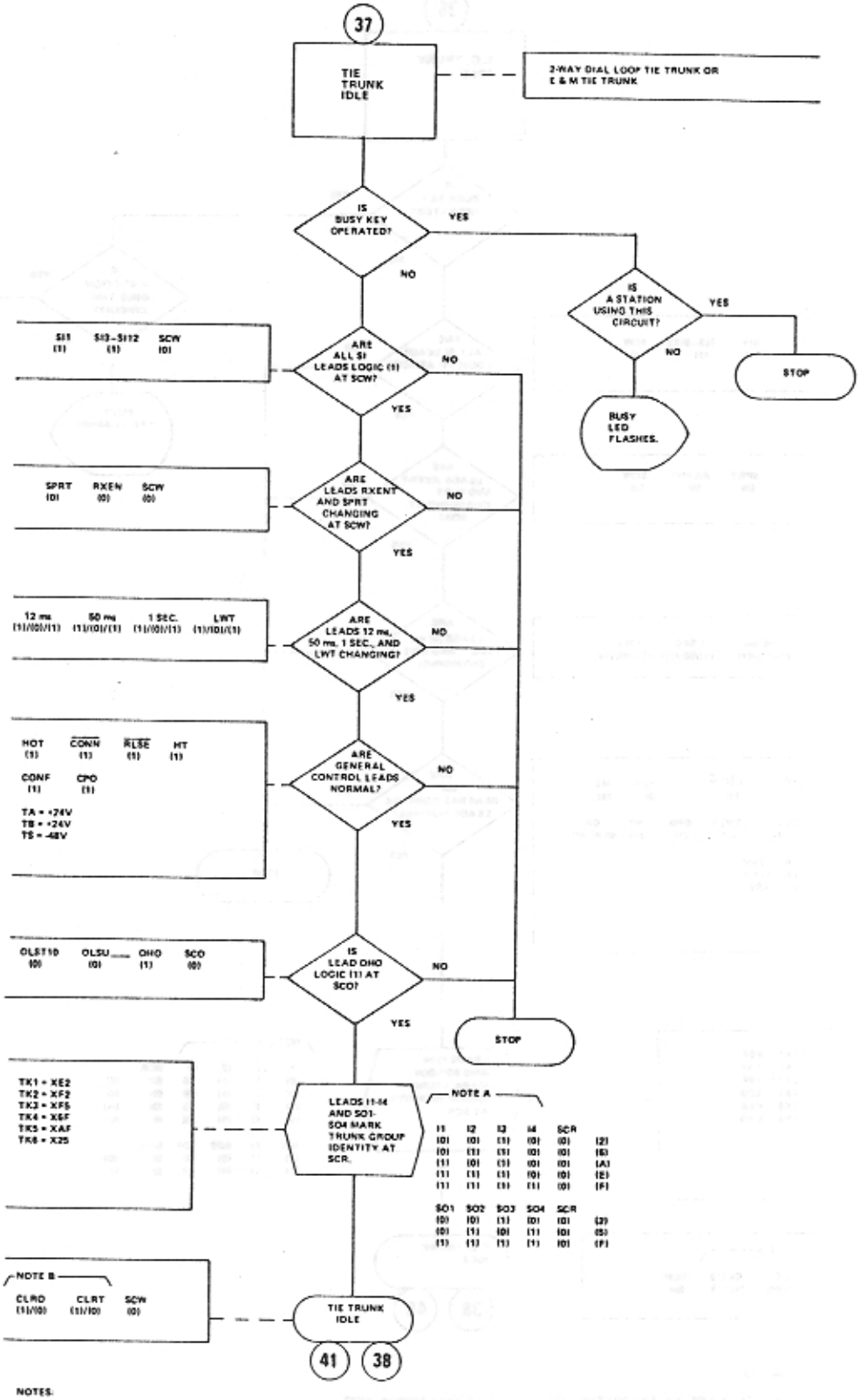


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS 6F, AF, 2, F, 2D, ED, AND AD.

B. LEADS NORMALLY CHANGING, (0)/(1), CHECK FOR CHANGE.

FIGURE A-1.35 Flow Chart 36, C.O. Trunk Idle

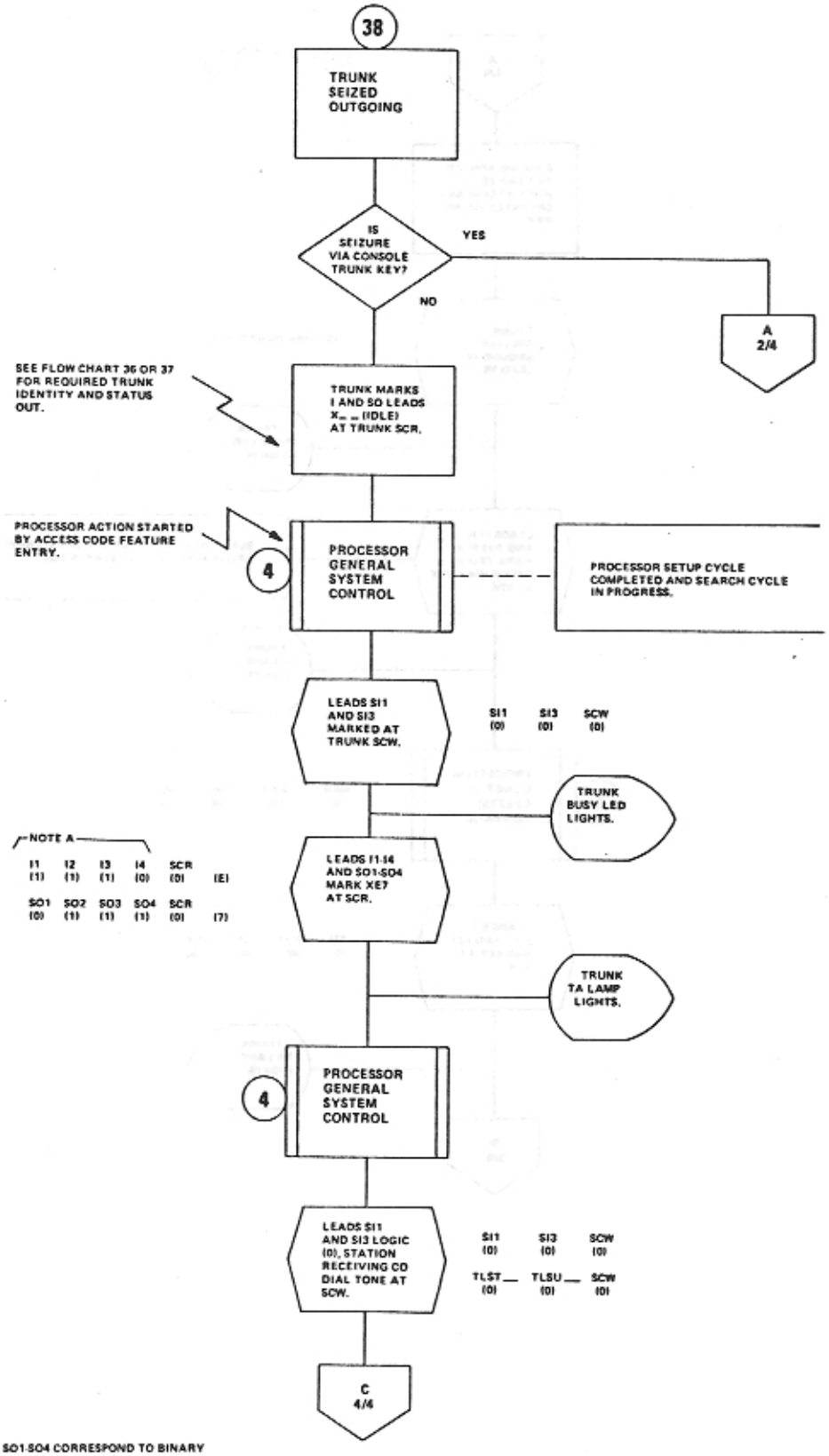


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E2, F2, F5, 6F, AF, AND 25.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR CHANGE.

FIGURE A-1.36 Flow Chart 37, Tie Trunk Idle



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

FIGURE A-1.37 Flow Chart 38, Trunk Seized Outgoing (Sheet 1 of 4)

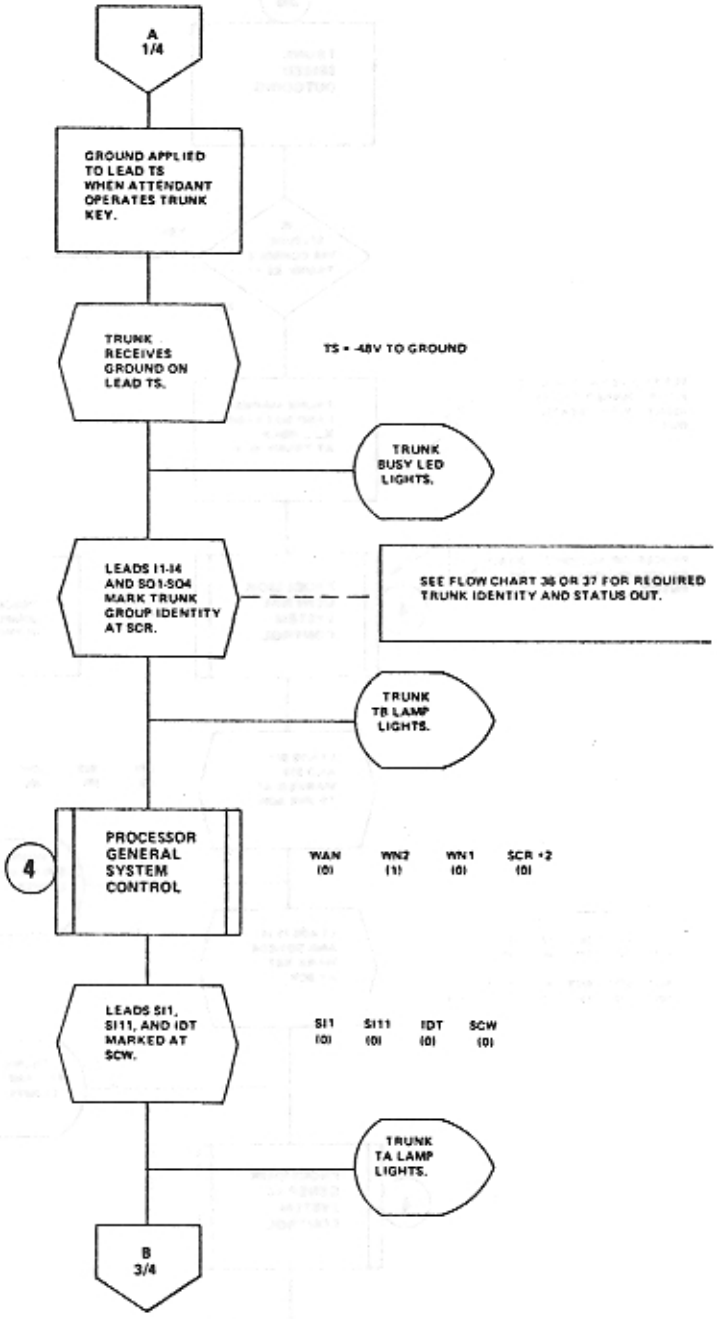
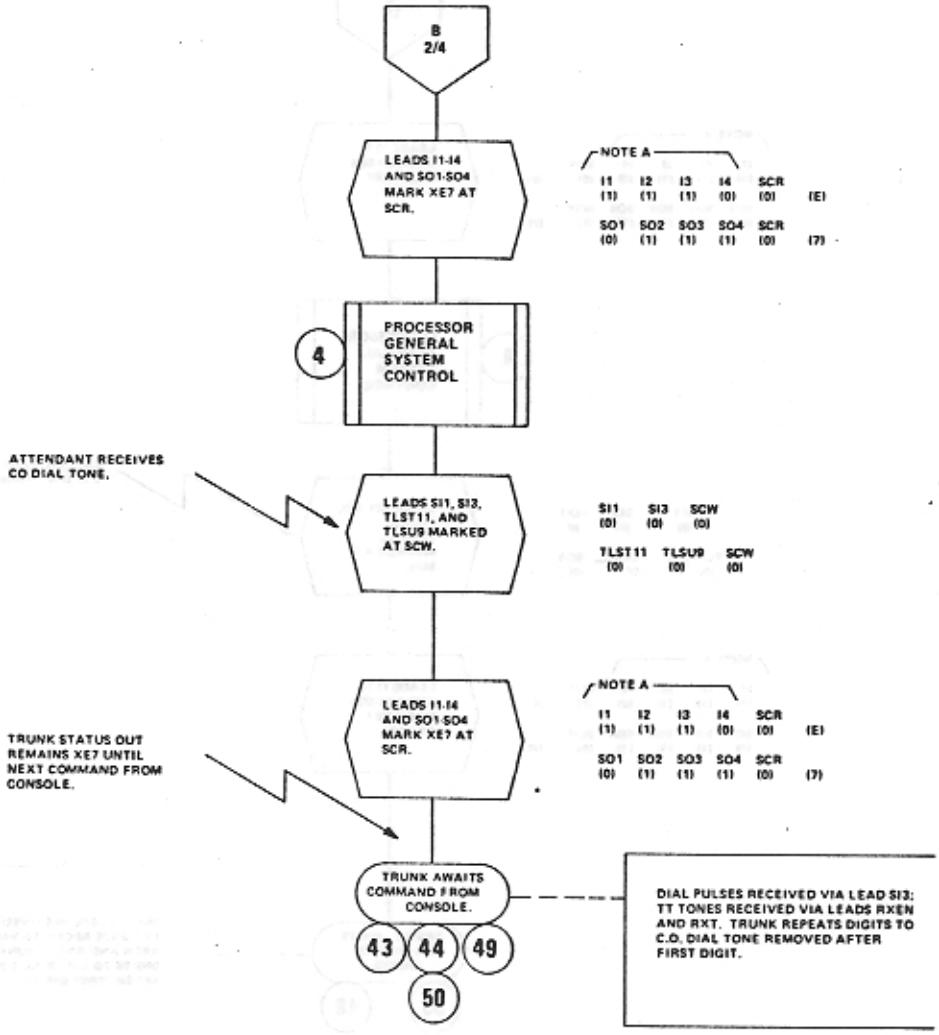


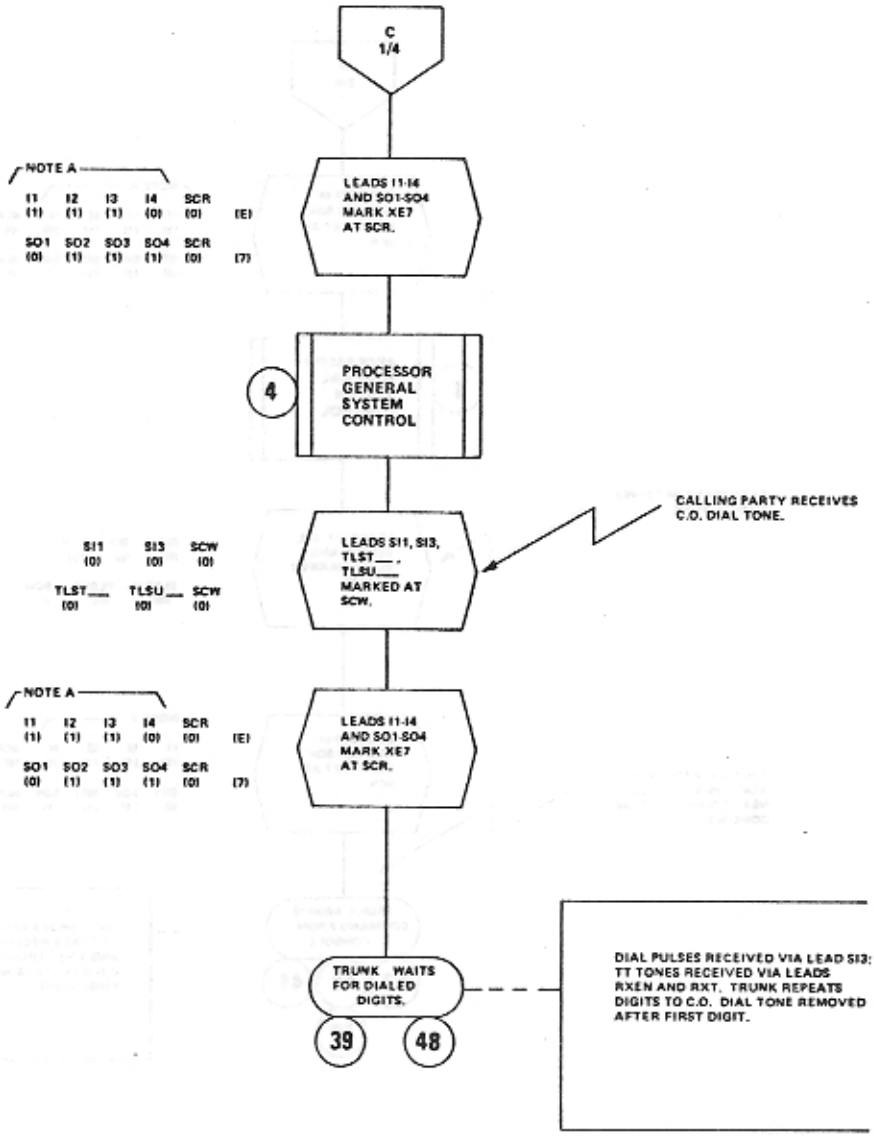
FIGURE A-1.37 Flow Chart 38, Trunk Seized Outgoing (Sheet 2 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

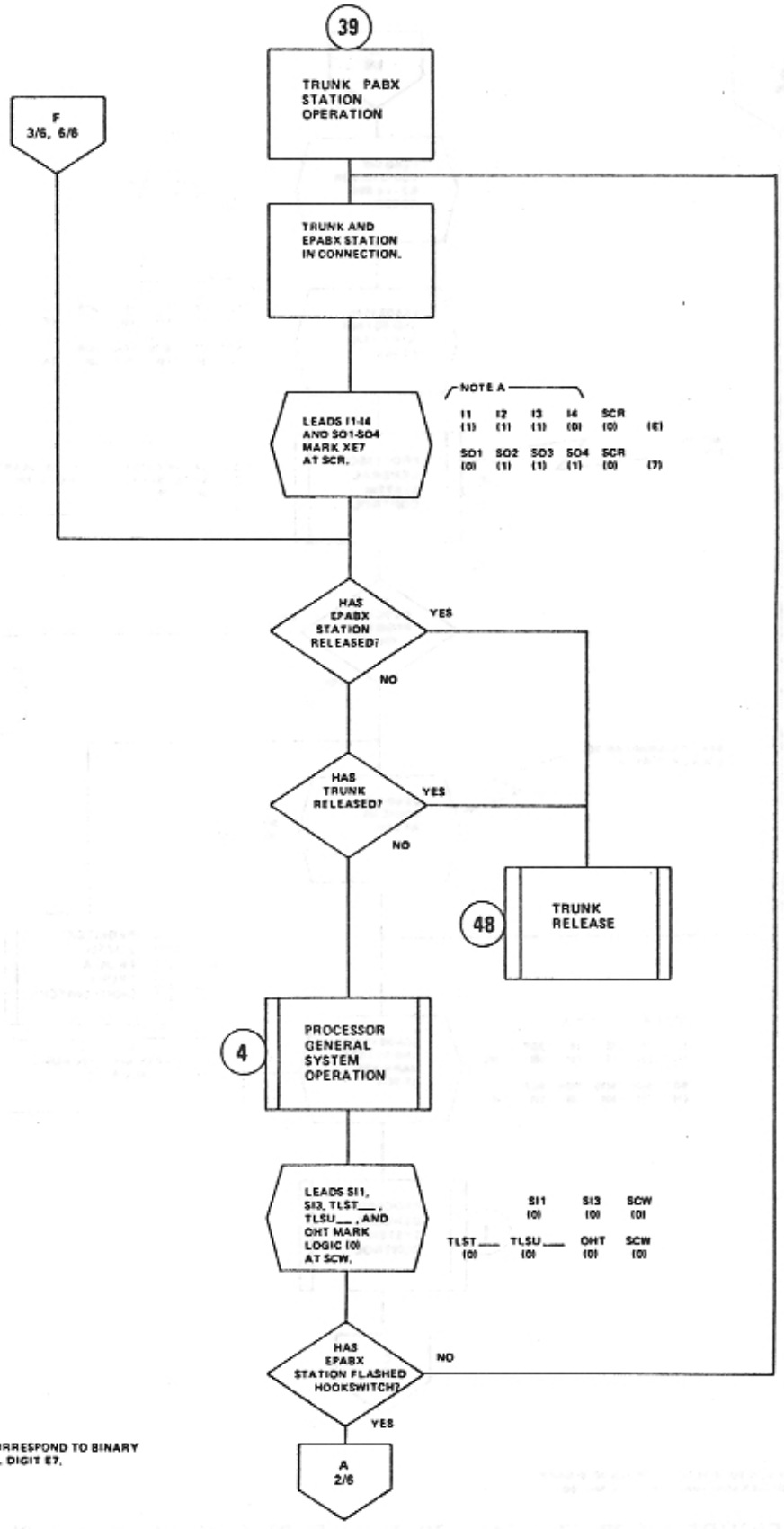
FIGURE A-1.37 Flow Chart 38, Trunk Seized Outgoing (Sheet 3 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

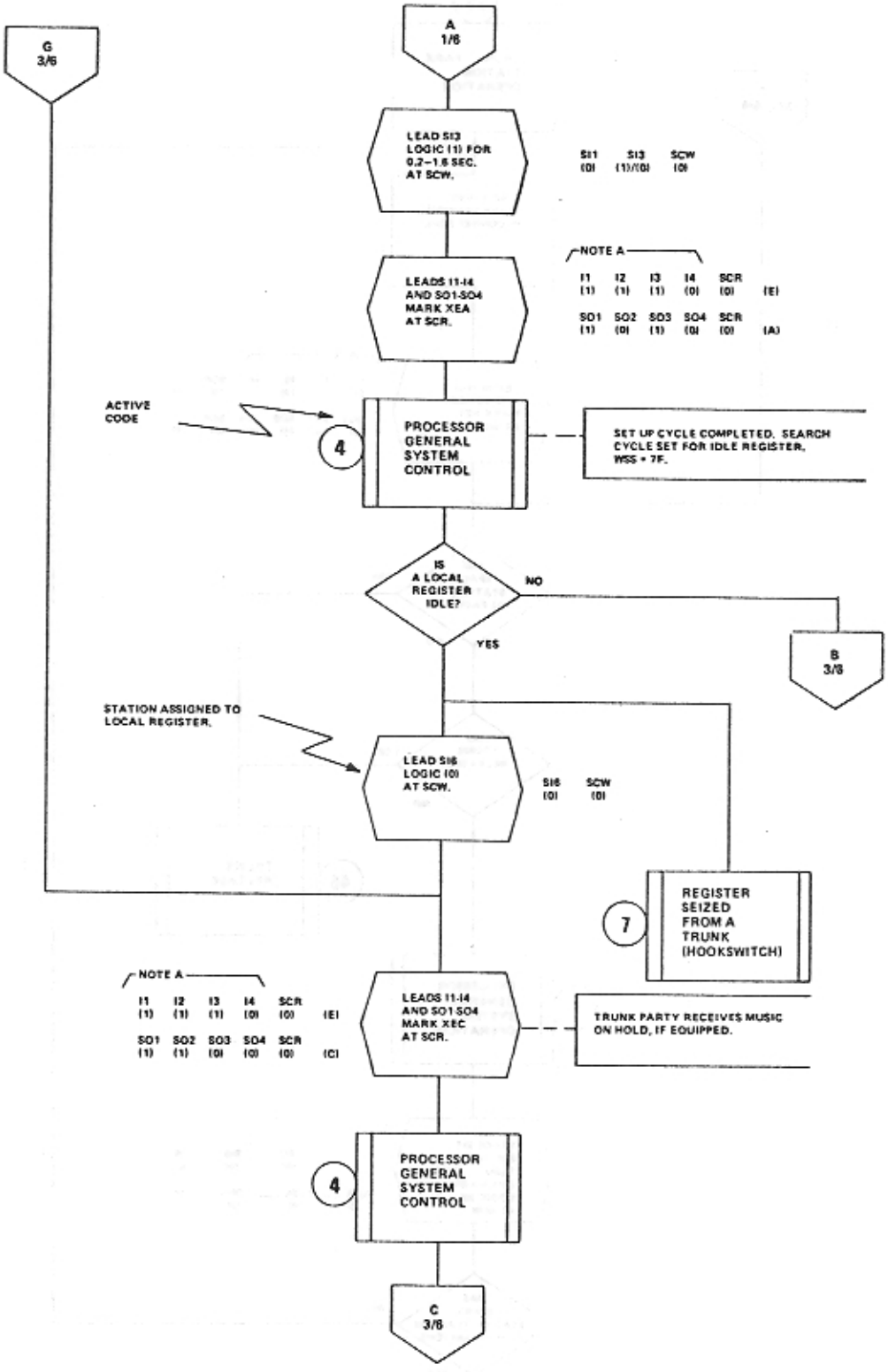
FIGURE A-1.37 Flow Chart 38, Trunk Seized Outgoing (Sheet 4 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

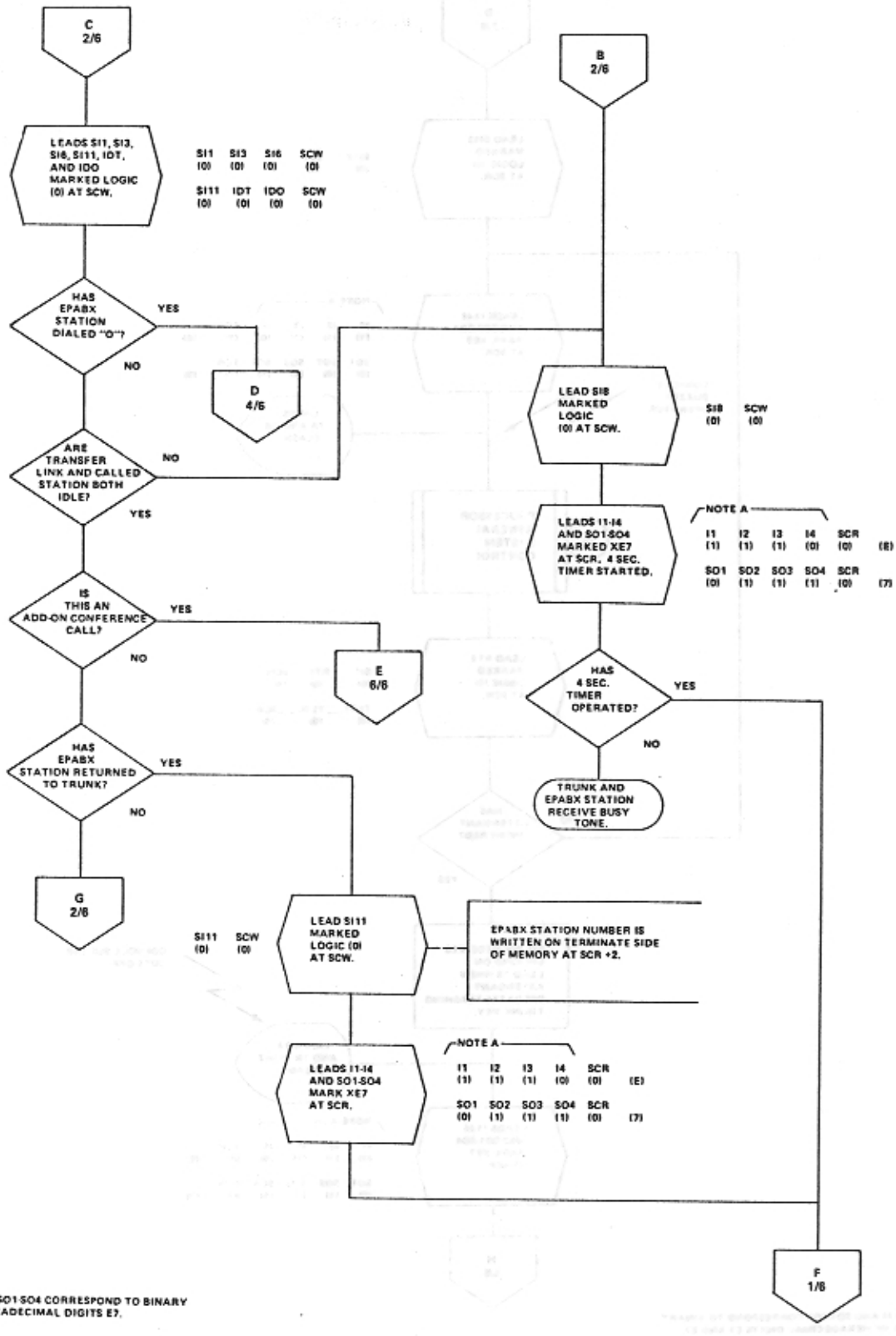
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 1 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS EA AND EC.

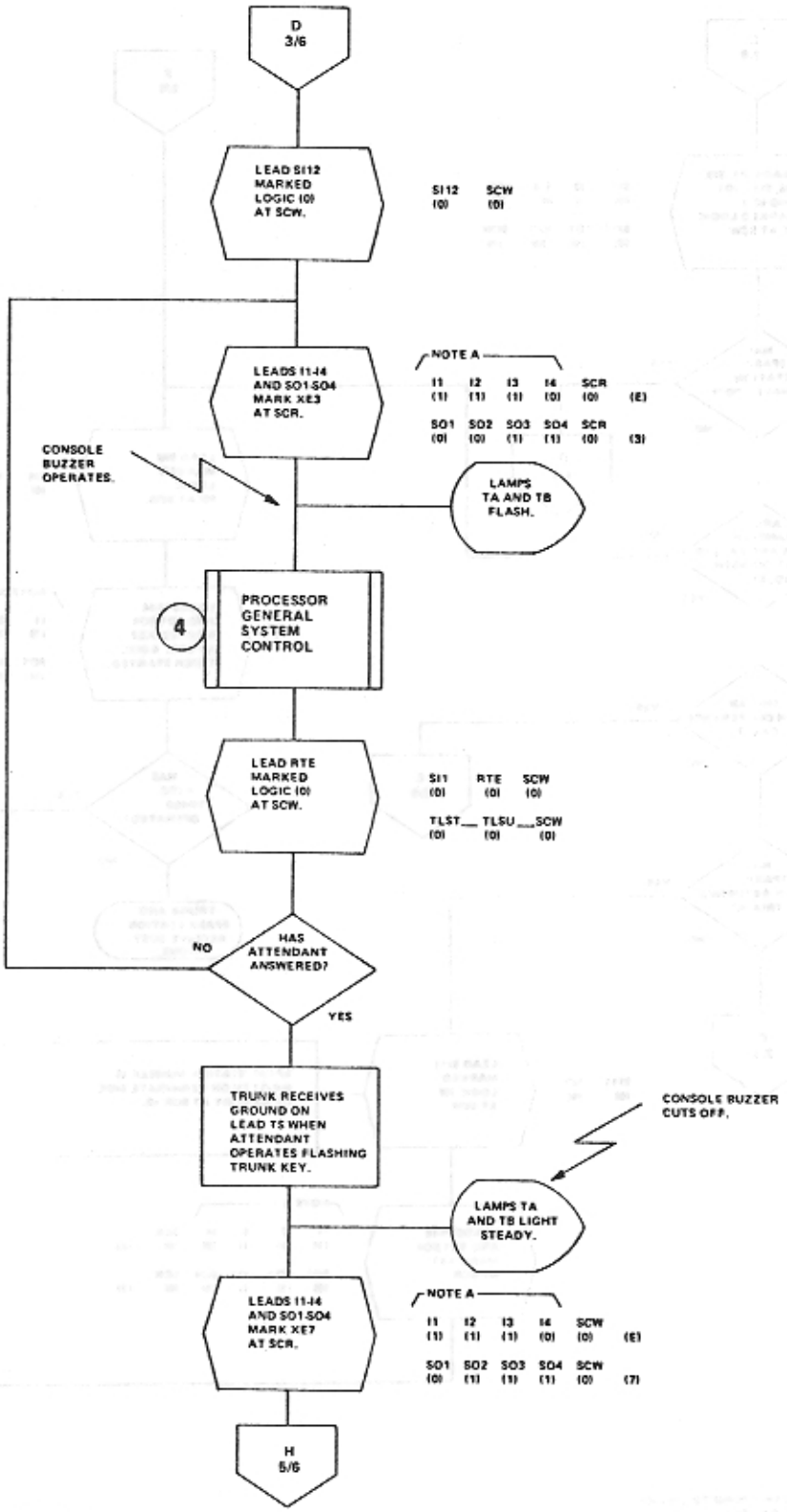
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 2 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E7.

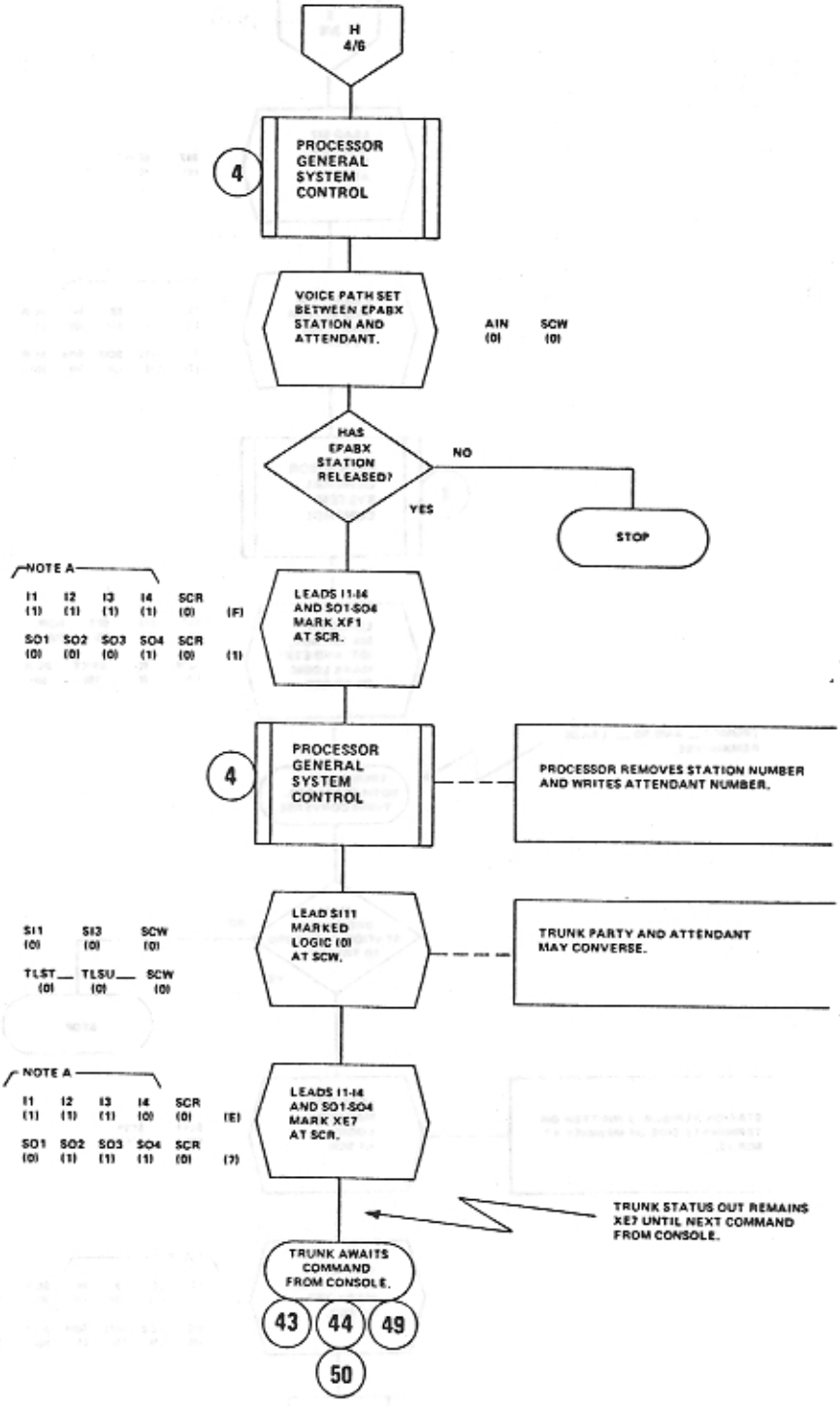
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 3 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E3 AND E7.

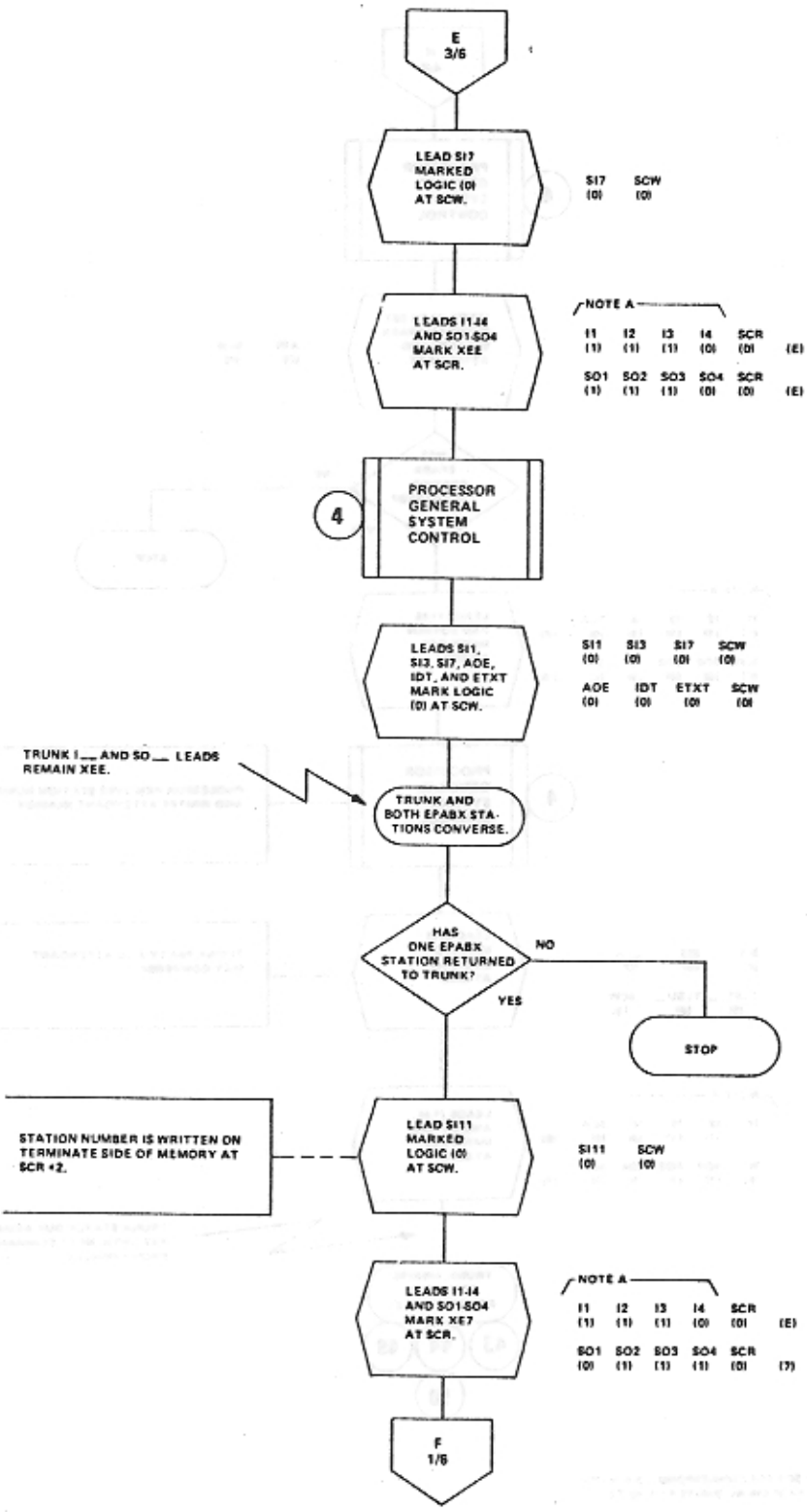
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 4 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS F1 AND E7.

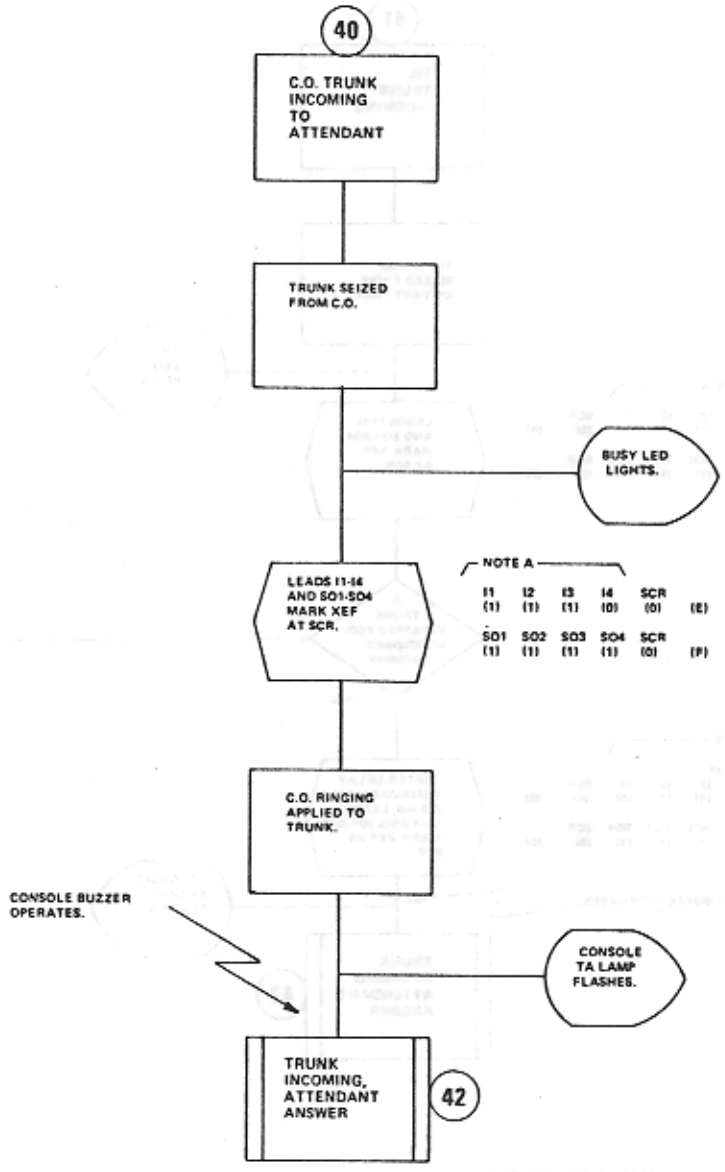
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 5 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS EE AND E7.

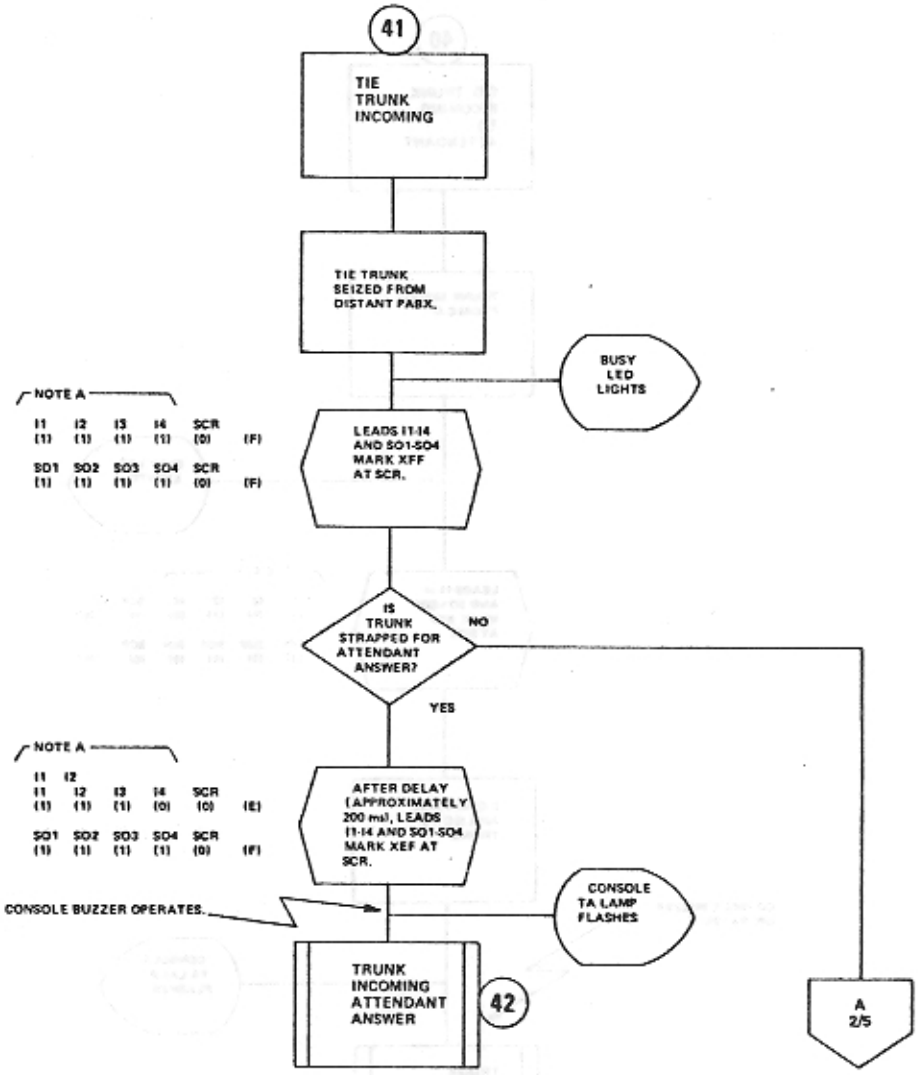
FIGURE A-1.38 Flow Chart 39, Trunk PABX Station Operation (Sheet 6 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT EF.

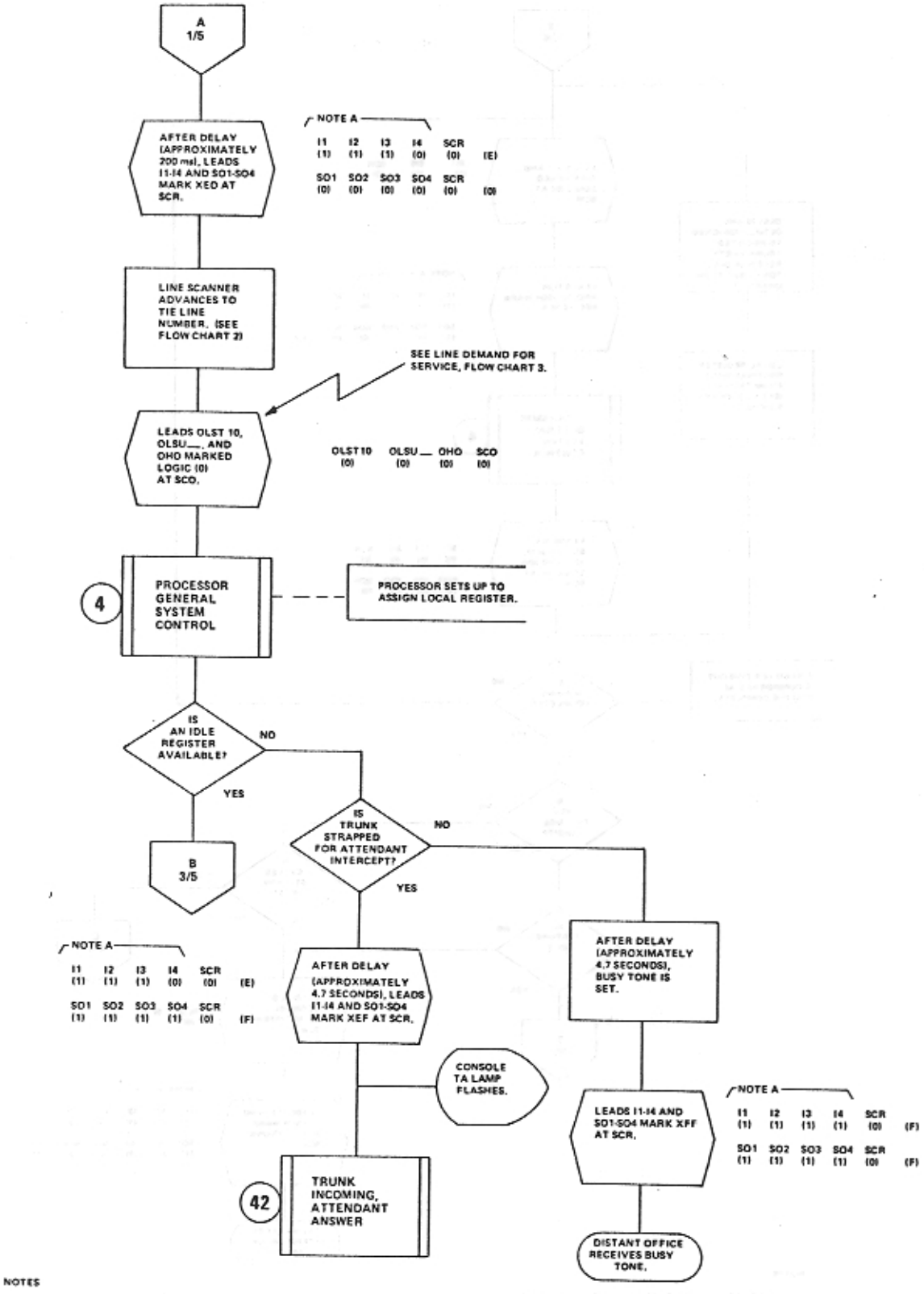
FIGURE A-1.39 Flow Chart 40, C.O. Trunk Incoming to Attendant



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS FF AND EF.

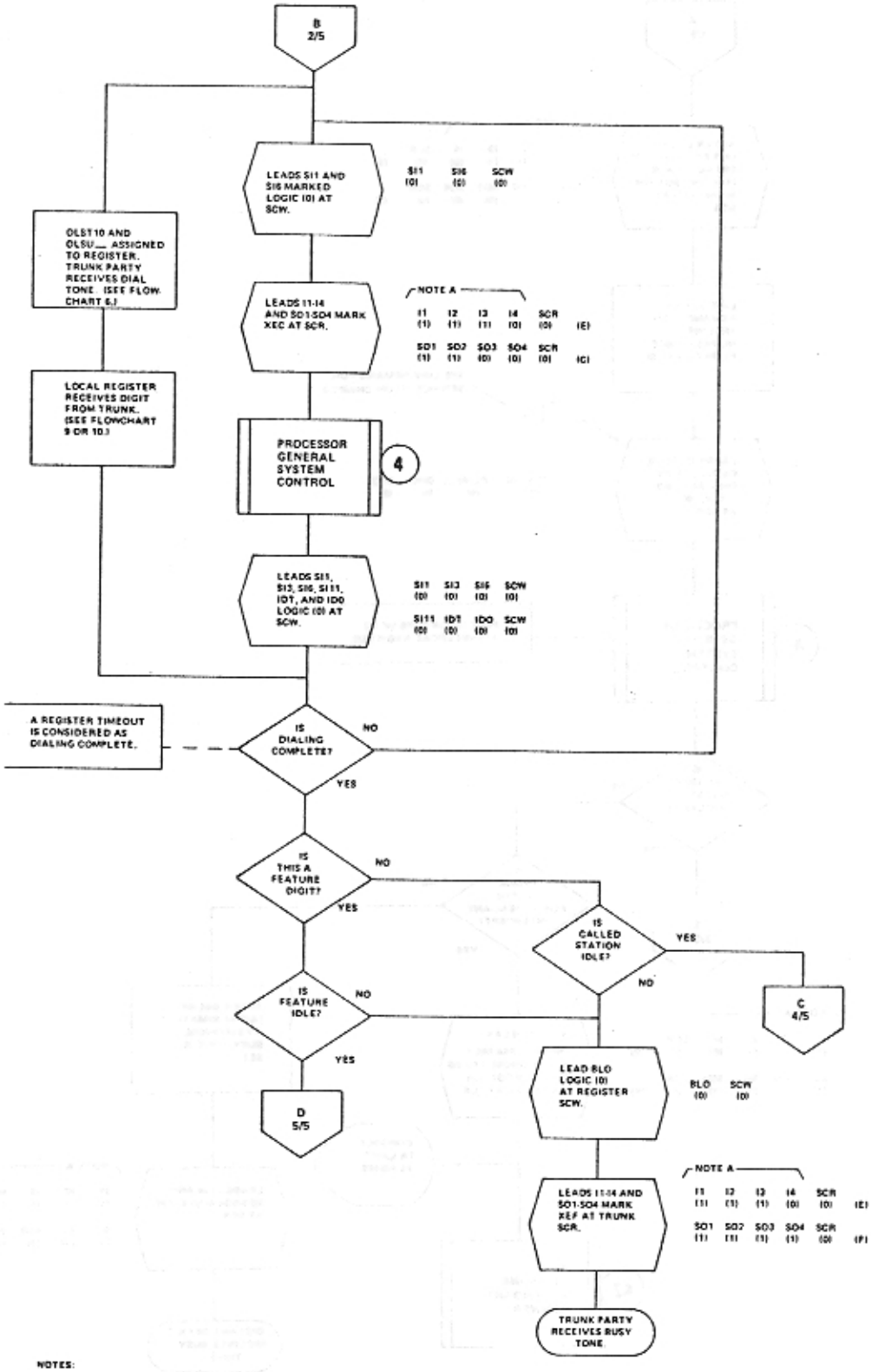
FIGURE A-1.40 Flow Chart 41, Tie Trunk Incoming (Sheet 1 of 5)



NOTES

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E0, EF, AND FF.

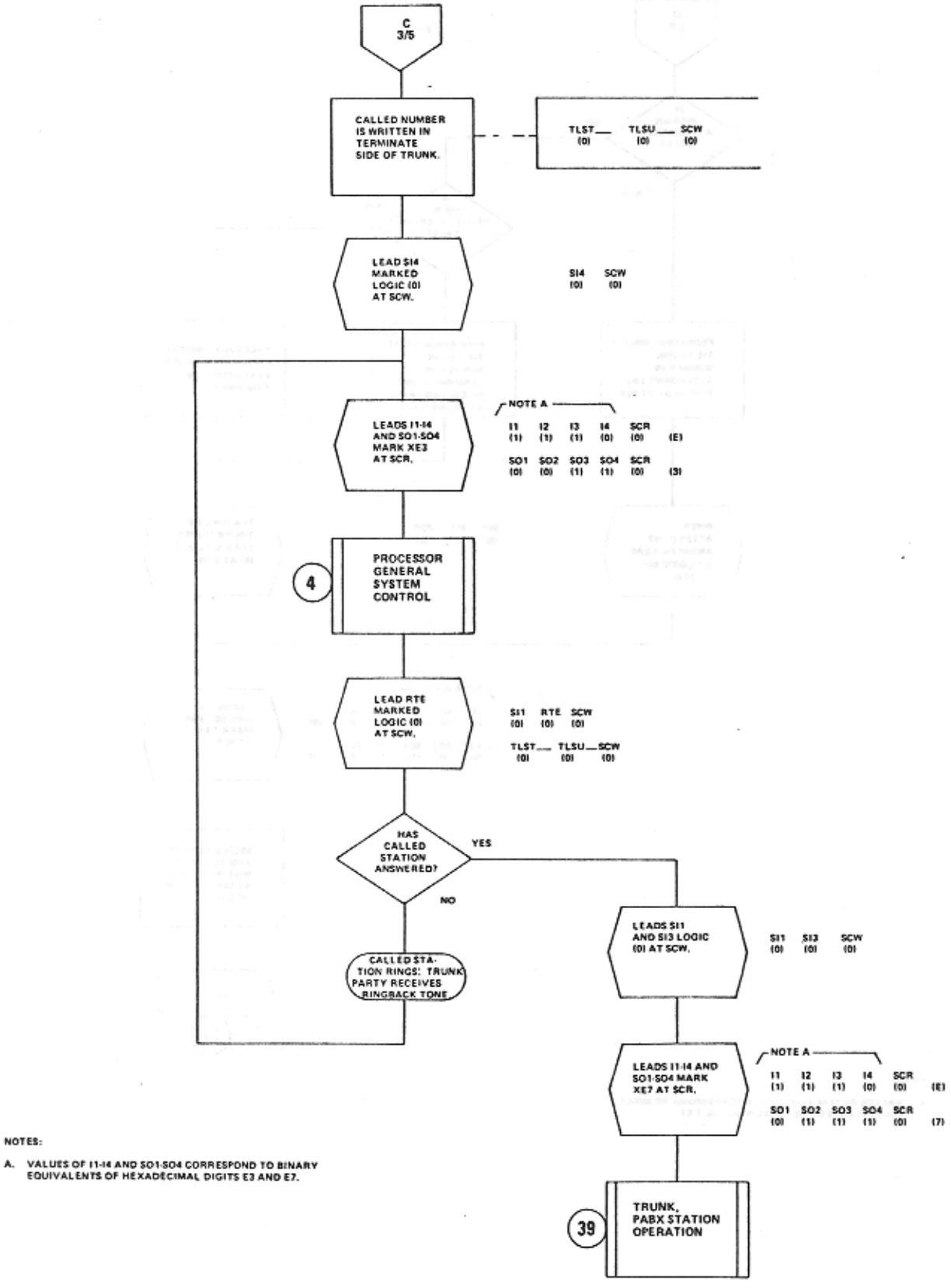
FIGURE A-1.40 Flow Chart 41, Tie Trunk Incoming (Sheet 2 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS EC AND EF.

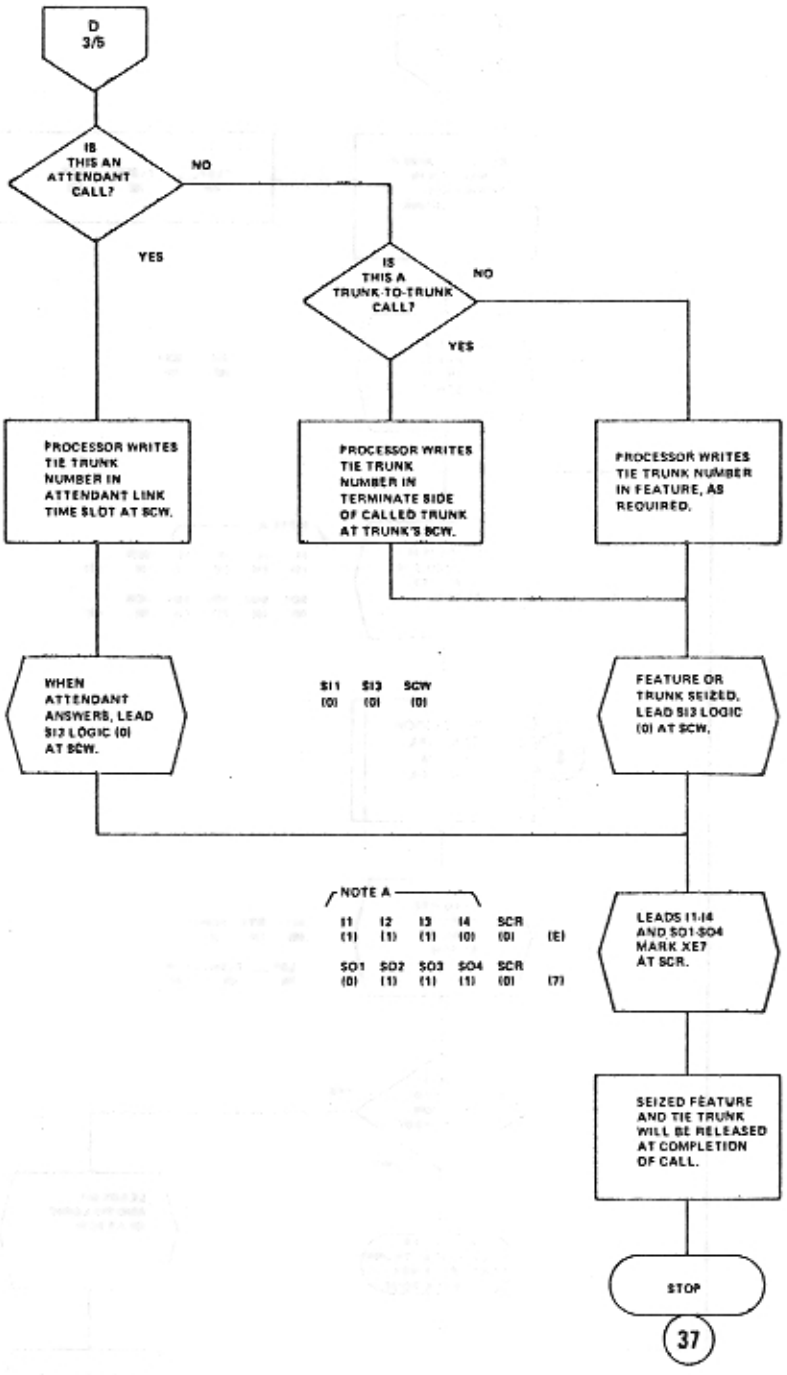
FIGURE A-1.40 Flow Chart 41, Tie Trunk Incoming (Sheet 3 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E3 AND E7.

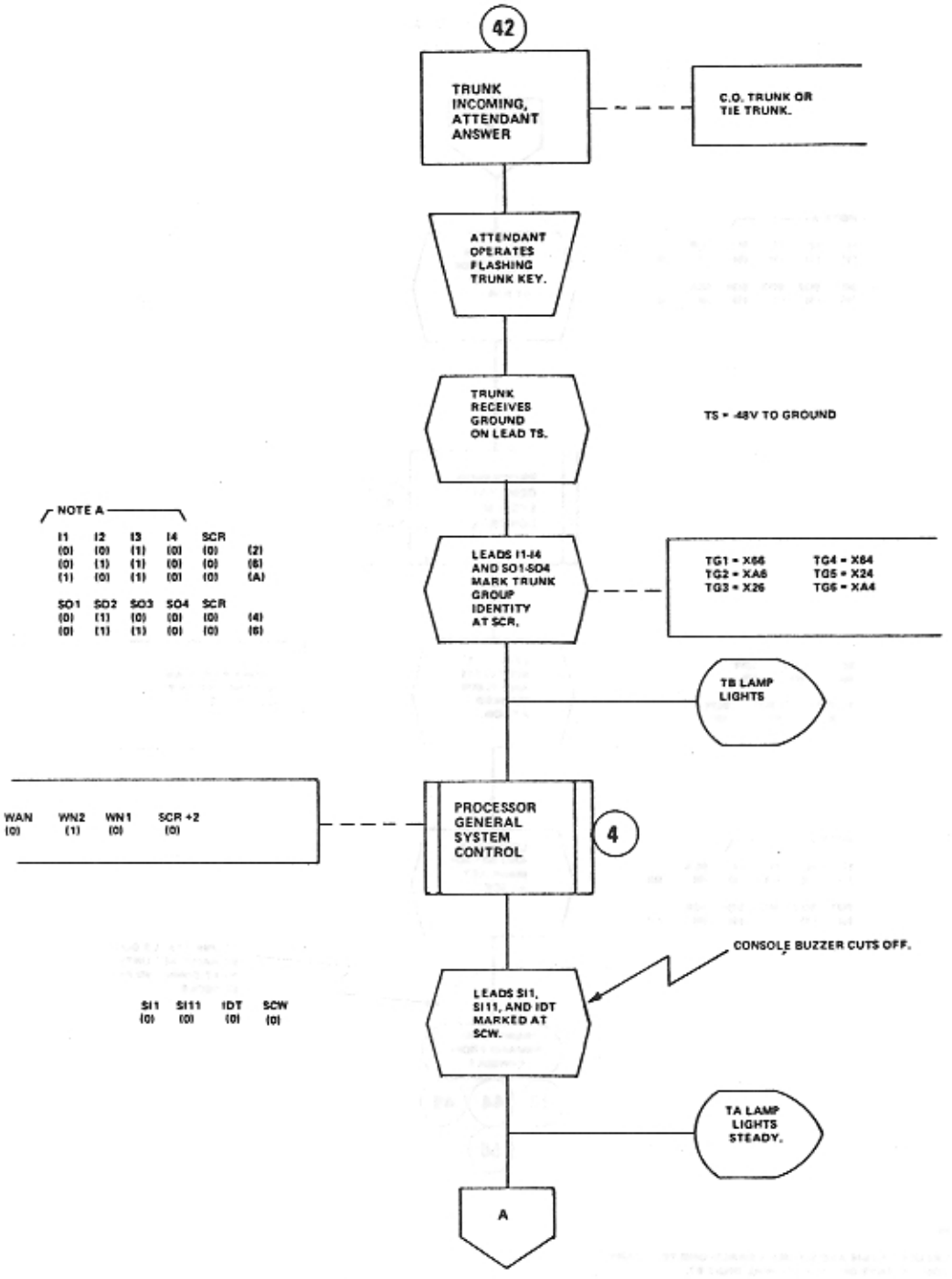
FIGURE A-1.40 Flow Chart 41, Tie Trunk Incoming (Sheet 4 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

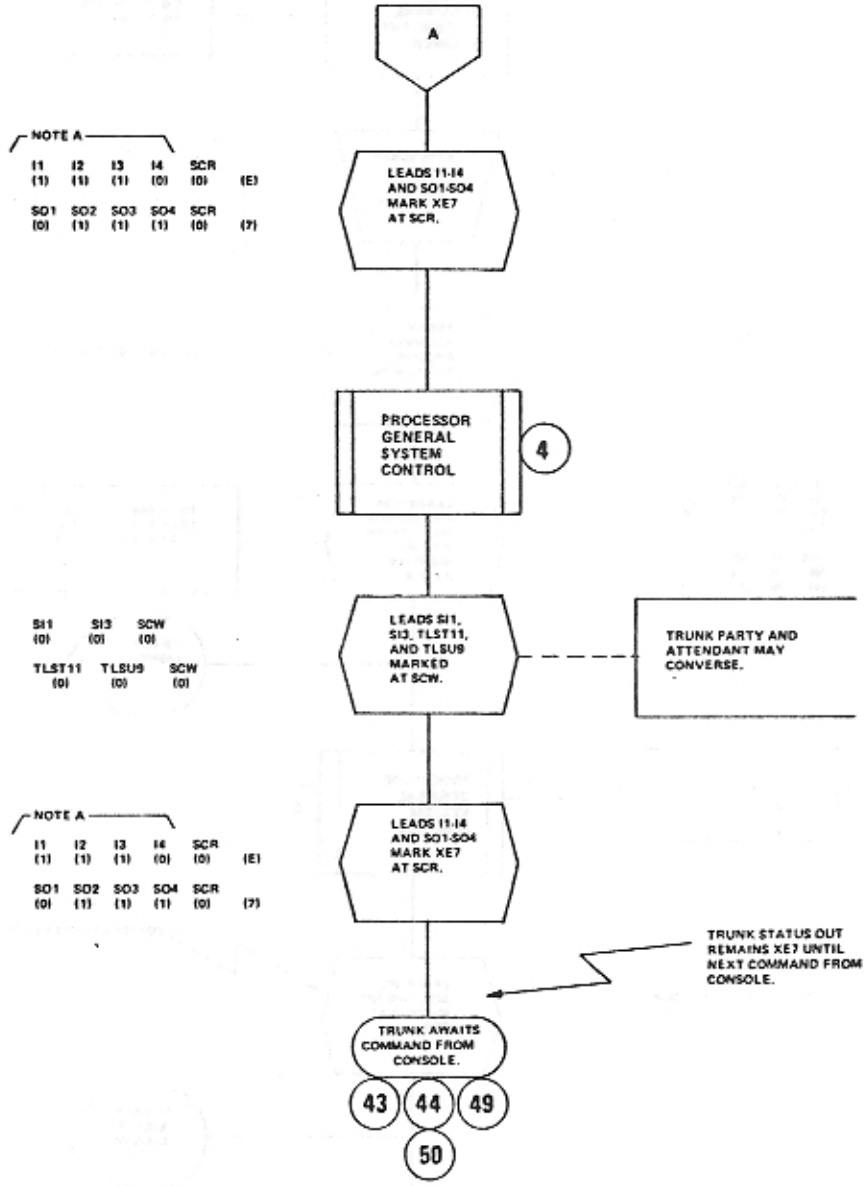
FIGURE A-1.40 Flow Chart 41, Tie Trunk Incoming (Sheet 5 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS 66, A6, 26, 64, 24, AND A4.

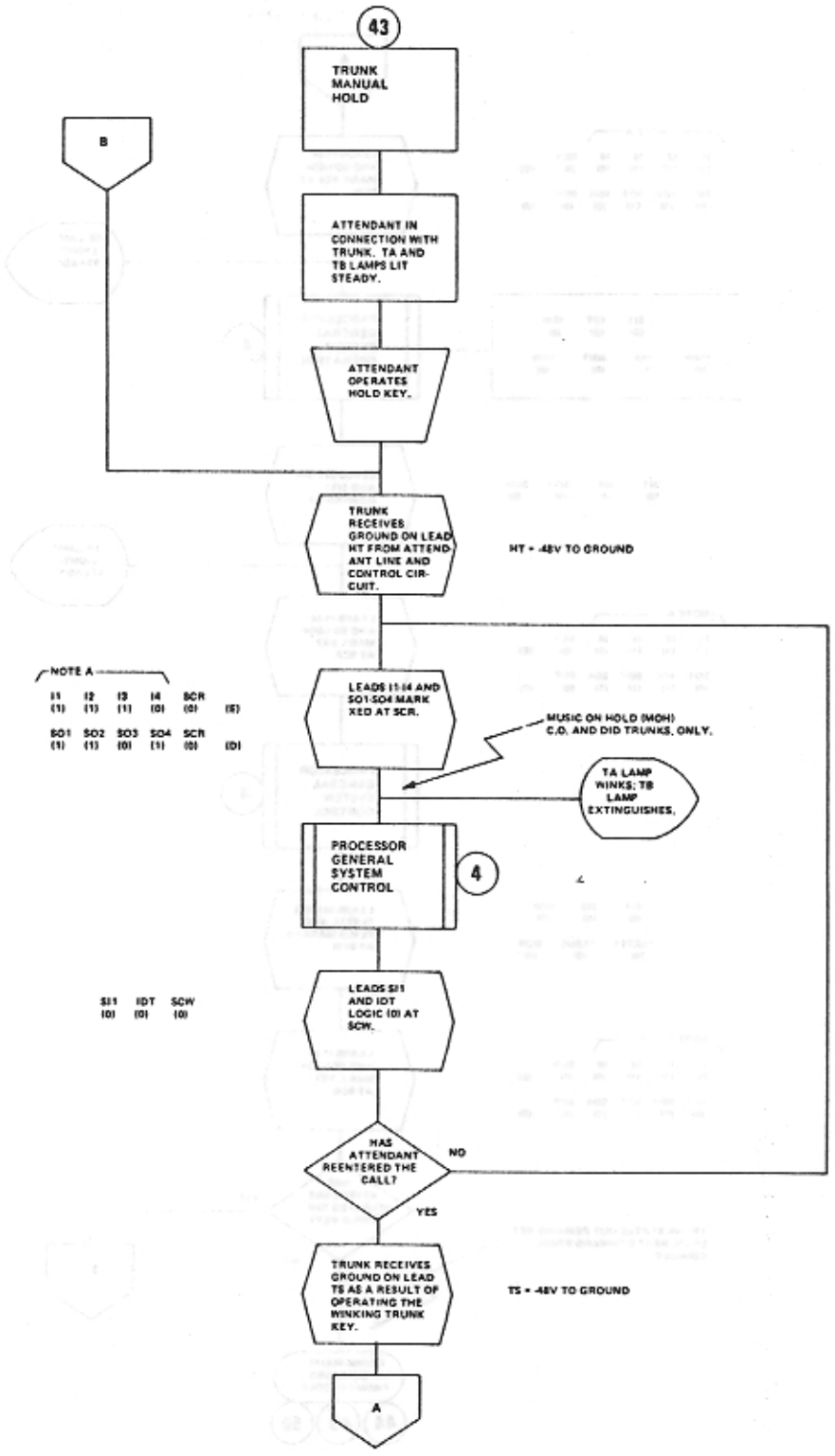
FIGURE A-1.41 Flow Chart 42, Trunk Incoming, Attendant Answer (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

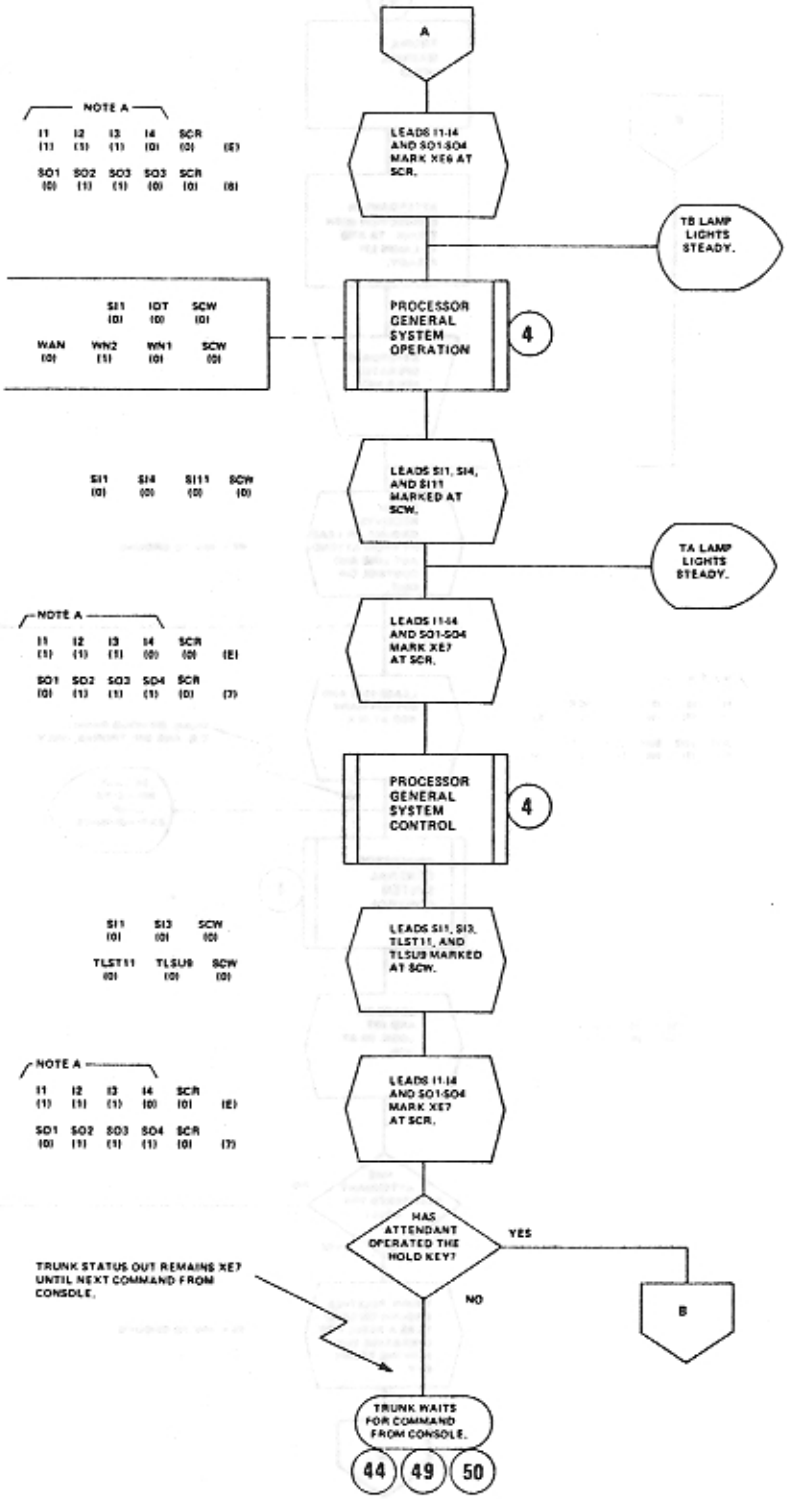
FIGURE A-1.41 Flow Chart 42, Trunk Incoming, Attendant Answer (Sheet 2 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT ED.

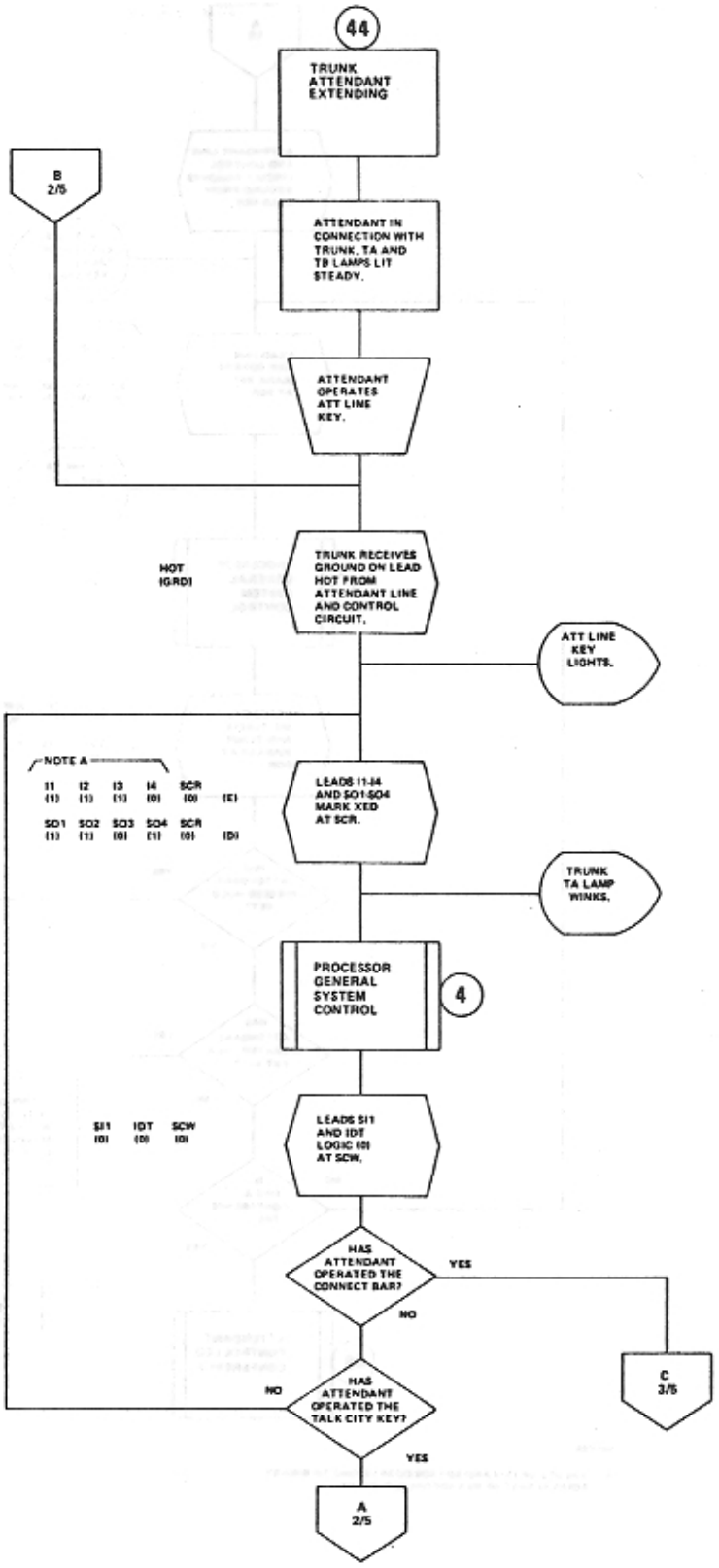
FIGURE A-1.42 Flow Chart 43, Trunk Manual Hold (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E6 AND E7.

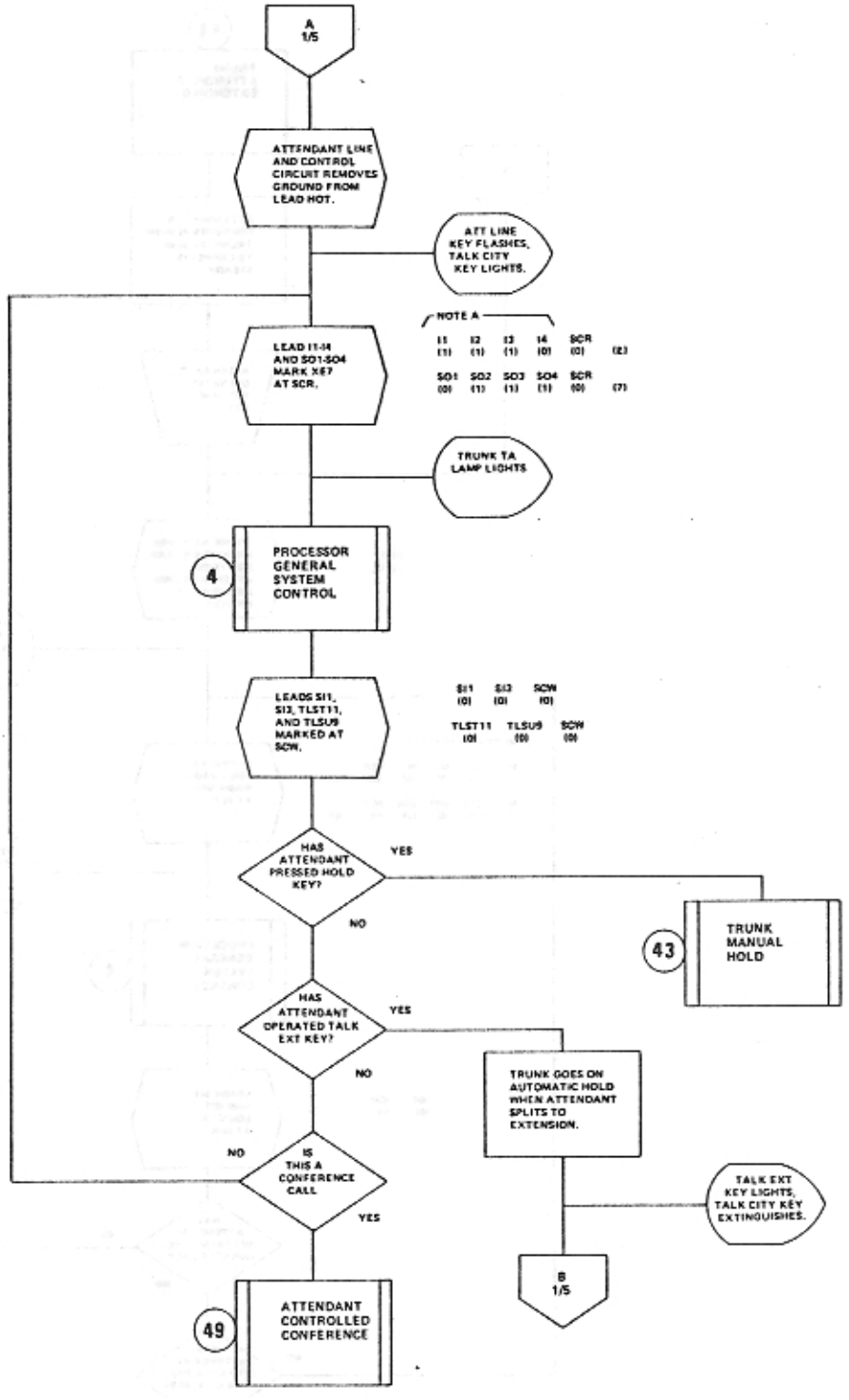
FIGURE A-1.42 Flow Chart 43, Trunk Manual Hold (Sheet 2 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT ED.

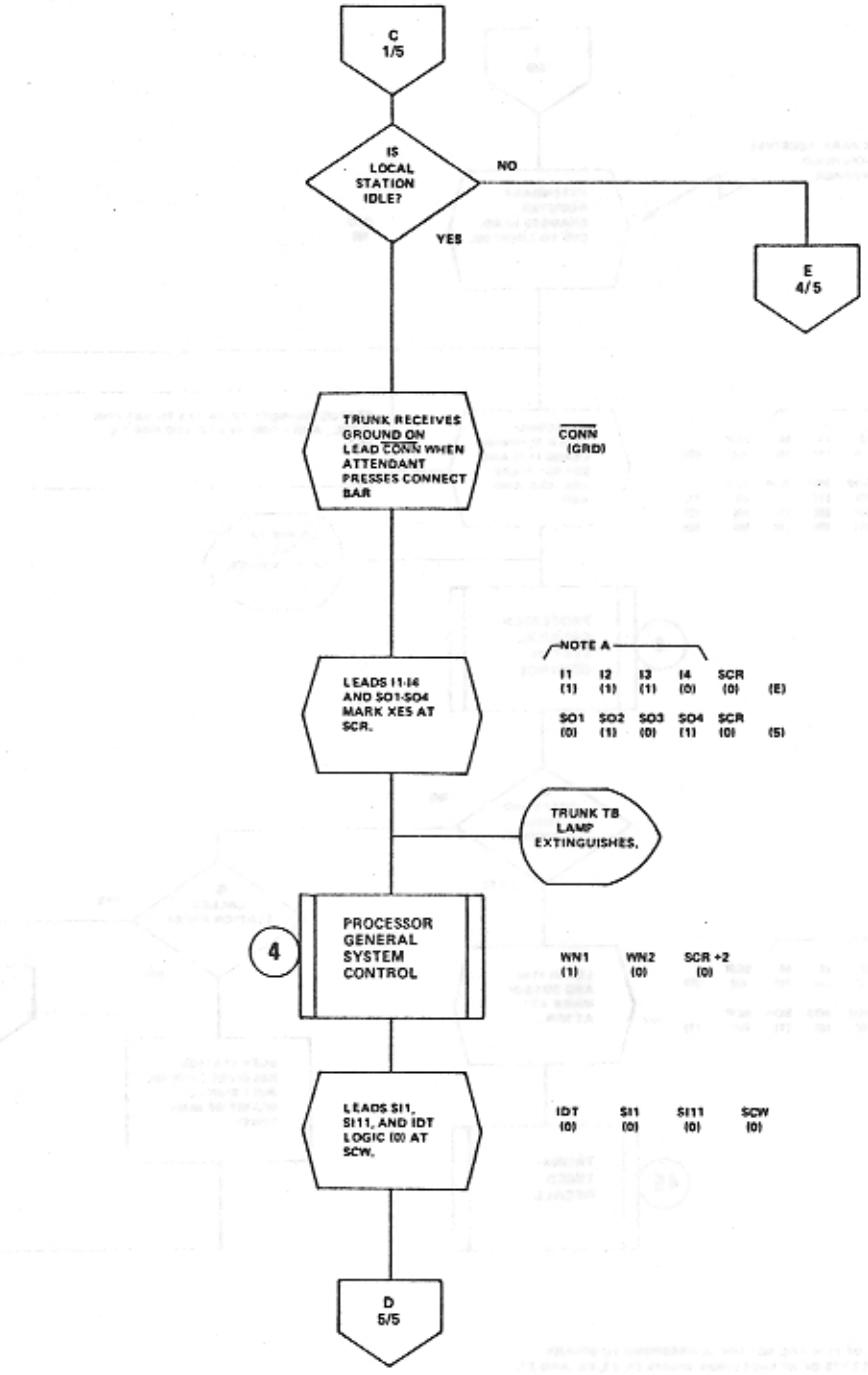
FIGURE A-1.43 Flow Chart 44, Trunk Attendant Extending (Sheet 1 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

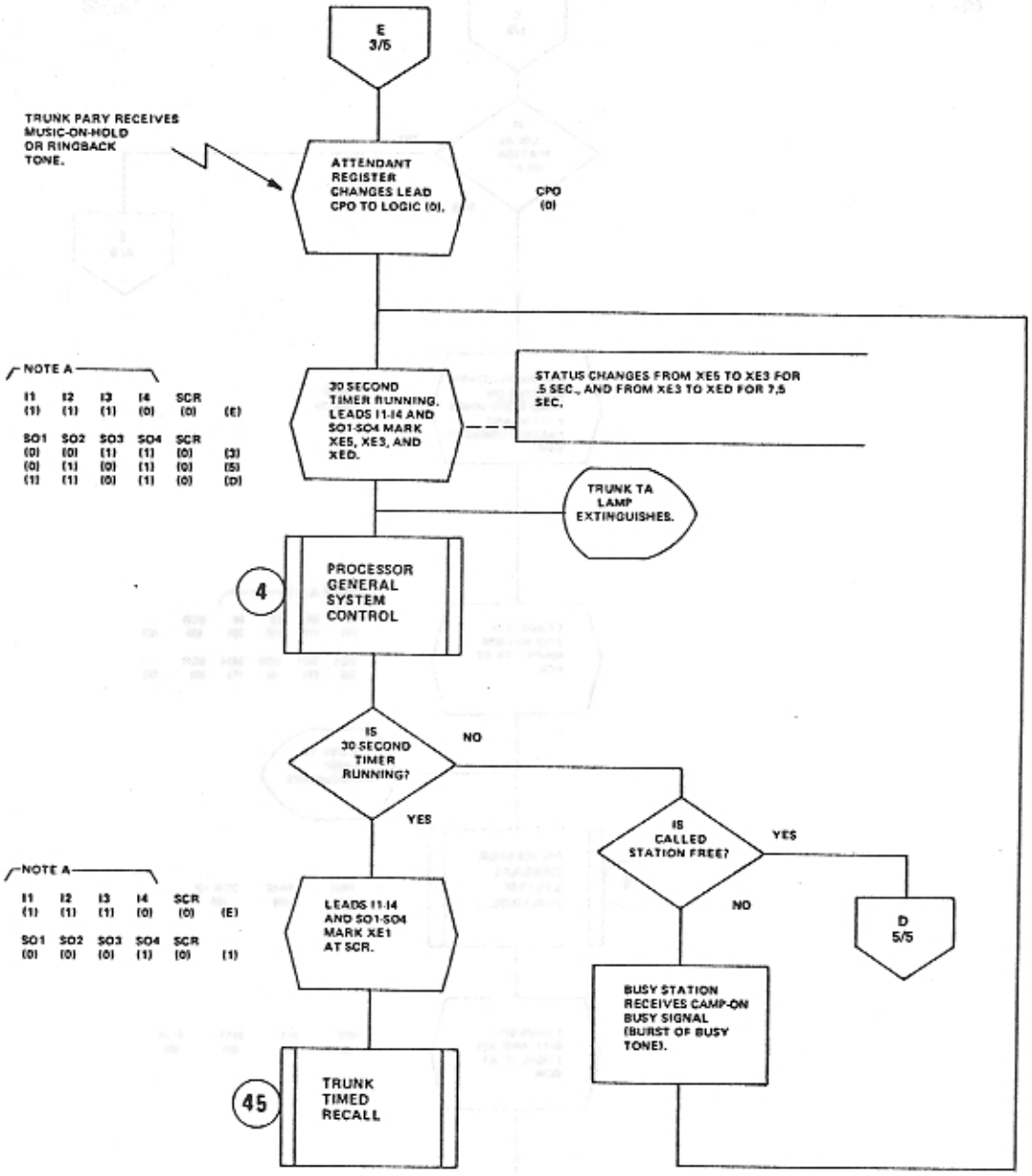
FIGURE A-1.43 Flow Chart 44, Trunk Attendant Extending (Sheet 2 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E5.

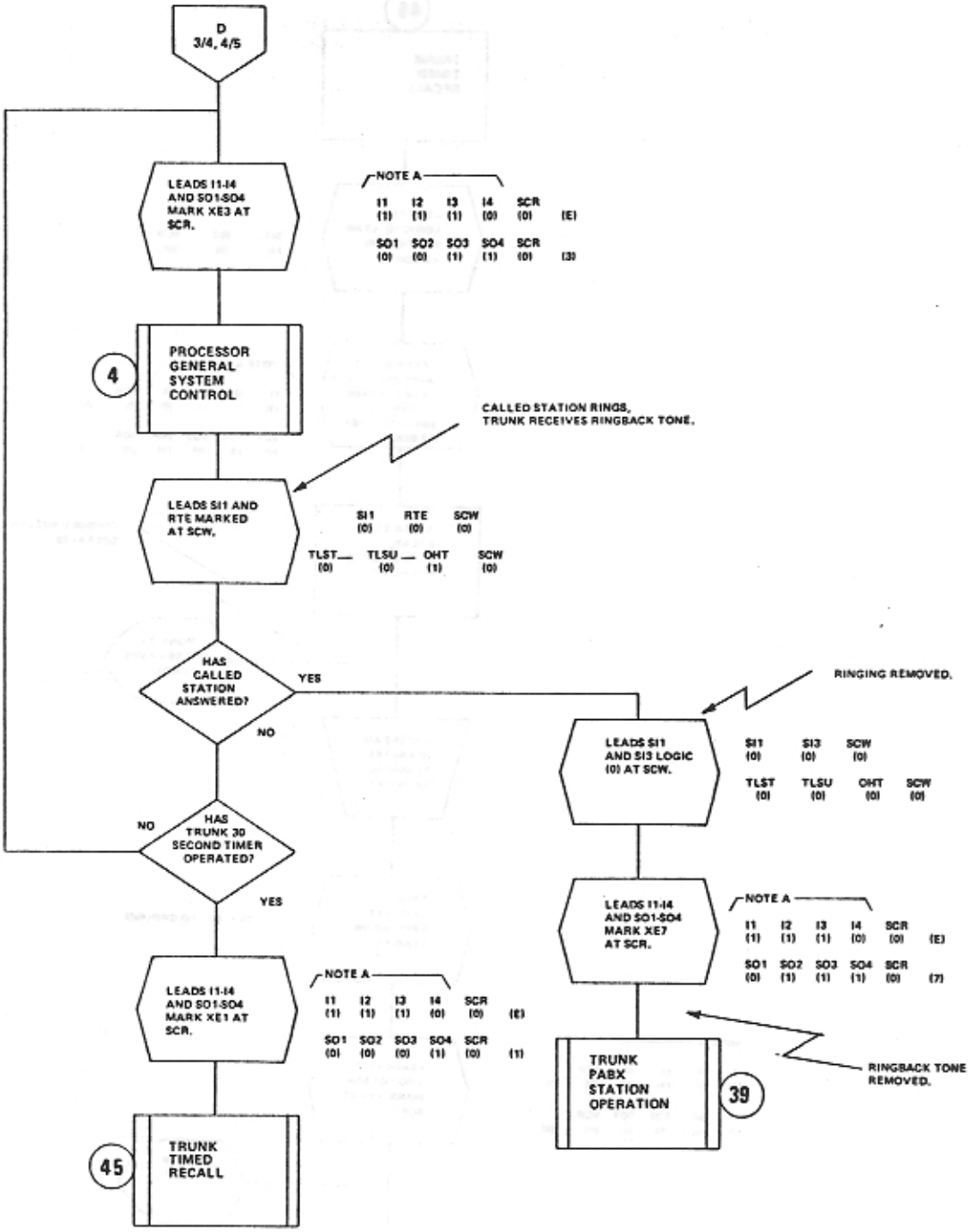
FIGURE A-1.43 Flow Chart 44, Trunk Attendant Extending (Sheet 3 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E5, E3, ED, AND E1.

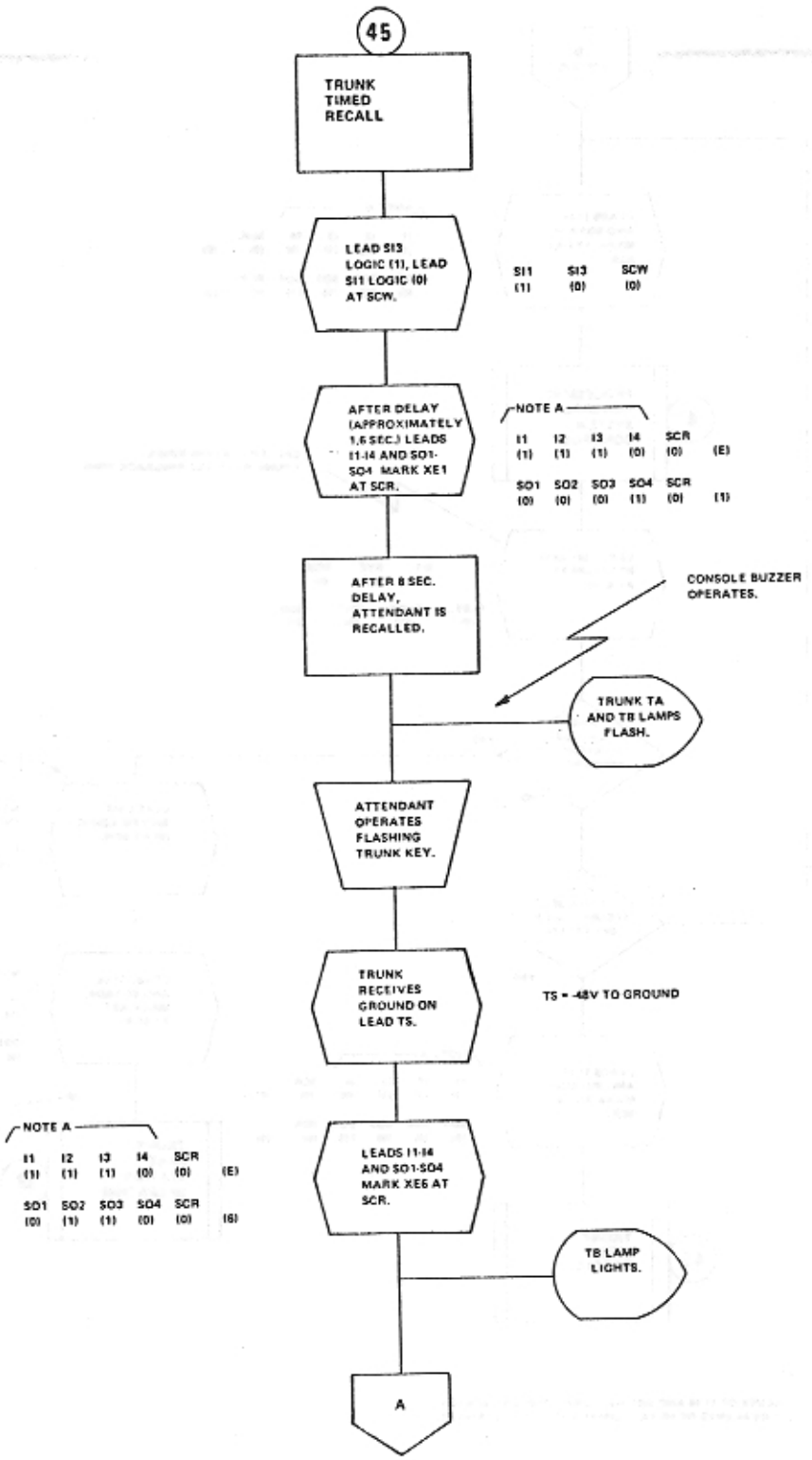
FIGURE A-1.43 Flow Chart 44, Trunk Attendant Extending (Sheet 4 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E3, E7, AND E1.

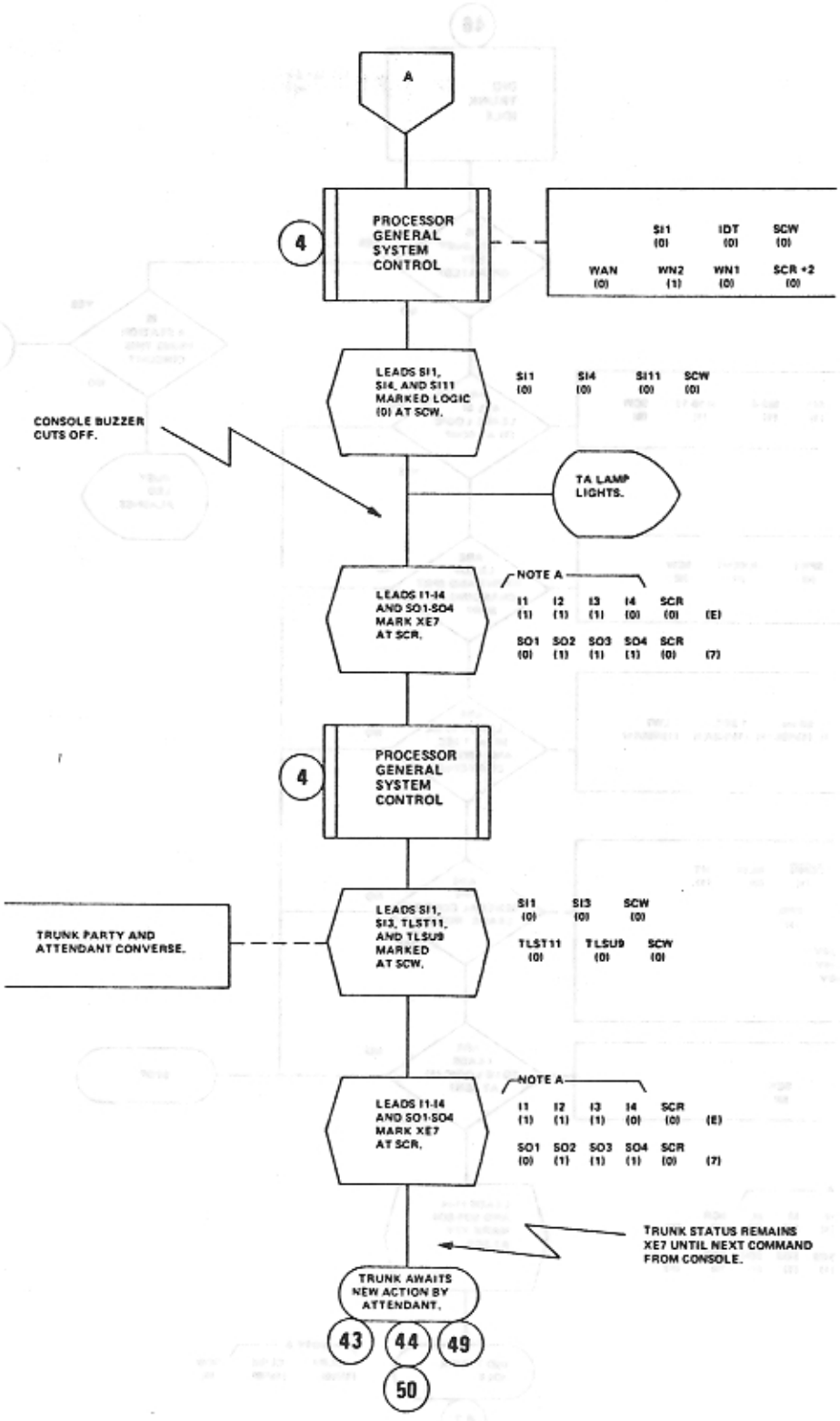
FIGURE A-1.43 Flow Chart 44, Trunk Attendant Extending (Sheet 5 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E1 AND E6.

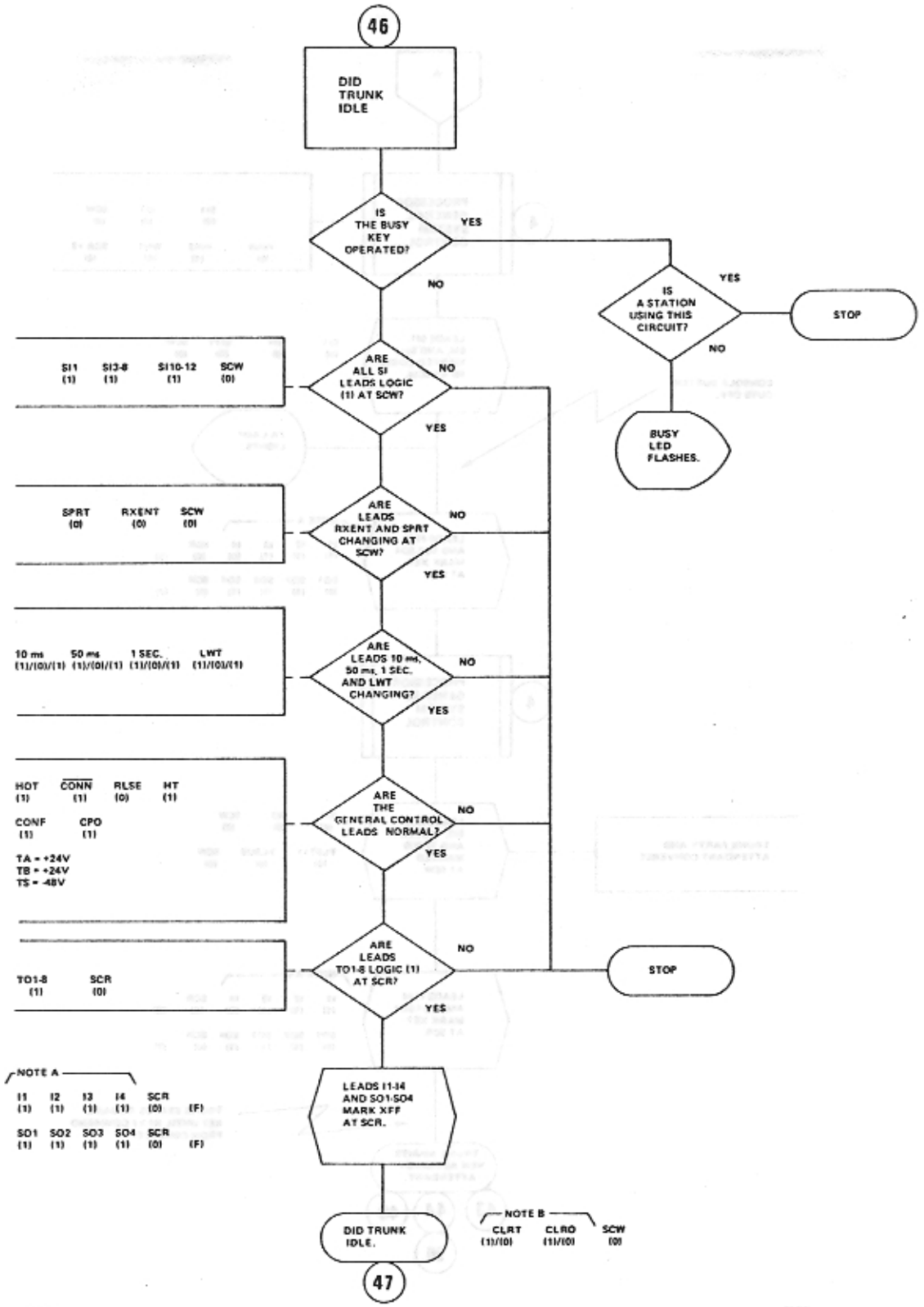
FIGURE A-1.44 Flow Chart 45, Trunk Timed Recall (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

FIGURE A-1.44 Flow Chart 45, Trunk Timed Recall (Sheet 2 of 2)

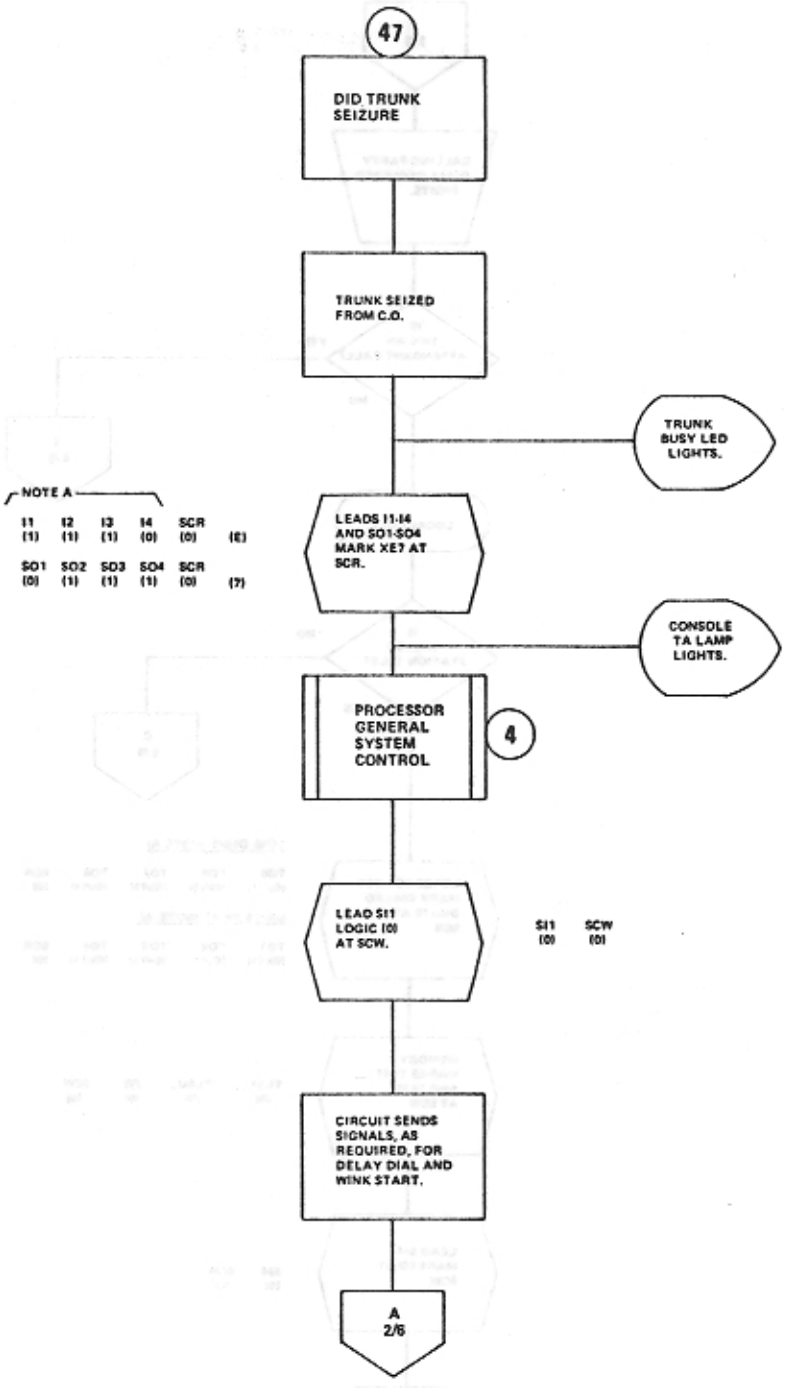


NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT FF.

B. LEADS NORMALLY CHANGING (1)/(0), CHECK FOR NO CHANGE.

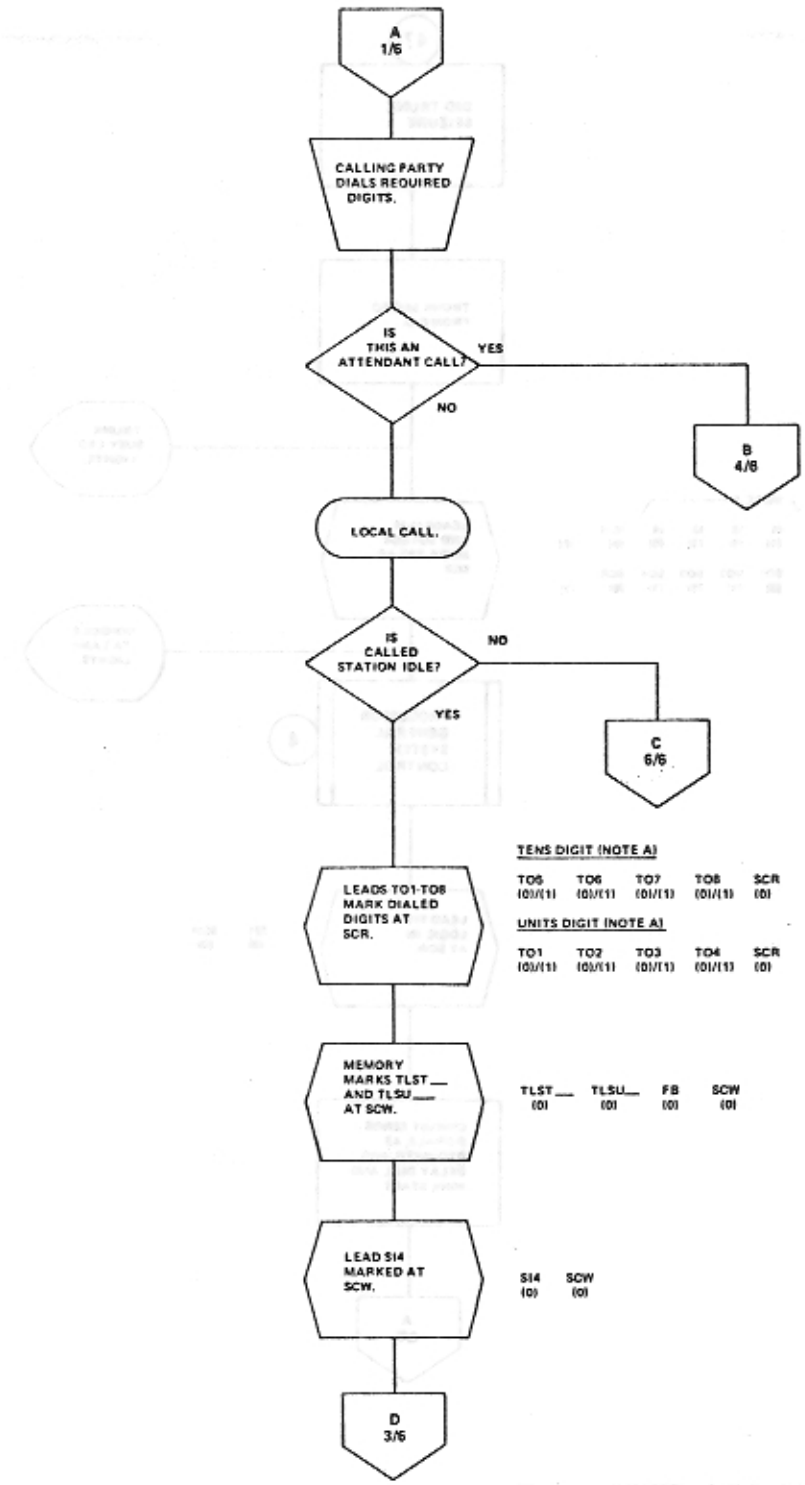
FIGURE A-1.45 Flow Chart 46, DID Trunk Idle



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

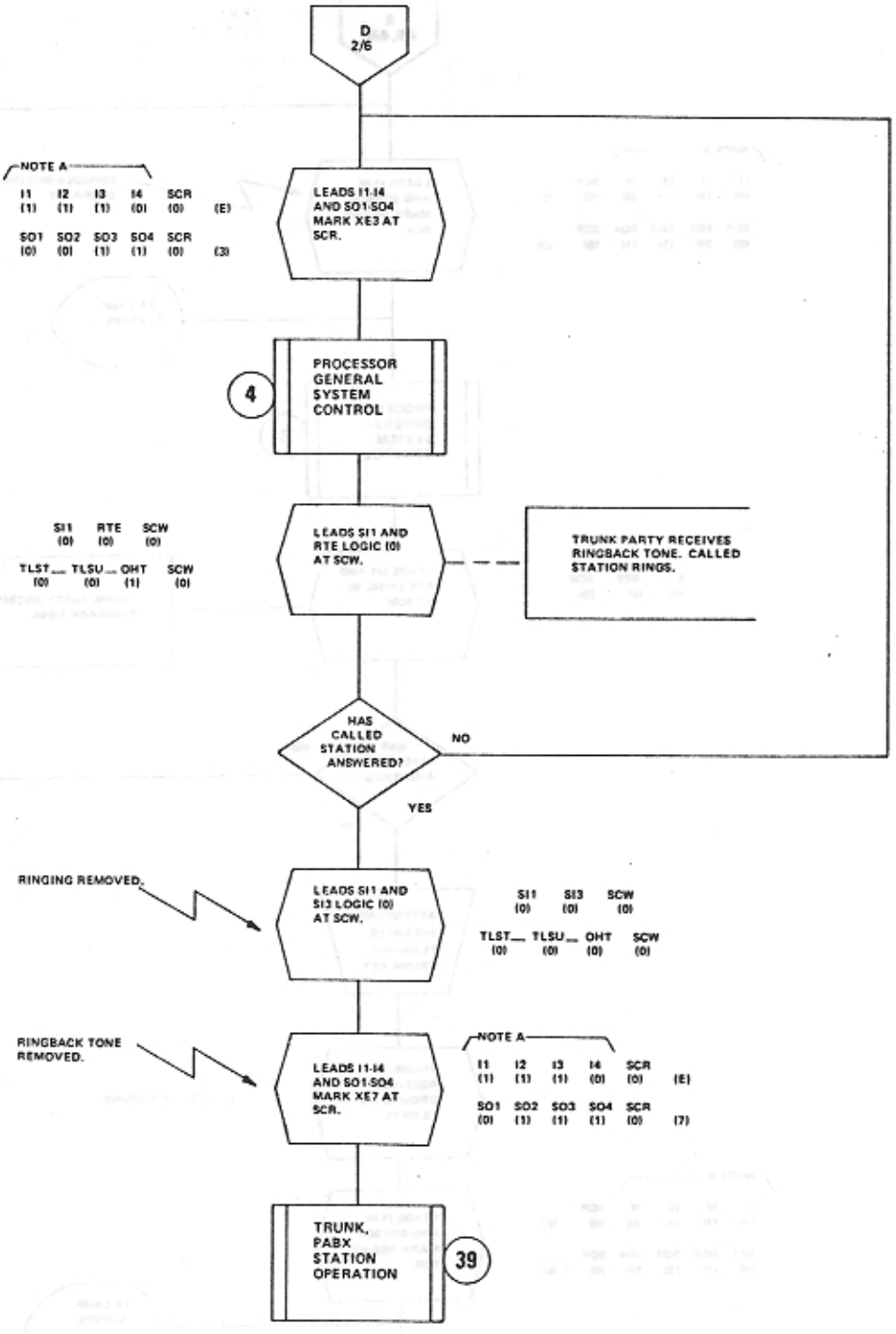
FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 1 of 6)



NOTES:

A. VALUES OF TO5-TO8 AND TO1-TO4 CORRESPOND TO BSO EQUIVALENT OF TENS AND UNITS DIGITS.

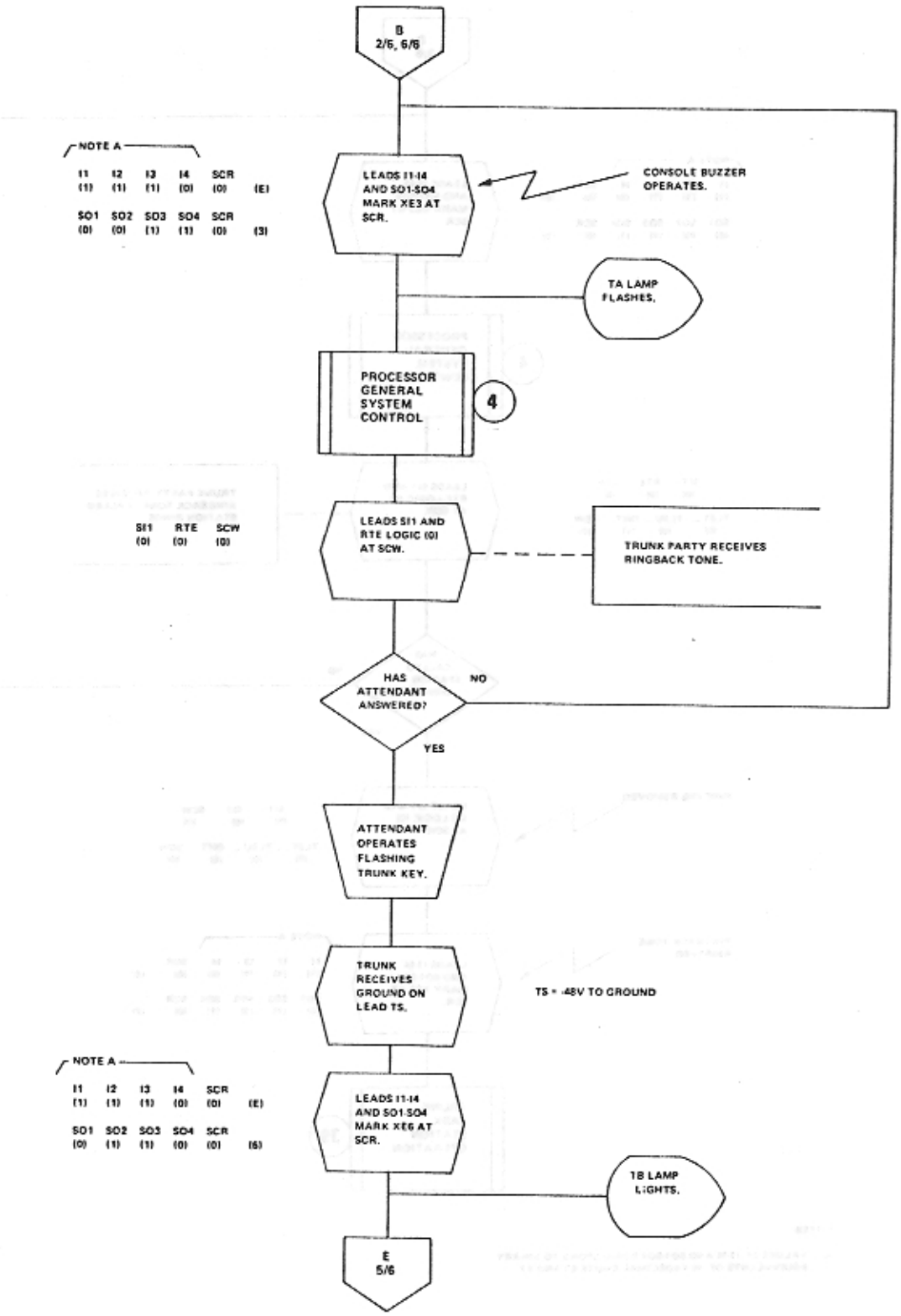
FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 2 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E3 AND E7.

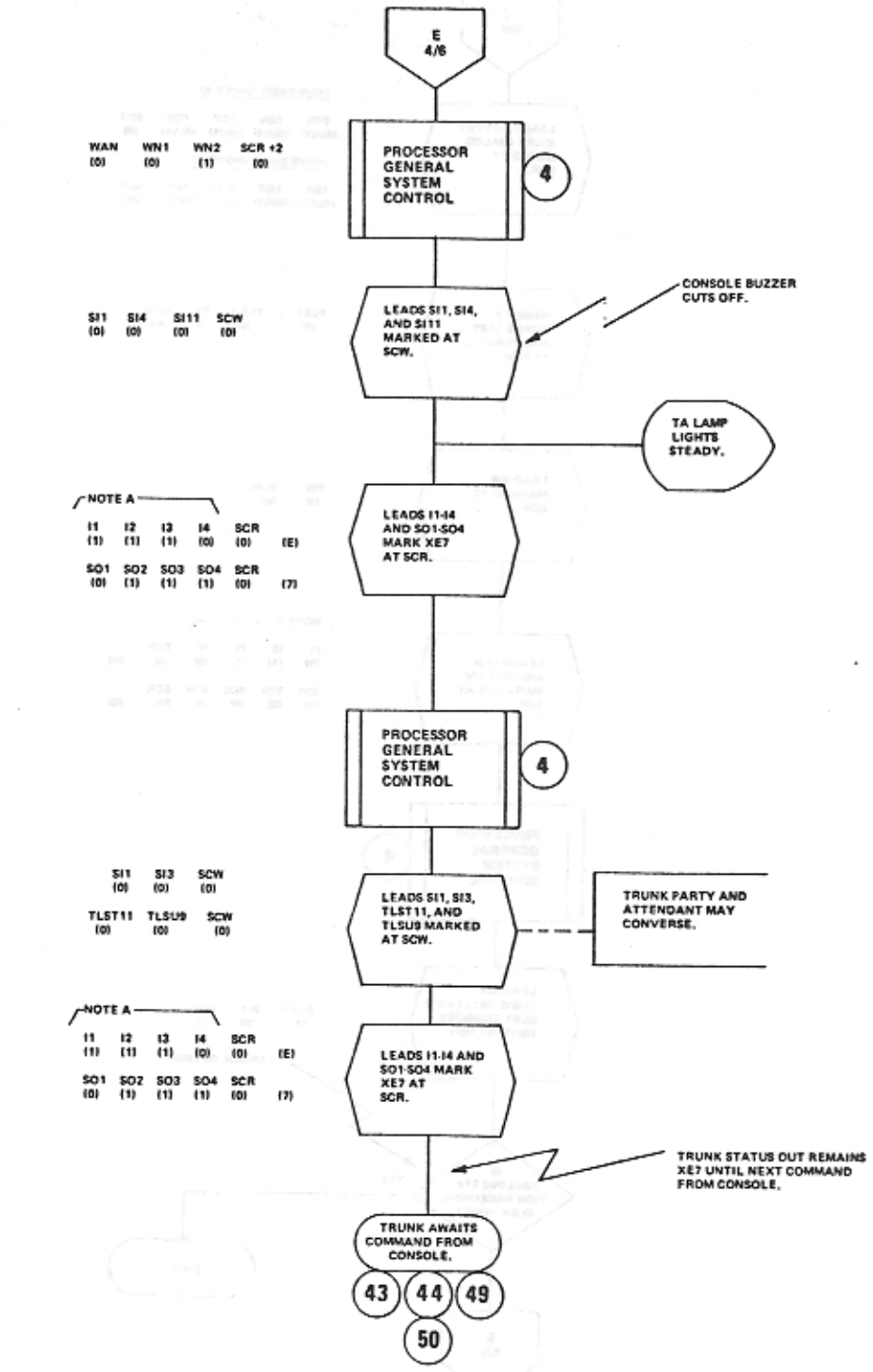
FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 3 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E3 AND E6.

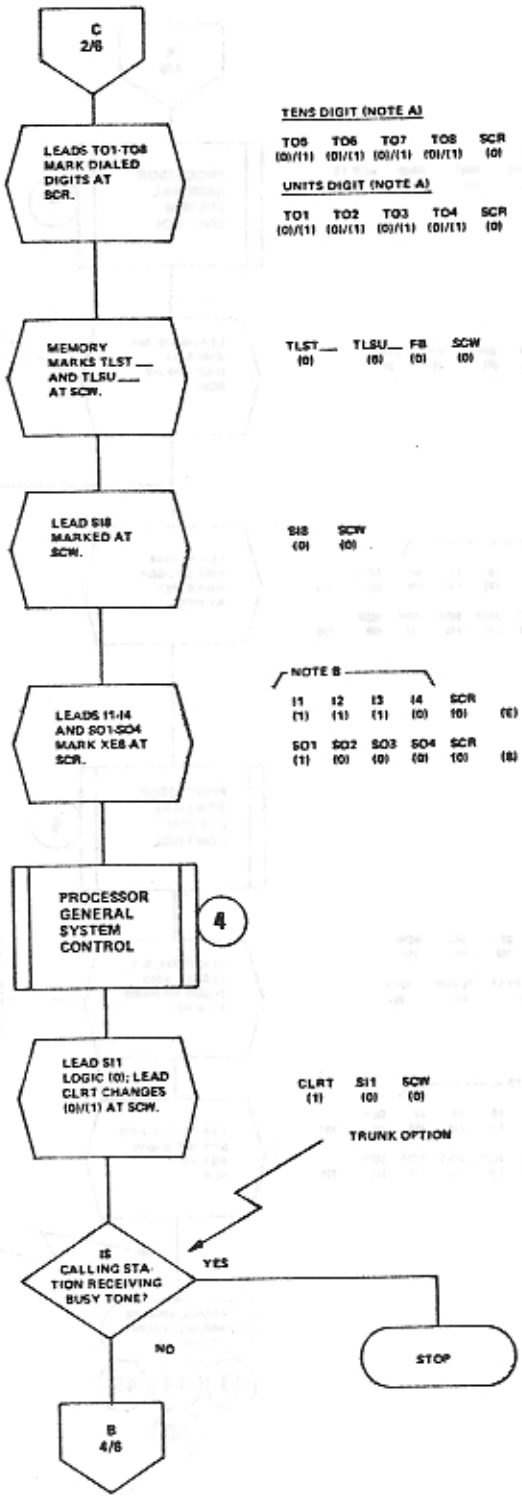
FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 4 of 6)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E7.

FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 5 of 6)



NOTES:

A. VALUES OF TO1-TO4 AND TO5 TO8 CORRESPOND TO BCD EQUIVALENTS OF UNITS AND TENS DIGITS.

B. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E8.

FIGURE A-1.46 Flow Chart 47, DID Trunk Seizure (Sheet 6 of 6)

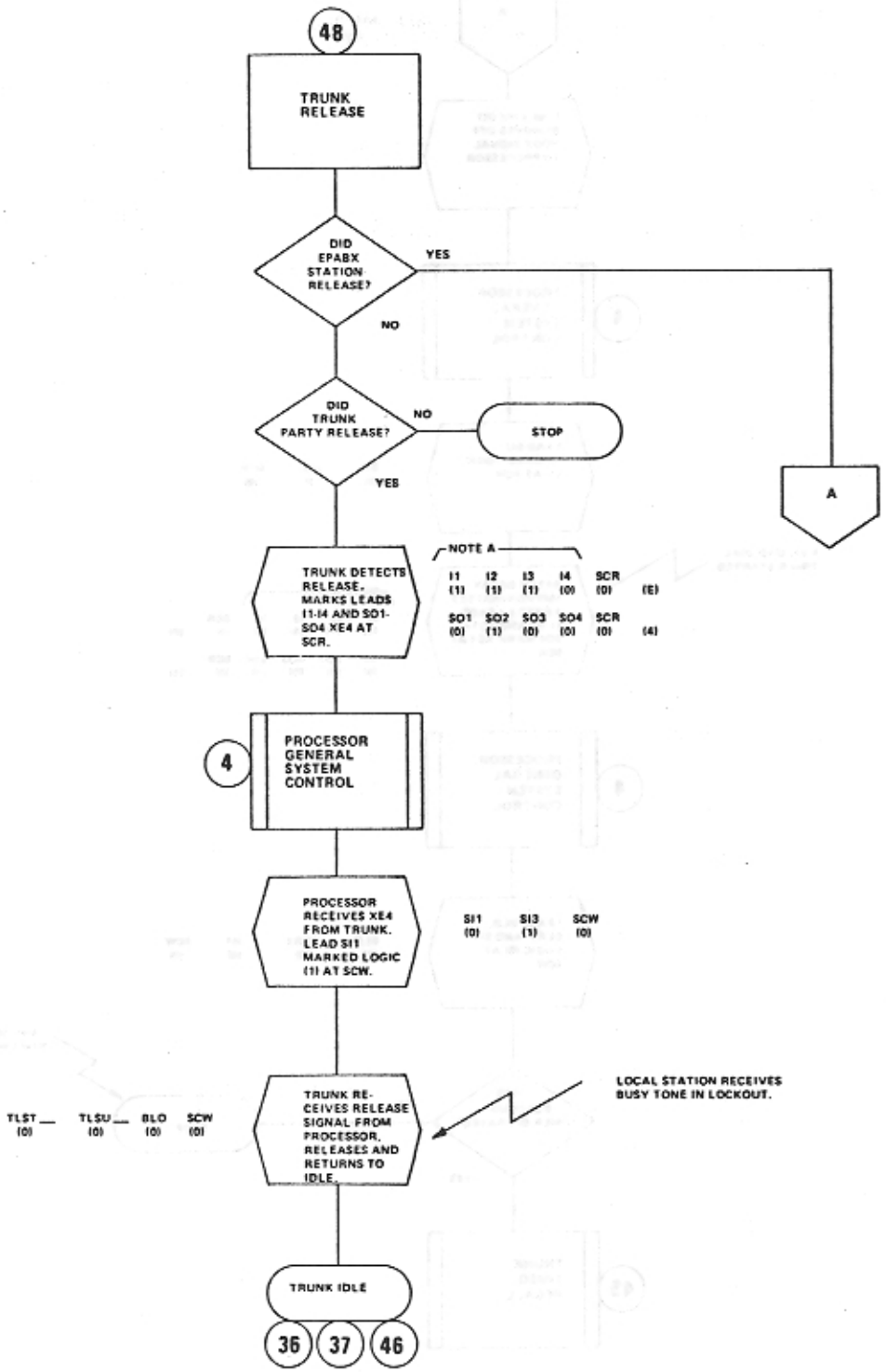
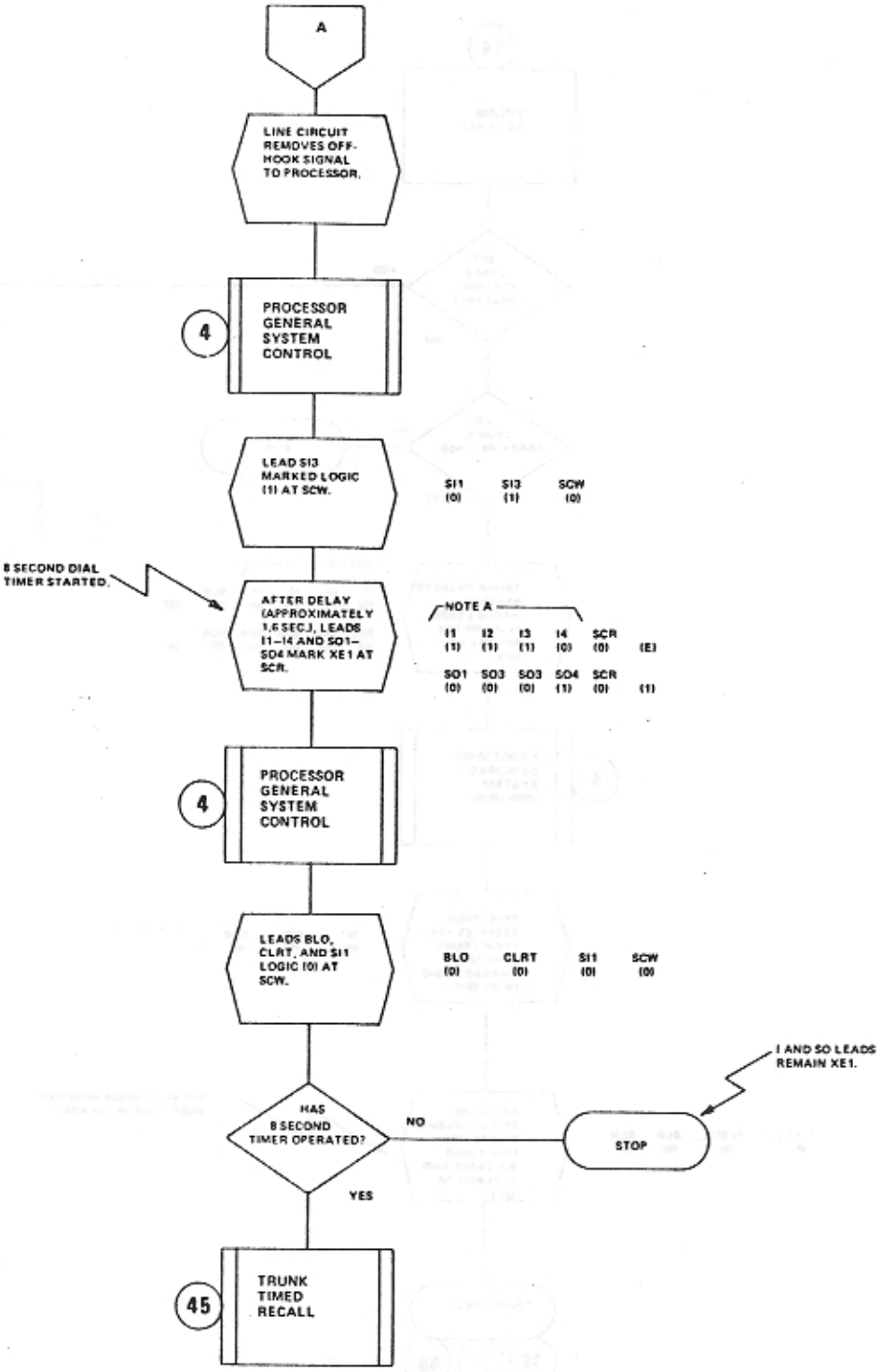


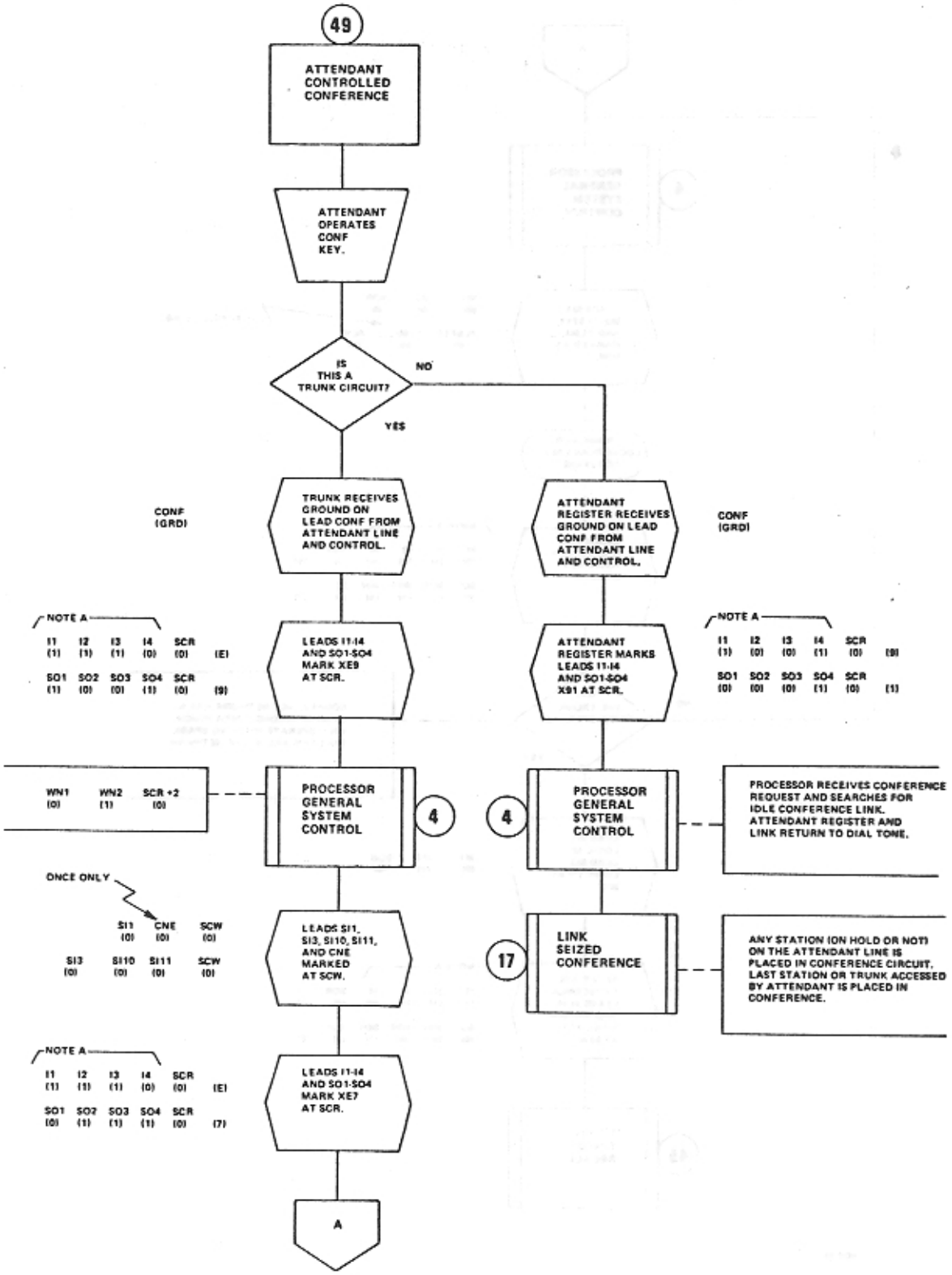
FIGURE A-1.47 Flow Chart 48, Trunk Release (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT E1.

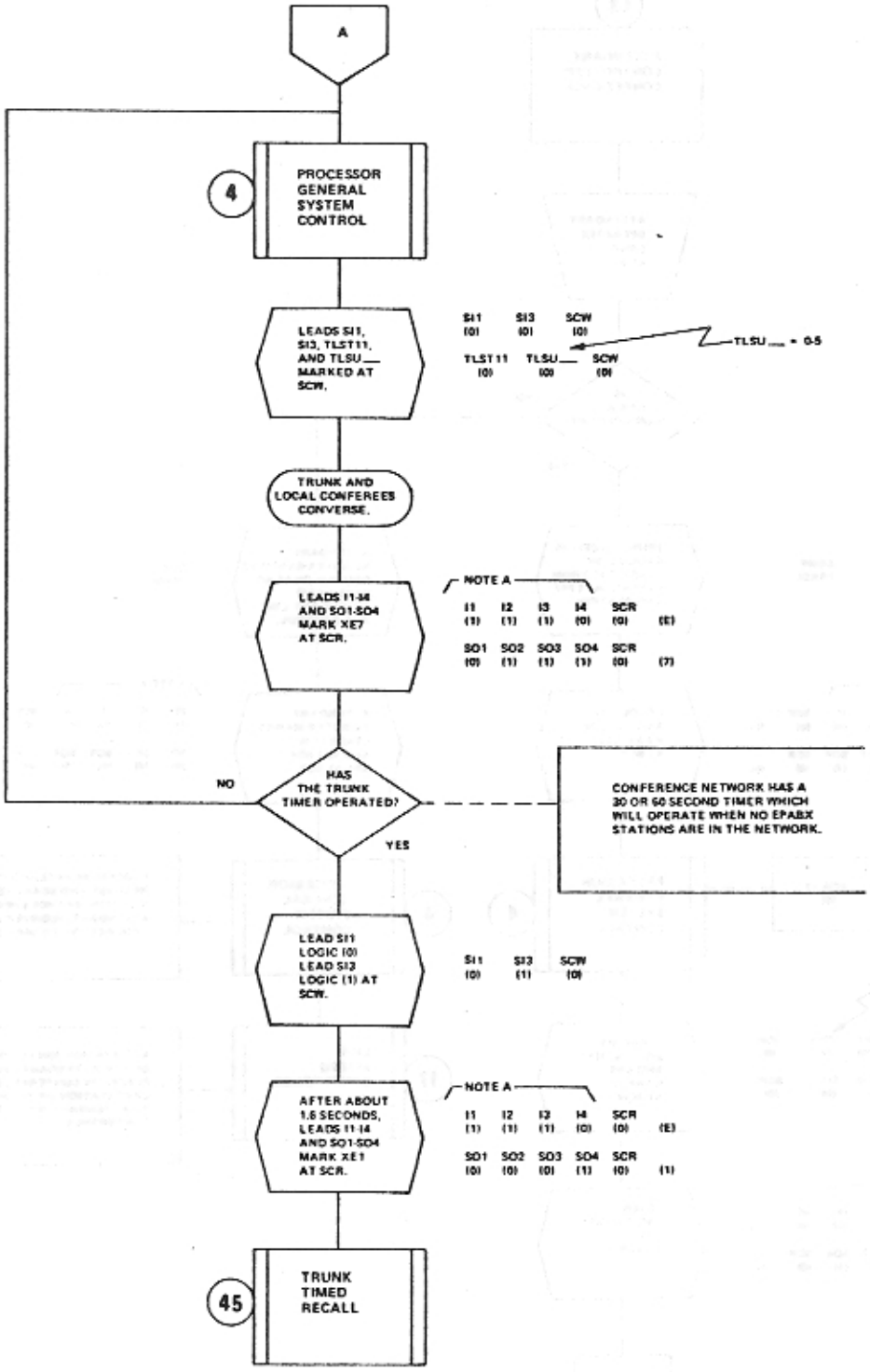
FIGURE A-1.47 Flow Chart 48, Trunk Release (Sheet 2 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E9, E7, OR 91.

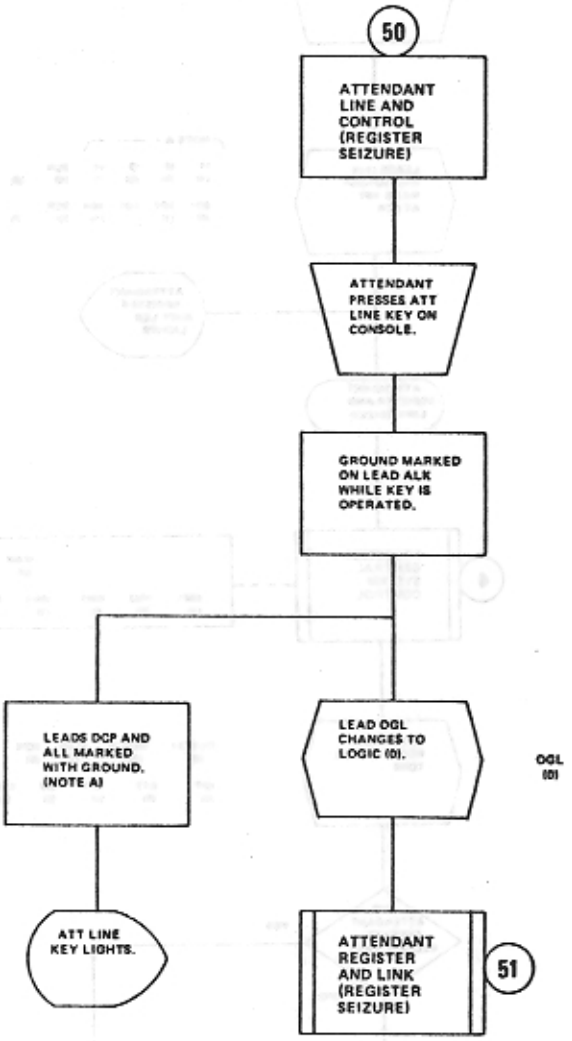
FIGURE A-1.48 Flow Chart 49, Attendant Controlled Conference (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS E7 AND E1.

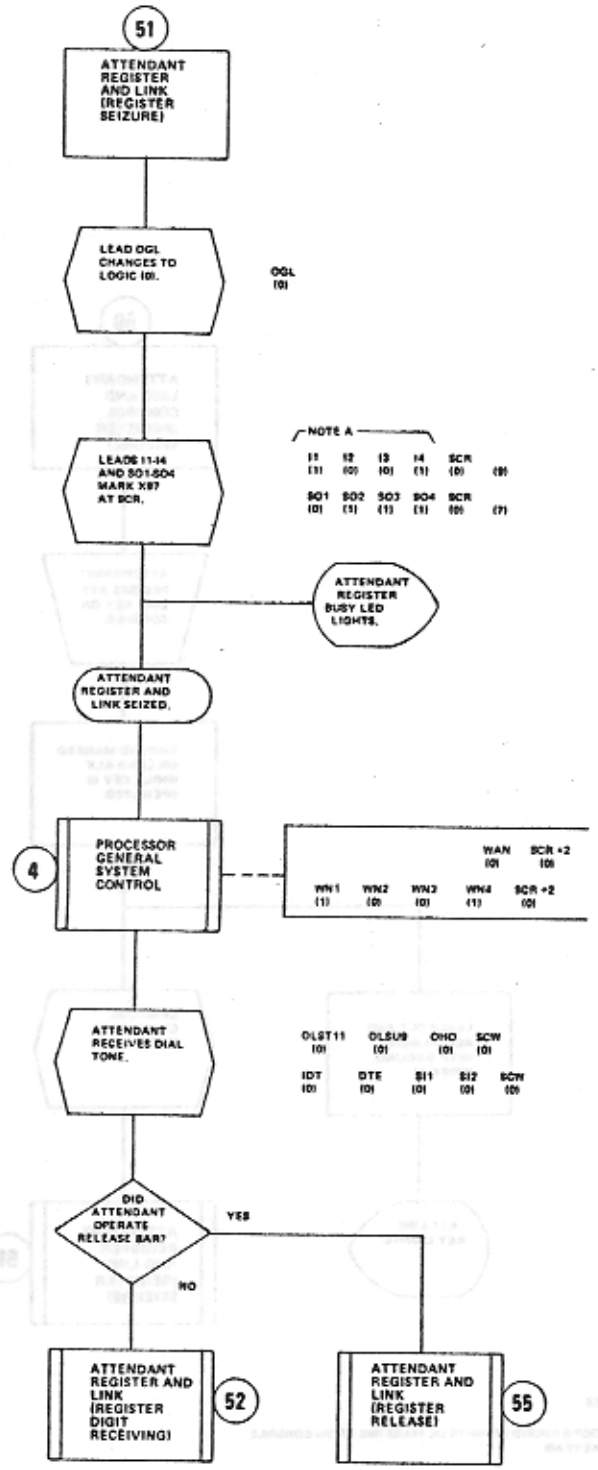
FIGURE A-1.48 Flow Chart 49, Attendant Controlled Conference (Sheet 2 of 2)



NOTES:

A. DCP GROUND PERMITS DC MARKING FROM CONSOLE KEYPAD.

FIGURE A-1.49 Flow Chart 50, Attendant Line and Control (Register Seizure)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 97.

FIGURE A-1.50 Flow Chart 51, Attendant Register and Link (Register Seizure)

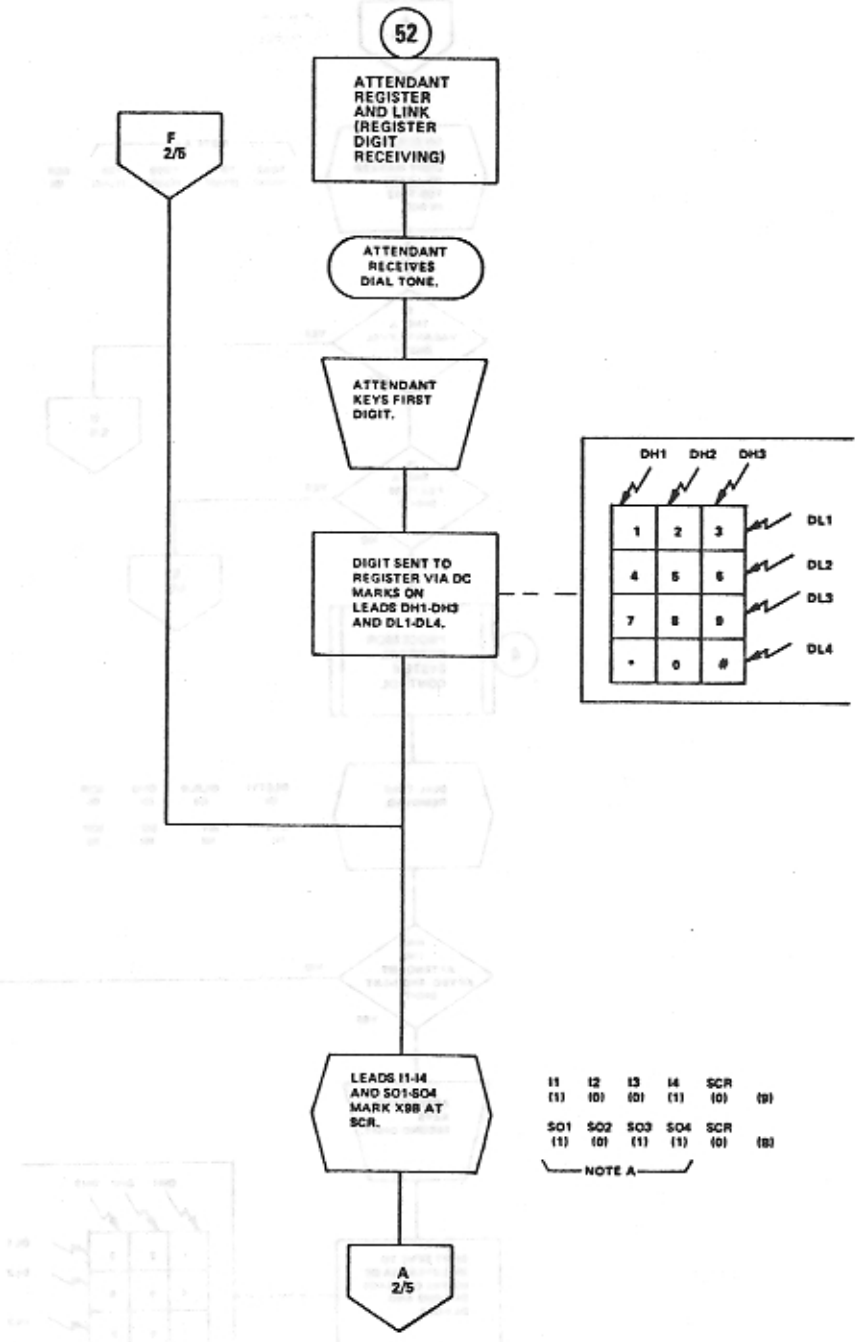
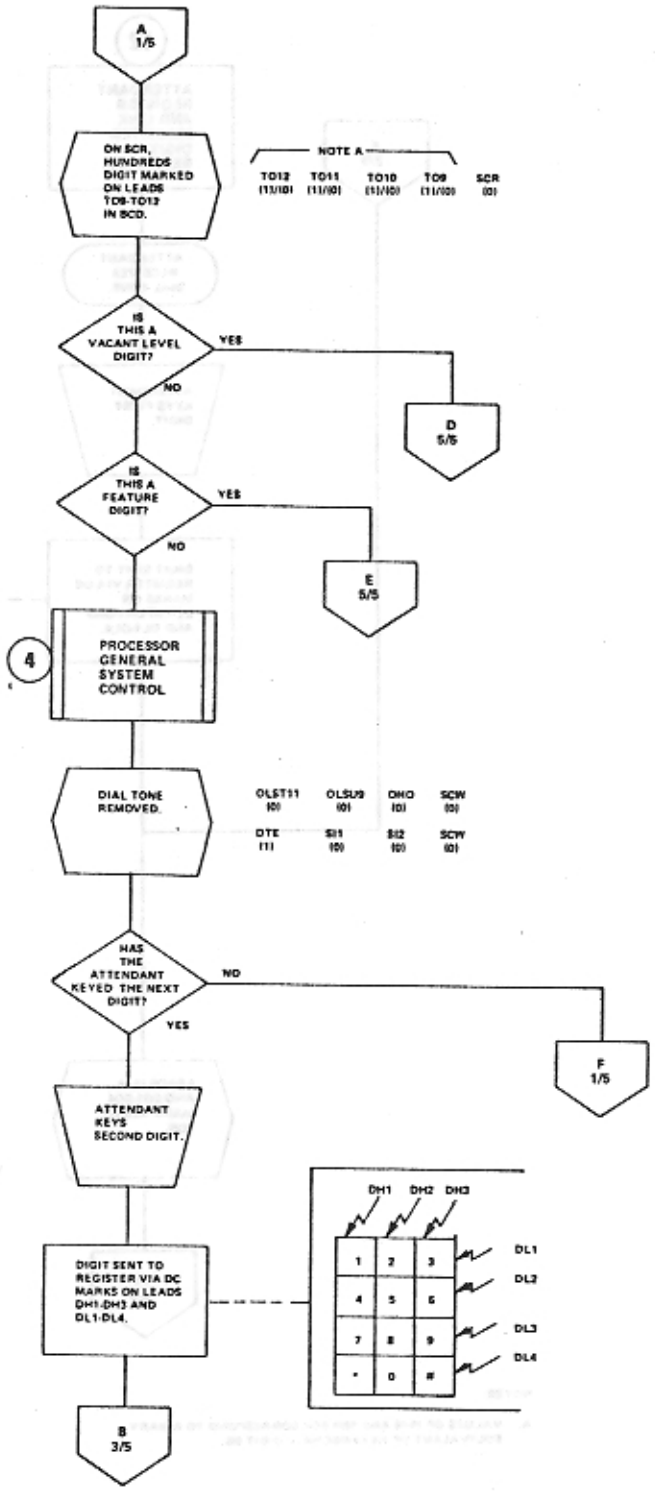


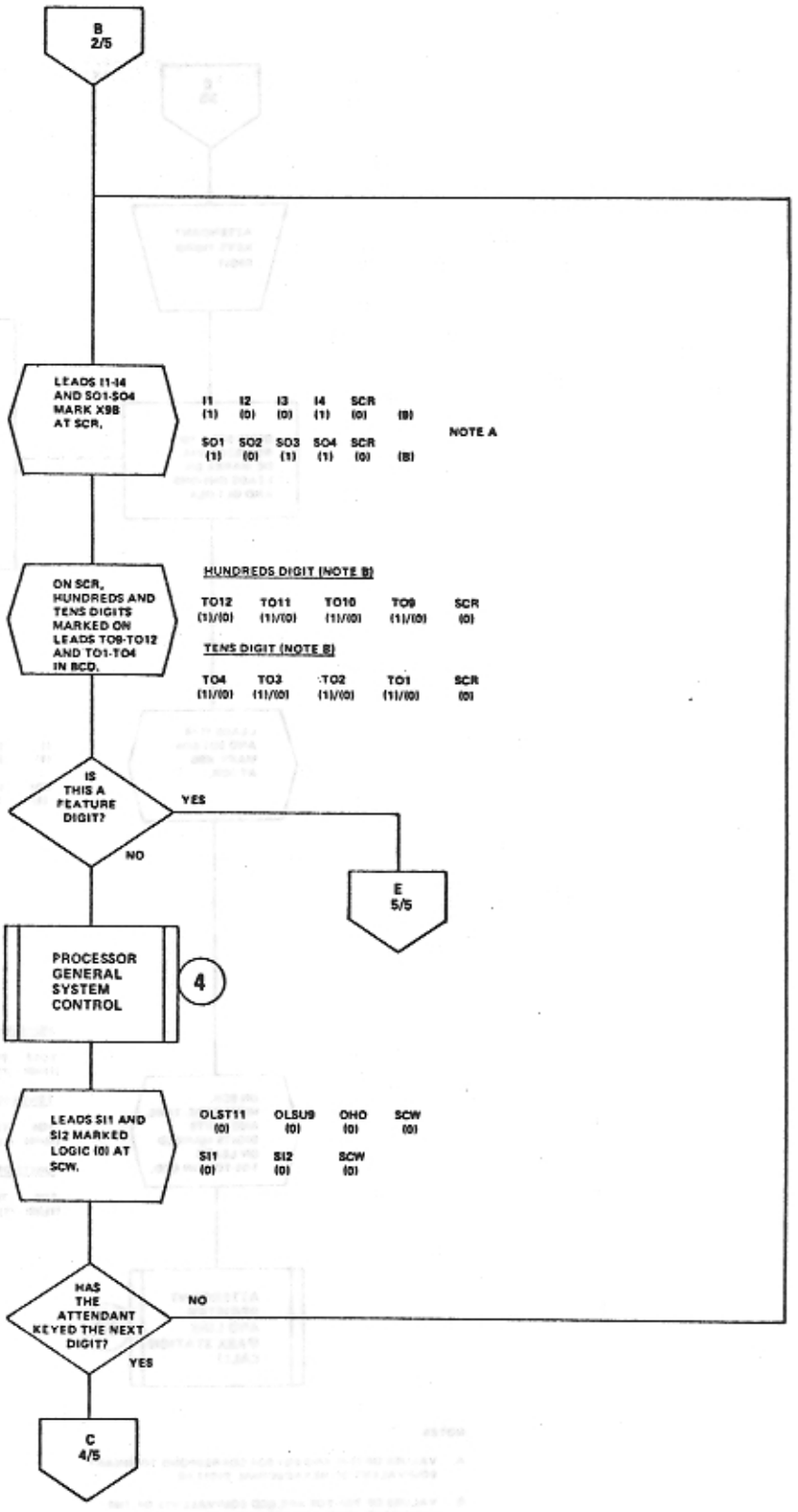
FIGURE A-1.51 Flow Chart 52, Attendant Register and Link (Register Digit Receiving) (Sheet 1 of 5)



NOTES:

A. VALUES OF TO8-TO12 ARE BCD EQUIVALENTS OF THE HUNDREDS DIGITS.

FIGURE A-1.51 Flow Chart 52, Attendant Register and Link (Register Digit Receiving) (Sheet 2 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 9B.

B. VALUES OF TO9-TO12 AND TO1-TO4 ARE BCD EQUIVALENTS OF THE HUNDREDS AND TENS DIGITS.

FIGURE A-1.51 Flow Chart 52, Attendant Register and Link (Register Digit Receiving) (Sheet 3 of 5)

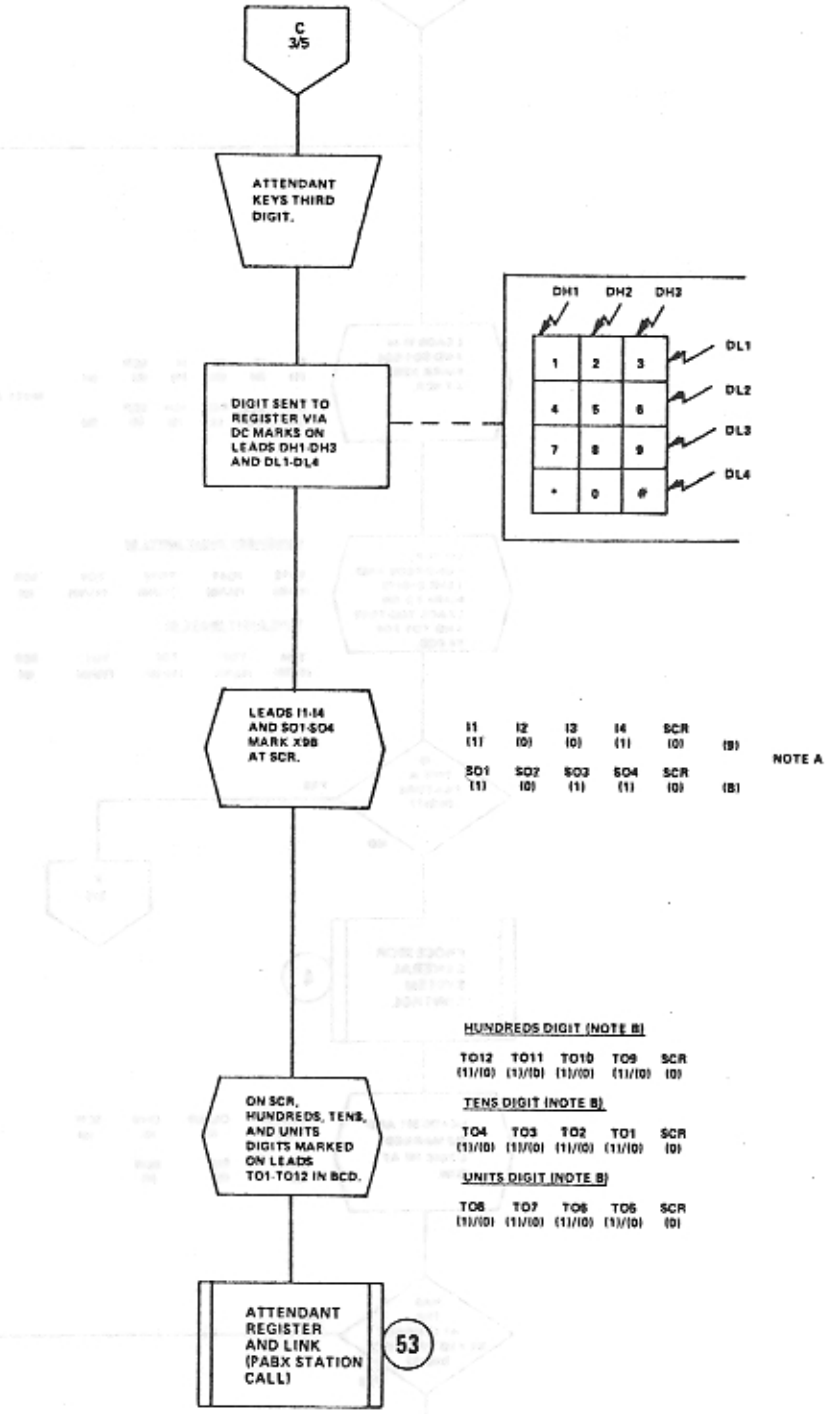
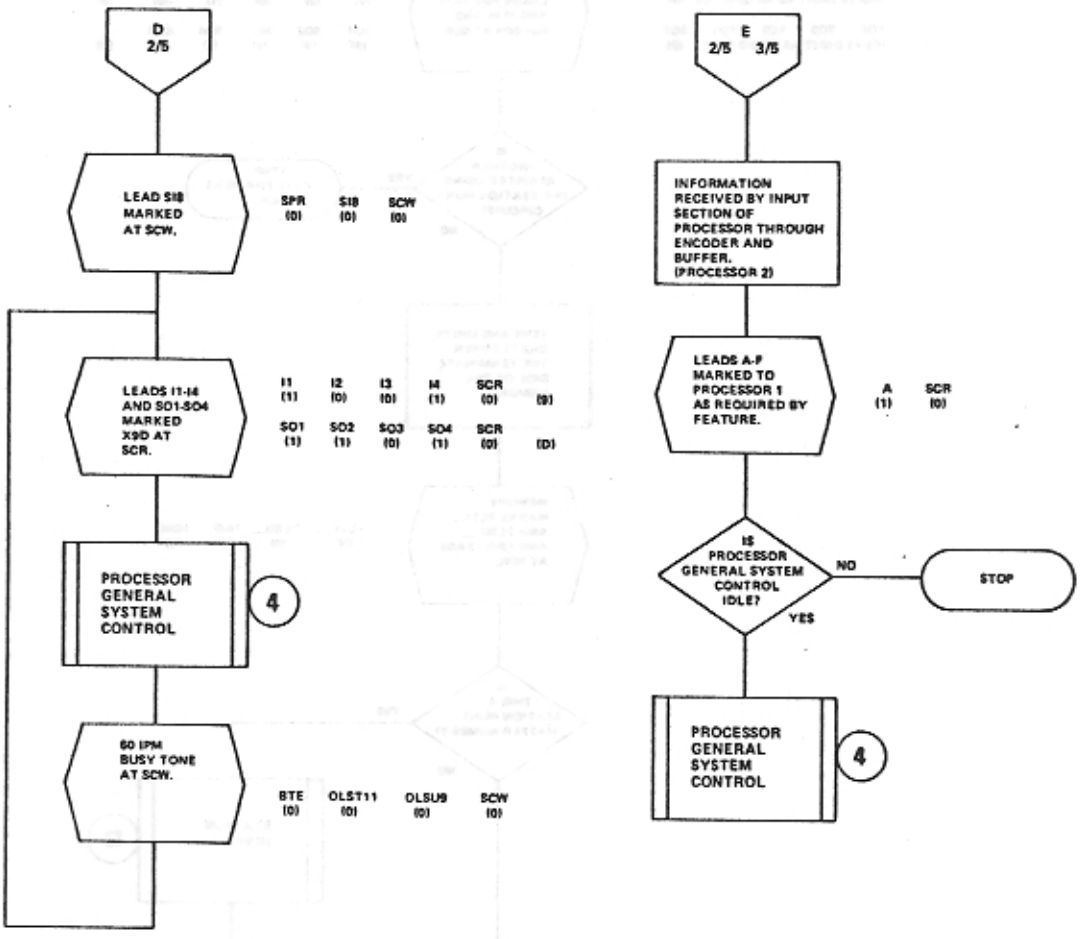


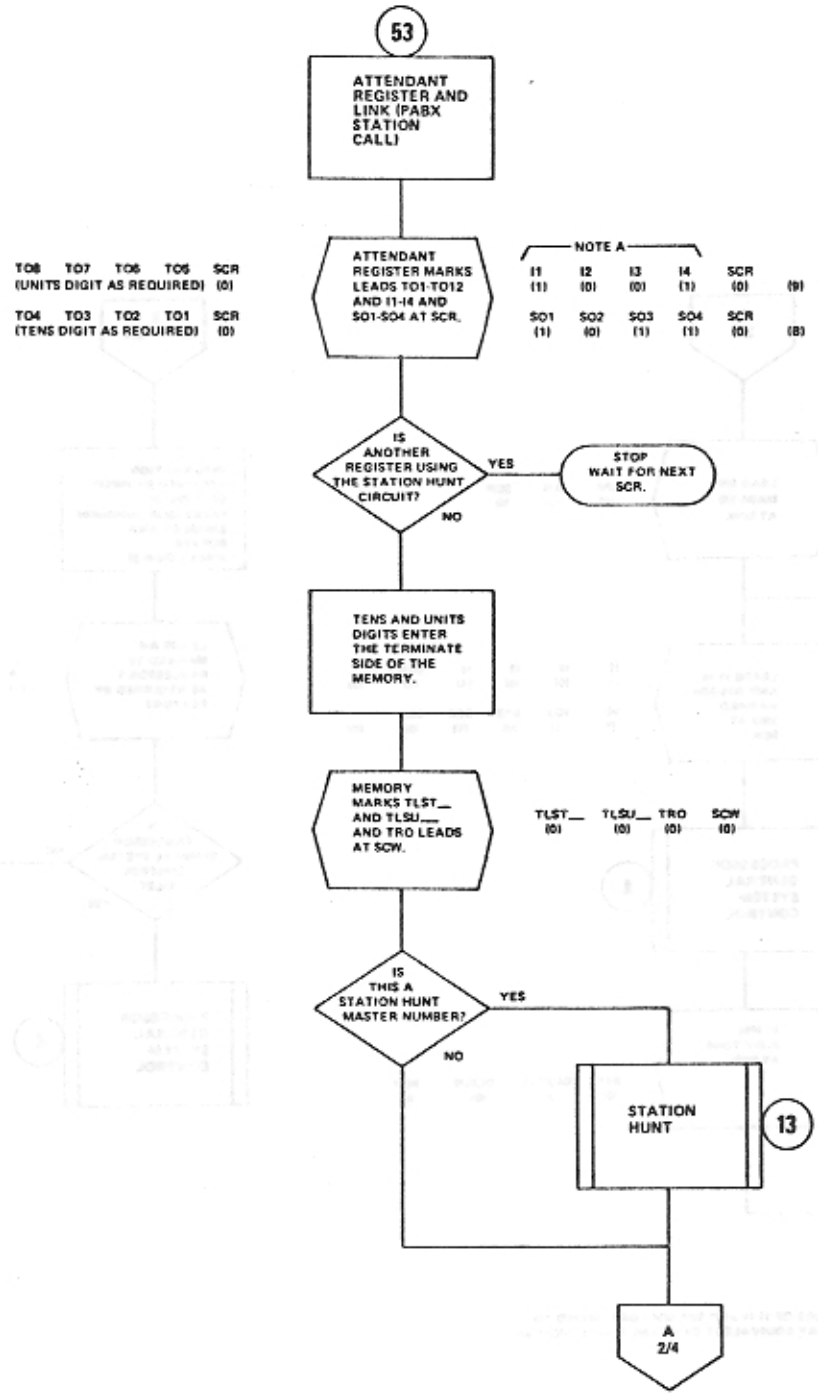
FIGURE A-1.51 Flow Chart 52, Attendant Register and Link (Register Digit Receiving) (Sheet 4 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 9D.

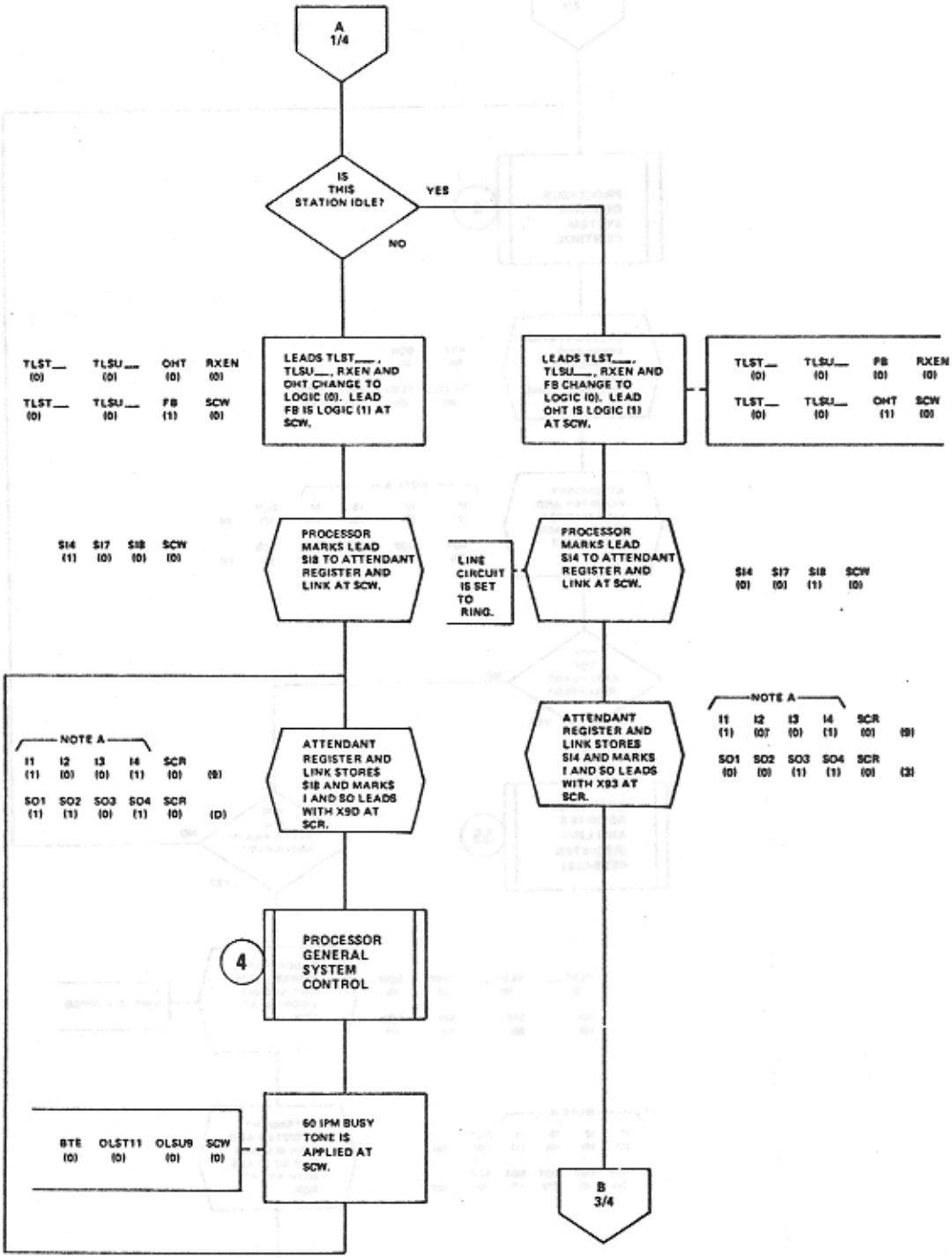
FIGURE A-1.51 Flow Chart 52, Attendant Register and Link (Register Digit Receiving) (Sheet 5 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT 9B.

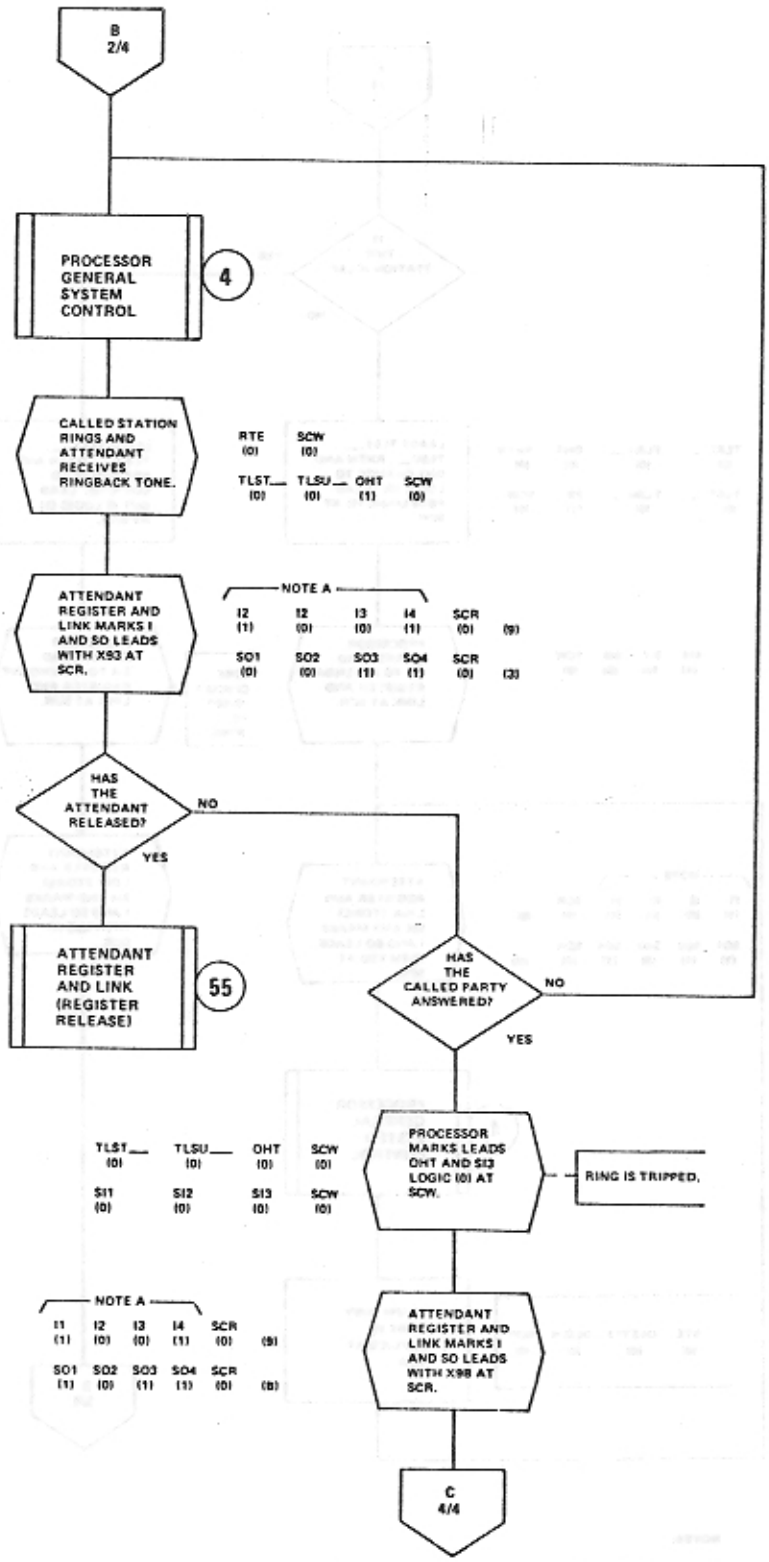
FIGURE A-1.52 Flow Chart 53, Attendant Register and Link (PABX Station Call) (Sheet 1 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 9D AND 93.

FIGURE A-1.52 Flow Chart 53, Attendant Register and Link (PABX Station Call) (Sheet 2 of 4)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGITS 93 AND 98.

FIGURE A-1.52 Flow Chart 53, Attendant Register and Link (PABX Station Call) (Sheet 3 of 4)

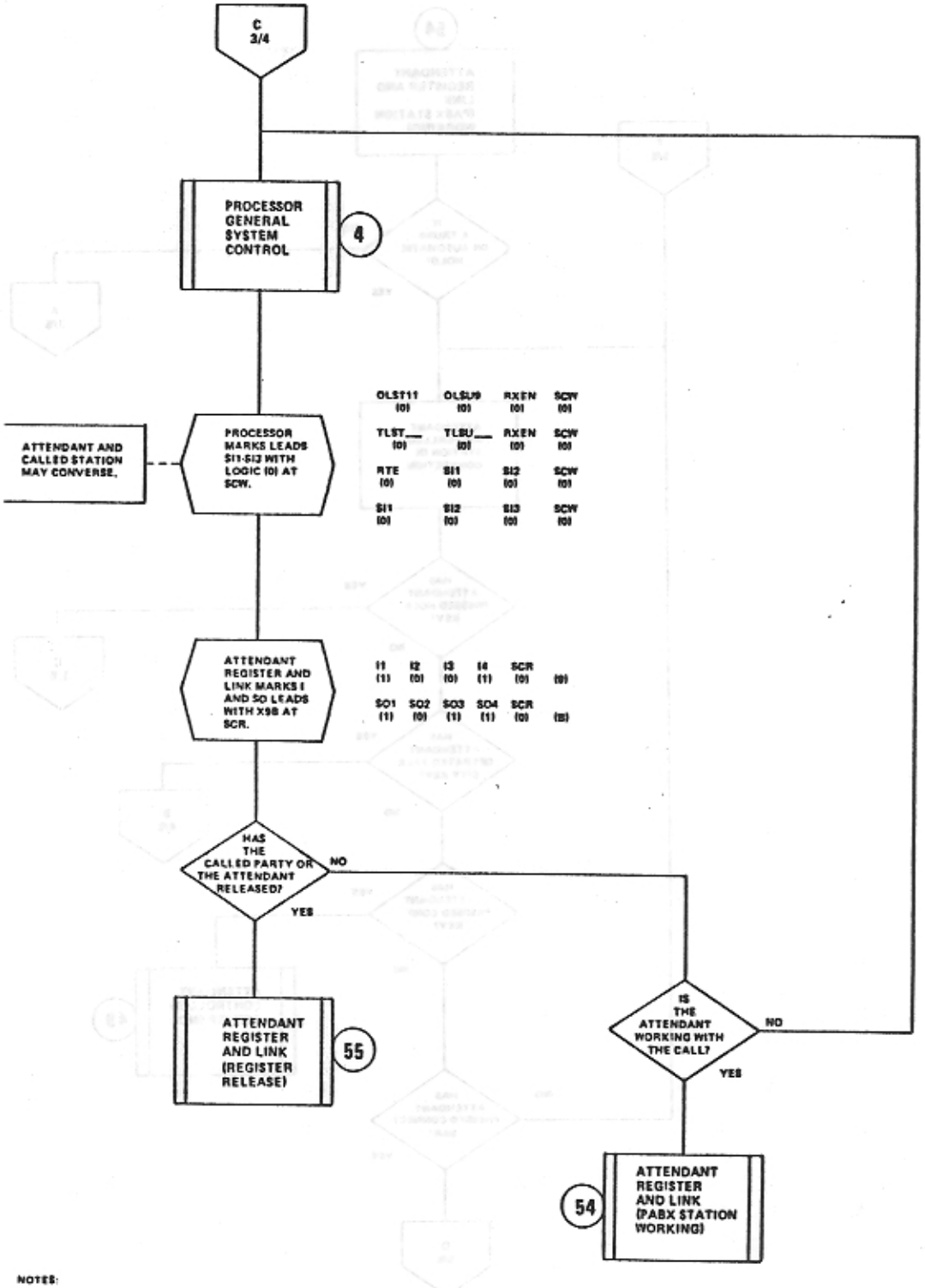


FIGURE A-1.52 Flow Chart 53, Attendant Register and Link (PABX Station Call) (Sheet 4 of 4)

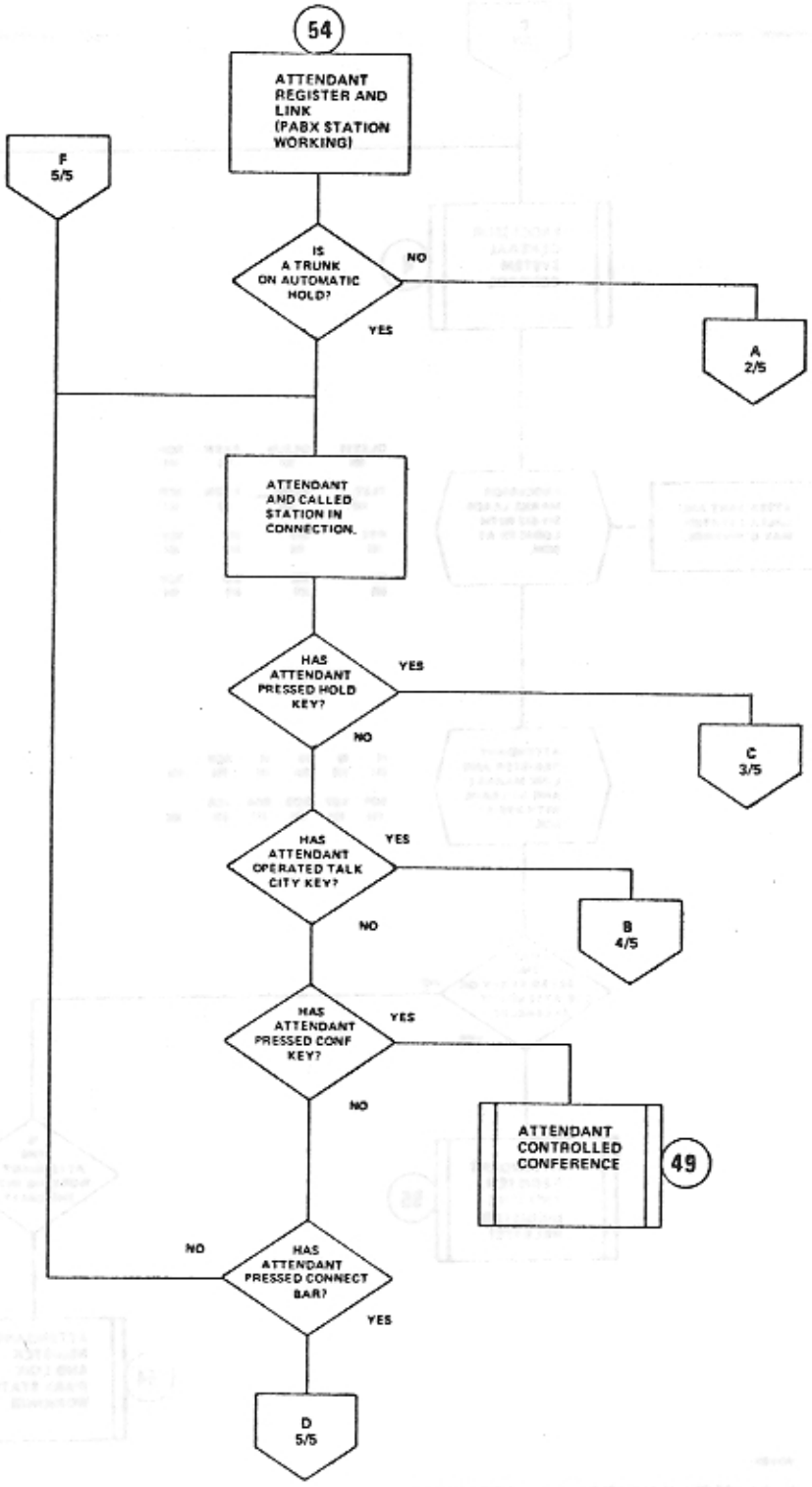
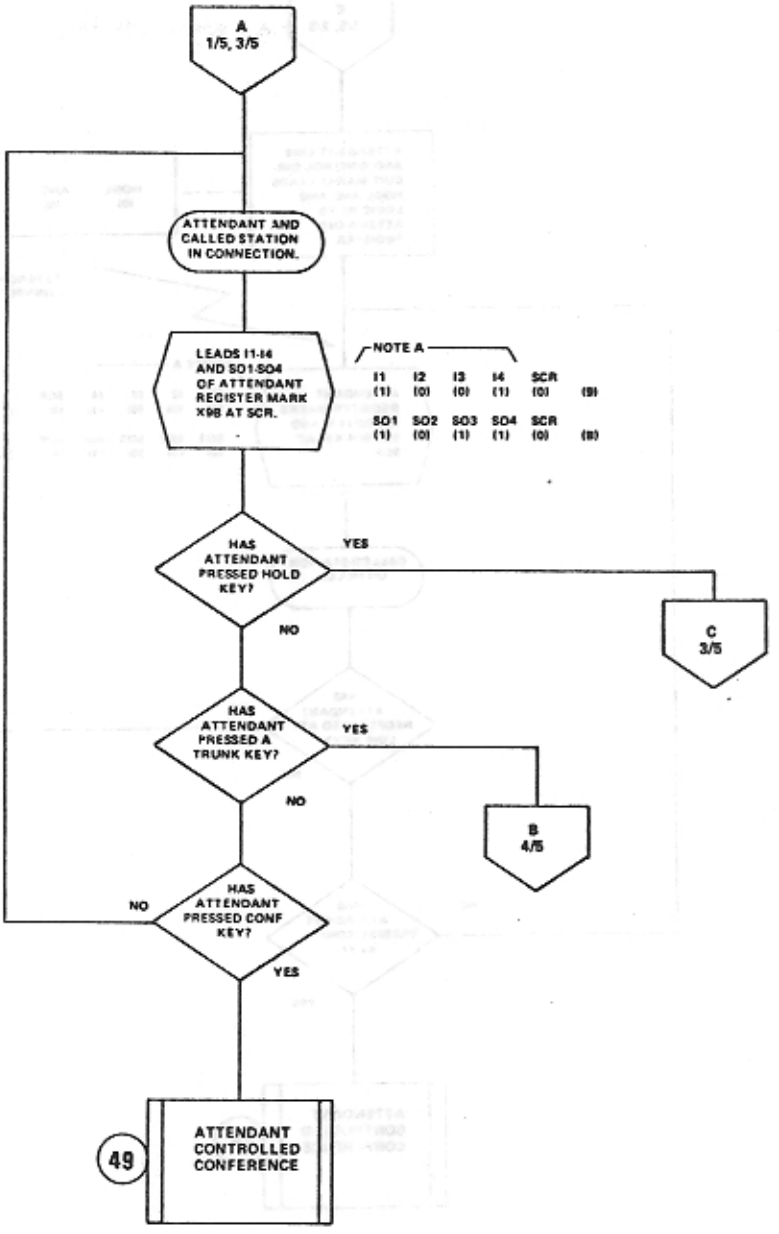


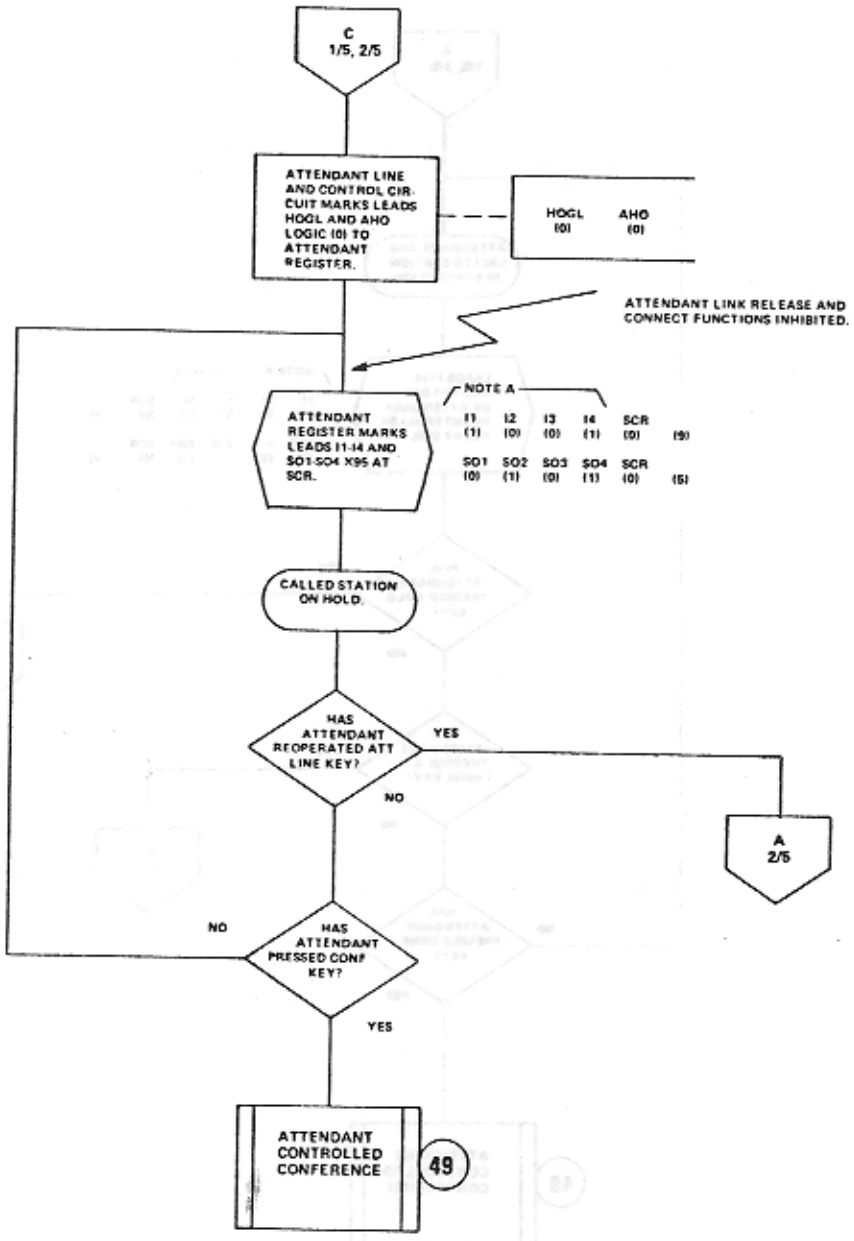
FIGURE A-1.53 Flow Chart 54, Attendant Register and Link (PABX Station Working) (Sheet 1 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 98.

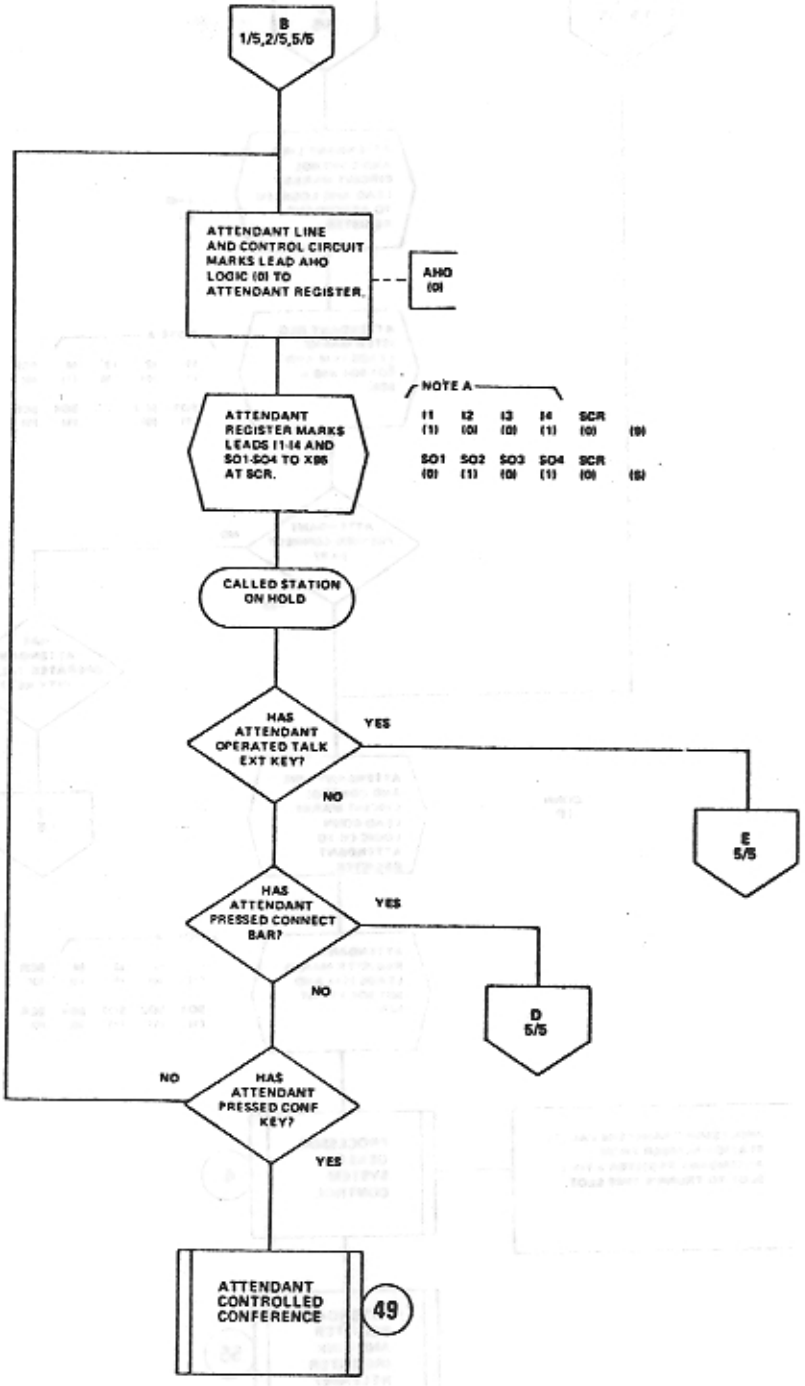
FIGURE A-1.53 Flow Chart 54, Attendant Register and Link (PABX Station Working) (Sheet 2 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 95.

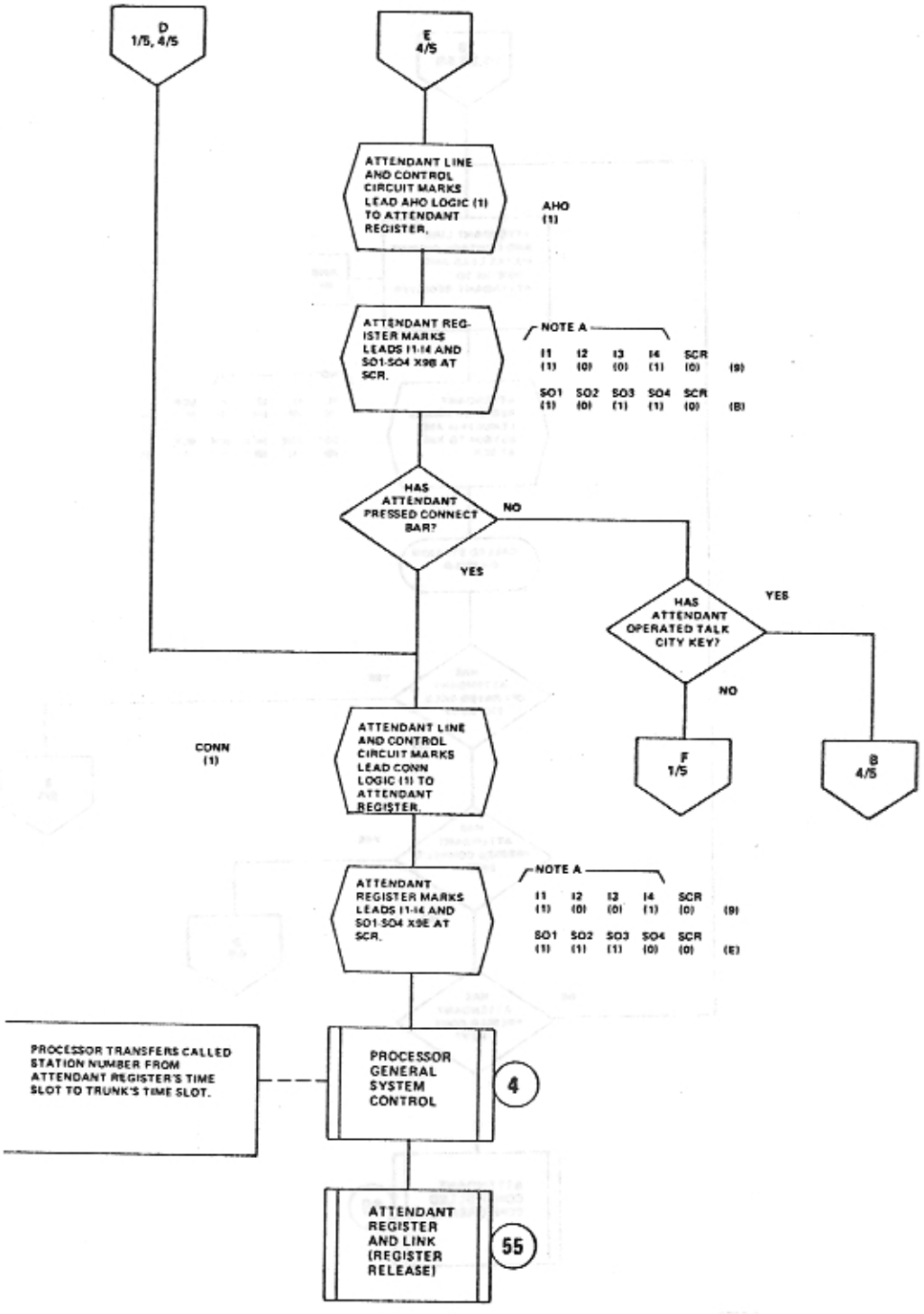
FIGURE A-1.53 Flow Chart 54, Attendant Register and Link (PABX Station Working) (Sheet 3 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGIT 95.

FIGURE A-1.53 Flow Chart 54, Attendant Register and Link (PABX Station Working) (Sheet 4 of 5)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENTS OF HEXADECIMAL DIGITS 9B AND 8E.

FIGURE A-1.53 Flow Chart 54, Attendant Register and Link (PABX Station Working) (Sheet 5 of 5)

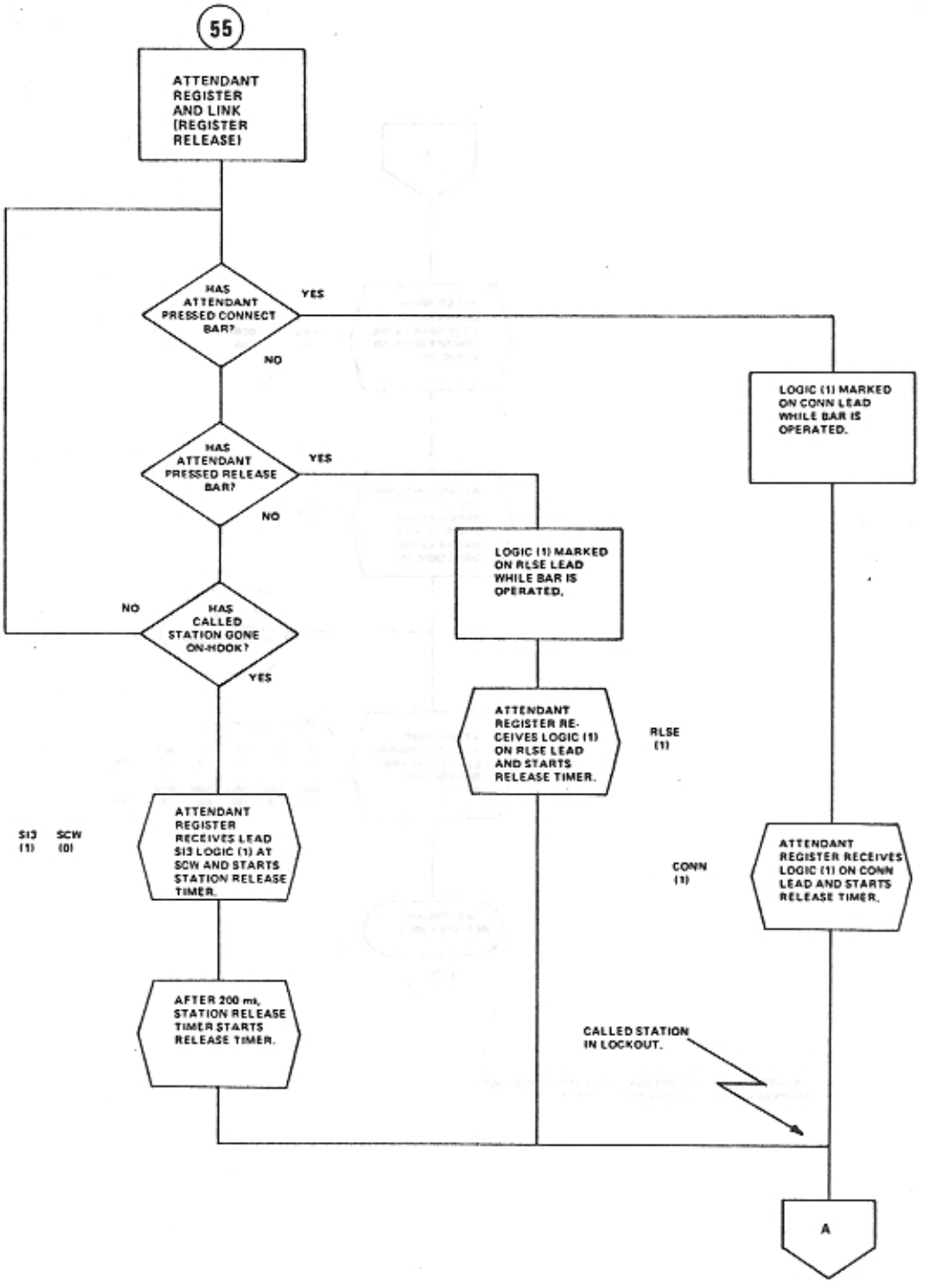
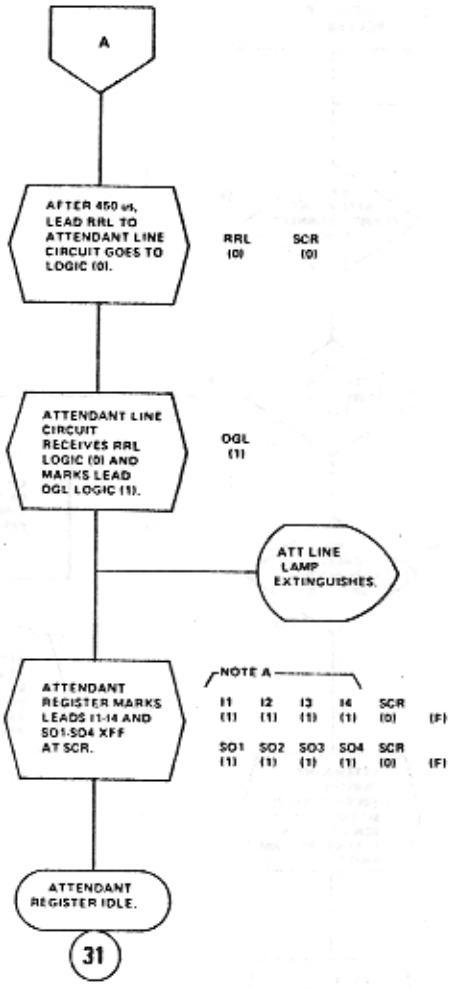


FIGURE A-1.54 Flow Chart 55, Attendant Register and Link (Register Release) (Sheet 1 of 2)



NOTES:

A. VALUES OF I1-I4 AND SO1-SO4 CORRESPOND TO BINARY EQUIVALENT OF HEXADECIMAL DIGIT FF.

FIGURE A-1.54 Flow Chart 55, Attendant Register and Link (Register Release) (Sheet 2 of 2)

POWER SUPPLY MAINTENANCE TEST PROCEDURES
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section provides a testing procedure and replacement instructions for the power supply and power supply control box for the TD-100 Electronic Private Automatic Branch Exchange. Also included are output voltage parameters for the power supply.

NOTE: Completion of this procedure necessitates shutdown of the TD-100 system.

2.00 POWER SUPPLY

2.01 Testing. The following paragraphs provide a step by step procedure for functionally testing the TD-100 power supply with minor variations in tolerances as noted in the associated tables. The test equipment required is a volt-ohmmeter (20,000 ohms per volt minimum). Perform the test as follows:

a. Remove the front cabinet cover.

b. Place the POWER switch on the power supply control box in the OFF position.

c. Remove the commercial AC service plug from the socket.

d. Remove the rear cabinet cover.

e. Remove the terminal block cover(s) from the three terminal blocks on the rear of the power supply.

f. Note that the three terminal blocks are designated, from left to right, A, B, and C. The left-most terminal on each block is designated number "1." Terminal block A has terminals 1 through 8; B has 1 through 12; C has 1 through 5 or 6.

g. From the front of the cabinet, pull all plug-in PCB's from the connectors, leaving them in the guide slots with the end of each board at least one inch from its connector on the motherboard.

h. Carefully check the connections at the power supply terminal blocks, the connections to the bus bar at the bottom rear of the cabinet, and the power connections at each board subrack. Confirm that the connections are secure, with no evidence of shorts.

i. Verify that the fuses on the power supply control box and the power supply are properly inserted, are of the correct size, and that there is no sign of damage to the fuse holders of the circuit breaker.

j. Plug the commercial AC service plug into the power receptacle.

WARNING: Dangerous voltages are now accessible at the rear of the cabinet. A protective cover is over the 117 VAC terminals, but exercise caution to avoid the possibility of shock.

k. Set the POWER switch to the ON position at the power supply control box. The POWER ON indicator on the control box must light.

l. Using the voltmeter (set to the appropriate scale), check the outputs of the power supply as outlined in table 1.00 (refer to figure 1.00). Also check the voltages at the motherboards as outlined in table 1.01 (refer to figure 1.01). Note that the ringing voltage may not be checked until the PCB's are reinserted.

m. Set the POWER switch to the OFF position.

n. Carefully reinsert all plug-in PCB's into the correct connector.

o. Set the POWER switch to the ON position. Momentarily operate the alarm RESET switch and verify that the power-on LED on each PCB lights. After approximately 8 seconds, verify that no alarm LED's on the alarm board are lit. The power supply LED should be lit. Check the ringing voltage per tables 1.00 and 1.01.

p. If any of the power supply LED's do not light, set the POWER switch to the OFF position. Remove all PCB's as described in step g. and, using the voltmeter (set to the appropriate scale), check the voltages at the power supply and at the mother boards as outlined in tables 1.00 and 1.01 (refer to figure 1.01).

NOTE: If the voltages for step p. are not present, operate the RESET button on the power supply control box and check again.

q. If voltages are not within given parameters, set the POWER switch to the OFF position. Check for loose or shorted connections on the rear of the power supply. Check for incorrect wire connections if the power supply has been replaced. Check for blown fuses or an open circuit breaker in the power supply.

r. When the power supply output voltages are within the given parameters, and after confirming that the POWER switch is in the OFF position, re-install the power supply terminal block covers.

s. Confirm that all PCB's are correctly inserted into their connectors.

t. Place the POWER switch in the ON position and momentarily operate the alarm RESET switch. The power supply should be functional.

2.02 Replacement. The following paragraphs provide a step by step procedure for replacing the TD-100 power supply. Perform the following steps:

a. Remove the front cabinet cover.

b. Place the POWER switch on the power supply control box in the OFF position.

c. Remove the commercial AC service plug from the socket.

d. Remove the rear cabinet cover.

e. Remove the terminal block cover(s) from the three terminal blocks on the rear of the power supply.

f. Note the position of each wire connected to each terminal block, A through C. The terminals on each block are counted from left to right with the left-most terminal on each block being designated number 1.

TABLE 1.00 Power Supply Tests - Terminal Location

STEP	VOLTAGE	TERMINAL BLOCK	POSITION	TOLERANCE
1.	-48.0 VDC	A	Measure between terminals 1 and 2.	-48.0 ± 6.0 VDC (ANY LOAD 0 - 100%)
2.	+24.0 VDC	A	Measure between terminals 5 and 6.	+24.0 ± 1.2 VDC (ANY LOAD 25 - 100%, NO LOAD MAX. 26.8 VDC)
3.	+24.0 VDC	A	Measure between terminals 7 and 8.	+24.0 ± 2.4 VDC (ANY LOAD 25 - 100%, NO LOAD MAX. 26.8 VDC)
4.	+12.0 VDC	A	Measure between terminals 3 and 4.	½ of measurement at step 2 ± 2%
5.	+5.0 VDC	B	Measure between terminals 2 and 7.	5.15 to 5.7 VDC (ANY LOAD 25 - 100%, NO LOAD 5.9 V MAX)
6.	+5.0 VDC	B	Measure between terminals 3 and 6.	5.15 to 5.7 VDC (ANY LOAD 25 - 100%, NO LOAD. 5.9 V MAX)
7.	+5.0 VDC	B	Measure between terminals 4 and 5.	5.15 to 5.7 VDC (ANY LOAD 25 - 100% NO LOAD 5.9 V MAX)
8.	115 VAC*	B	Measure between terminals 10 and 12.	95 to 128 VAC* (59.7 to 60.3 Hz)
9.	+12.0 VDC	C	Measure between terminals 1 and 2.	9 to 15 VDC (ANY LOAD 0 - 100%)
10.	90 VAC (Ringing may not be present with PCB's extracted)	C	Measure between terminals 3 and 4.	100 V RMS (MAX) to 75 V RMS (MIN) For No Load to Full Load. (18 - 22 Hz)
11.	90 VAC †	C	Measure between terminal 6 and ground.	100 V RMS (MAX) to 75 V RMS (MIN) For No Load to Full Load. (18 - 22 Hz)

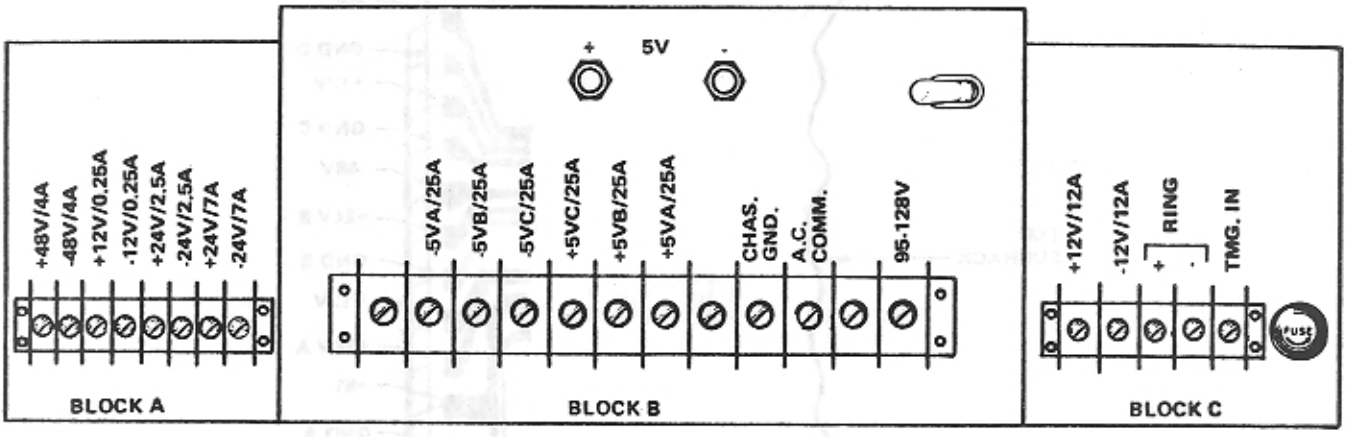
*NOTE: With Lorain power supply only, voltage may be between 185 and 254 VAC and the frequency may vary from 47 to 63 Hz, depending upon locally available power and the position of the AC input voltage adjustment plug.

†NOTE: Lorain export model only.

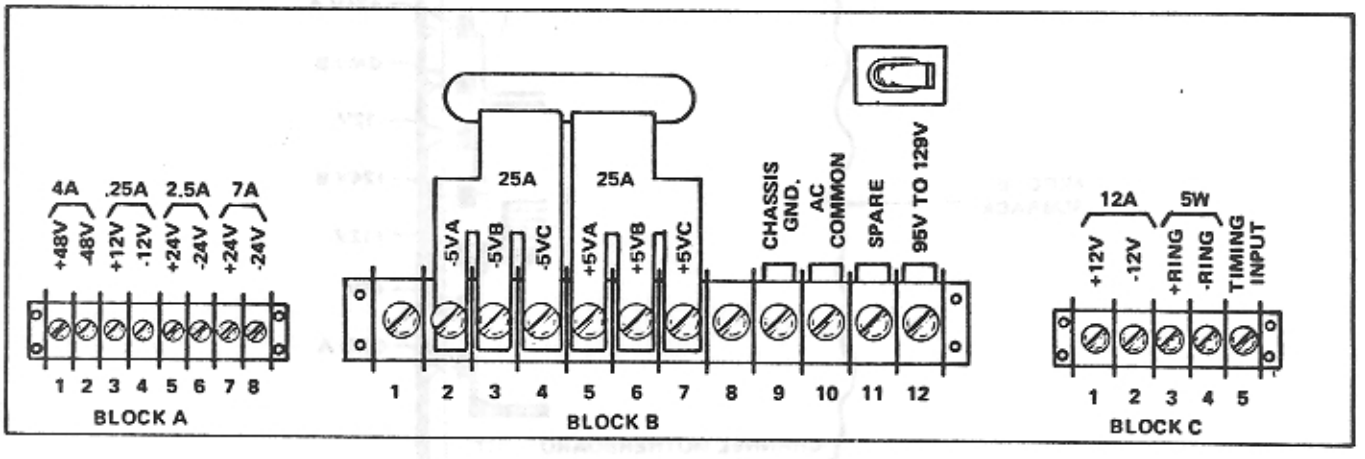
TABLE 1.01 Motherboard Voltages

STEP	VOLTAGE	TEST LOCATION		POWER SUPPLY TOLERANCE
		SUBRACK	TEST POINTS	
1.	+5.0 VDC	Top	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
2.	+24.0 VDC	Top	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
3.	+24.0 VDC	Top	+24 V B and GND C	+ 24.0 ± 2.4 VDC (no load 26.8 V max.)
4.	+12.0 VDC	Top	+12 V A and GND B	½ of measurement at step 2
5.	-48.0 VDC	Top	-48 V and GND C	-48.0 ± 6.0 VDC
6.	+12 VDC	Top	+12 V B and GND D	+12.0 ± 3 VDC
7.	+5.0 VDC	Middle	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
8.	+24.0 VDC	Middle	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
9.	+12.0 VDC	Middle	+12 V A and GND B	½ of measurement at step 8
10.	-12.0 VDC	Middle	-12 V and GND A	-12.0 ± 0.6 VDC
11.	+24.0 VDC	Middle	+24 V B and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
12.	+5.0 VDC	Bottom	+5 V and GND A	4.75 V to 5.7 VDC (no load 5.9 V max.)
13.	+12.0 VDC	Bottom	+12 V A and GND B	½ of measurement at step 8
14.	+24.0 VDC	Bottom	+24 V B and GND C	+24.0 ± 2.4 VDC (no load 26.8 V max.)
15.	+24.0 VDC	Bottom	+24 V A and GND B	+24.0 ± 2.4 VDC (no load 26.8 V max.)
16.	-48.0 VDC	Bottom	-48 V and GND C	-48 ± 6.0 VDC
17.	90 VAC	Top	RB and GND D	100 V to 75 V RMS
18.	90 VAC	Top	RK (Pin 35A) and GND D	100 V to 75 V RMS
19.	90 VAC	Bottom	RB and GND C	100 V to 75 V RMS

REAR VIEW OF 4200341 (POWER MATE) POWER SUPPLY



REAR VIEW OF 4200340 (NORTH) POWER SUPPLY



REAR VIEW OF 4200419 (LORAIN) POWER SUPPLY

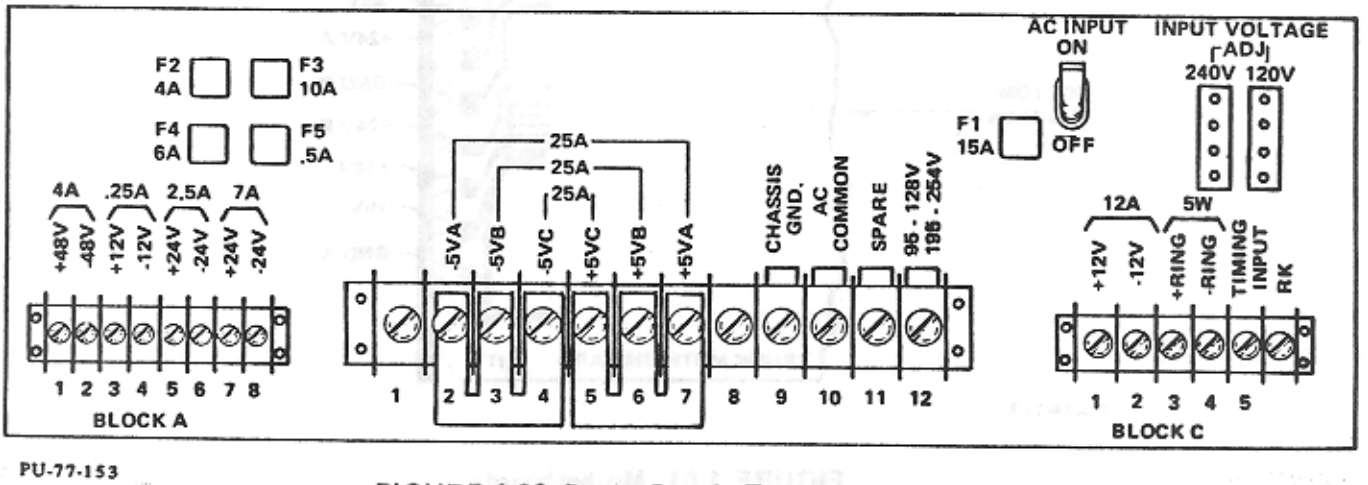


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FIGURE 1.00 Power Supply Terminal Blocks

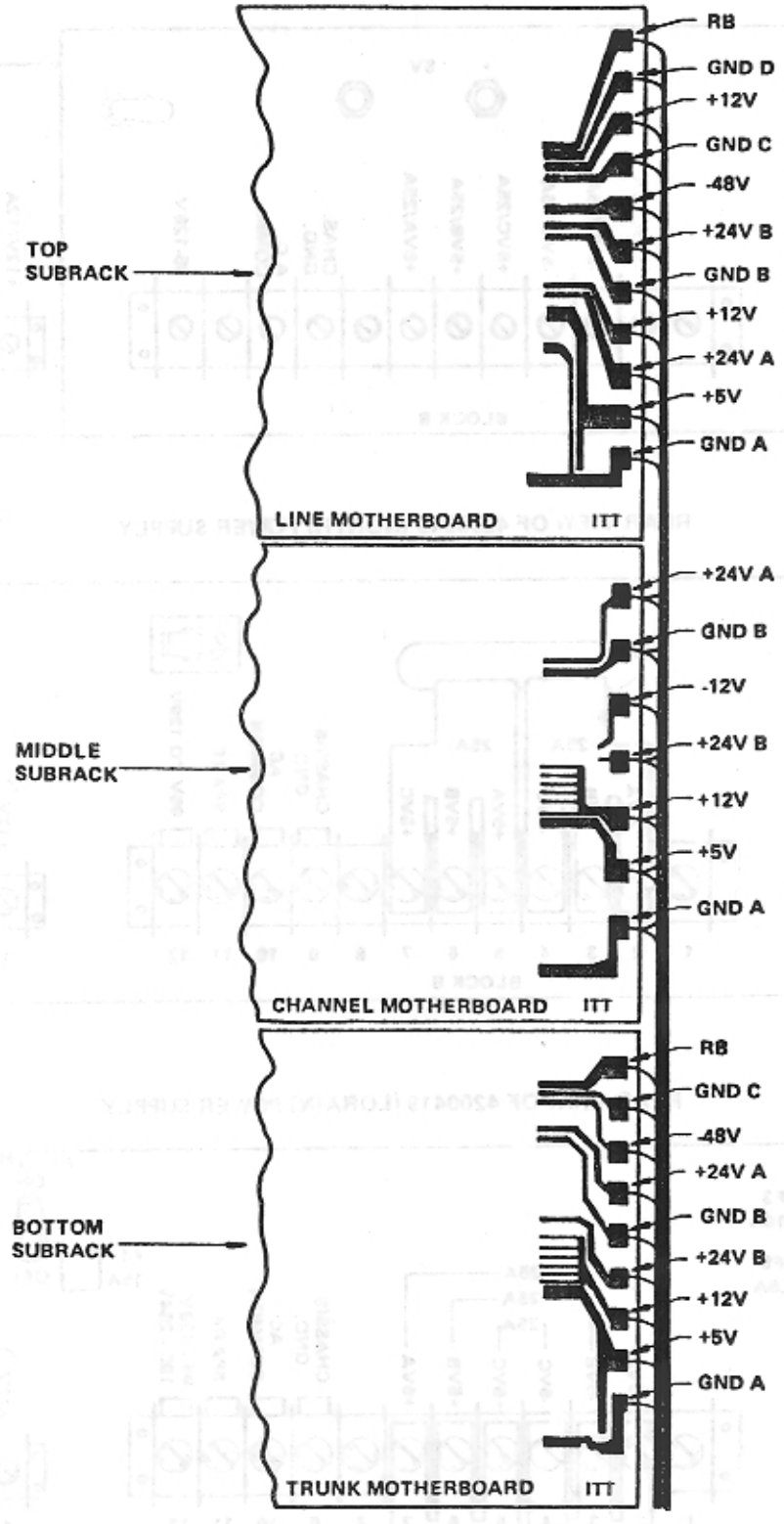

FIGURE 1.01 Motherboards

g. If each wire connected to the power supply does not have a numbered label attached to it, labels should be made and attached. Number the labels beginning with "1" for each terminal block: 1 through 8 for block A, 1 through 12 for block B, and 1 through 5 or 6 for block C.

h. At block A, terminal 1, loosen the screw, remove all wires and, if not already provided, attach the appropriate label (prepared in step g.) to the wire(s).

NOTE: Remove only the power supply end of each wire.

i. Repeat step h. for each terminal on each block. Attach the labels to each freed wire end before advancing (from left to right) to the next terminal. Note there is one wire that breaks from the cable at the lower right side that is not presently used; the terminal lug on the end at this wire is taped and should not be unwrapped.

j. All power supply terminals should now be free of wires. At the front of the cabinet, remove the four slot head screws and cup washers that hold the power supply in the cabinet frame. If the lower left front cabinet cover retaining stud is located in front of the power supply, remove it at this time.

k. At the rear of the power supply, remove the two power supply hold down screws. Note that a long bladed (slot type) screwdriver should be used.

l. The power supply should now be completely detached from (but still in) the cabinet.

NOTE: The bail handles on the front of the power supply may be used to pull the power supply toward the front of the cabinet, but should not be used to lift the entire power supply.

Slide the power supply toward the front of the cabinet and, with an assistant, lift it from the cabinet.

m. With an assistant, lift the replacement power supply into the cabinet and slide it into position.

n. Re-install the two hold down screws at the rear of the power supply.

o. Re-install the four retaining screws and cup washers at the front of the power supply. If it was removed in step j., replace the lower left front cabinet cover retaining stud.

p. Beginning at block A, terminal 1, and working from left to right, reconnect the wires to the appropriate terminals. Work carefully to avoid placing wires on incorrect terminals and omitting wires. (Do not connect the spare wire described in paragraph 2.02, step i.) Tighten all terminal screws securely; all wire labels should be removed if field-installed.

q. Re-install the three terminal block covers and the cabinet covers if post-installation testing is not to begin immediately.

CAUTION: Do not reconnect the AC power source or place the power switch in the ON position until time for post-installation testing.

If testing is to begin immediately, go to the power supply test procedure, paragraph 2.01, step g.

3.00 POWER SUPPLY CONTROL BOX

3.01 Testing. The following paragraphs provide a step by step procedure for functionally testing the TD-100 power supply control box. The test equipment required is a volt-ohmmeter (20,000 ohms per volt minimum). Perform the test as follows:

a. Remove the front cabinet cover.

b. Place the POWER switch on the power supply control box in the OFF position.

c. Remove the commercial AC service plug from the socket.

d. Remove the rear cabinet cover.

e. Remove the terminal block cover from the three terminal blocks on the rear of the power supply control box.

f. Note, as shown in figure 1.02, 1.03, or 1.04 (as required), that the three terminal blocks are designated, from left to right, 1, 2, and 3. The top-most terminal on each block is designated number "1." Each terminal block has terminals 1 through 14.

g. From the front of the cabinet, pull all plug-in PCB's from the connectors, leaving them in the guide slots with the end of each board at least one inch from its connector on the motherboard.

h. Carefully check the connections at the power supply control box terminal blocks, the connections to the bus bar at the bottom rear of the cabinet, and the power connections at each board subrack. Confirm that the connections are secure, with no evidence of shorts.

i. Verify that the fuses on the power supply control box and the power supply are properly inserted, are of the correct size, and that there is no sign of damage to the fuse holders or the circuit breaker.

j. Plug the commercial AC service plug into the power receptacle.

WARNING: Dangerous voltages are now accessible at the rear of the cabinet. Exercise caution to avoid the possibility of shock.

k. Set the POWER switch to the ON position at the power supply control box. The green POWER ON indicator on the control box must light.

l. Using the voltmeter (set to the appropriate scale), check the outputs of the power supply control box as outlined in table 1.02, 1.03, or 1.04 as required. (Also check the voltages at the motherboards as outlined in table 1.01. Refer to figure 1.01.

m. Set the POWER switch to the OFF position.

n. Carefully insert all plug-in PCB's into the correct connector.

o. Set the POWER switch to the ON position. Momentarily operate the alarm RESET switch and verify that the power-on LED on each PCB lights. After approximately 8 seconds, verify that no alarm LED's on the alarm board are lit. The power supply LED's should be lit.

p. If the power supply LED's do not light, set the POWER switch to the OFF position. Remove all PCB's as described in step g. and, using the voltmeter (set to the appropriate scale), check the voltages at the power supply, the power supply control box, and at the motherboards as outlined in tables 1.00, 1.01, 1.02, 1.03, or 1.04 as required.

NOTE: If the voltages for step p. are not present, operate the RESET button on the power supply control box and check again.

q. If voltages are incorrect, set the POWER switch to the OFF position. Check for loose or shorted connections on the rear of the power supply and power supply control box. Check for incorrect wire connections if the power supply control box has been replaced. Check for blown fuses or an open circuit breaker in the power supply.

r. When the power control box supply output voltages are correct, and after confirming that the POWER switch is in the OFF position, re-install the power supply control box terminal block cover.

s. Confirm that all PCB's are correctly inserted into their connectors.

t. Place the POWER switch in the ON position and momentarily operate the alarm RESET switch. The power supply and power supply control box should be functional.

TABLE 1.02 Power Supply Control Box Tests (TD-4101766-003 and earlier)

STEP	VOLTAGE/CONTINUITY	MEASURE BETWEEN
1.	0 VAC	TB1 terminal 14 and ground.
2.	117 VAC	TB1 terminal 12 and TB1 terminal 13.
3.	117 VAC	TB1 terminal 12 and TB1 terminal 11.
4.	117 VAC	TB3 terminal 7 and TB3 terminal 5.
5.	100 VAC (30 Hz) (not present with PCB's pulled)	TB2 terminal 14 and ground.
6.	10 VAC	TB1 terminal 8 and TB1 terminal 9.
7.	+24 VDC	TB2 terminal 7 and ground.
8.	+24 VDC	TB1 terminal 7 and ground.
9.	+24 VDC (pulsating, on 3 seconds and ground 1 second)	TB2 terminal 13 and ground.
10.	+10 VDC	TB1 terminal 1 and ground.
11.	+10 VDC	TB1 terminal 2 and ground.
12.	+10 VDC	TB3 terminal 1 and ground.
13.	+10 VDC	TB2 terminal 5 and ground.
14.	+10 VDC	TB2 terminal 8 and ground.
15.	+10 VDC	TB2 terminal 9 and ground.
16.	-12 VDC	TB1 terminal 4 and ground.
17.	Ground	TB2 terminal 2 and ground.
18.	Open	TB2 terminal 1 and ground.
19.	Ground	TB1 terminal 3 and ground.
20.	Ground	TB3 terminal 3 and ground.
21.	Open	TB3 terminal 4 and ground.
22.	Open	TB2 terminal 4 and ground.
23.	Shorted	TB3 terminal 4 and TB2 terminal 4.
24.	Shorted	TB2 terminal 3 and TB3 terminal 8.

3.02 Replacement. The following paragraphs provide a step by step procedure for replacing the TD-100 power supply control box. Perform the following steps:

a. Remove the front cabinet cover.

b. Place the POWER switch on the power supply control box in the OFF position.

c. Remove the commercial AC service plug from the socket.

d. Remove the rear cabinet cover.

e. Remove the terminal block cover from the three terminal blocks on the rear of the power supply control box.

f. Note the position of each wire connected to each terminal block, 1 through 3. The terminals on each block are counted from top to bottom with the top-most terminal on each block being designated number 1.

g. If each wire connected to the power supply control box does not have a numbered label attached to it, labels should be made and attached. Number the labels beginning with "1" for each terminal block and prepare labels only for those terminals with wire(s) attached.

h. At block 1, terminal 1, loosen the screw, remove all wires and, if not already provided, attach the appropriate label (prepared in step g.) to the wire(s).

TABLE 1.03 Power Supply Control Box Tests (TD-4101766-004)

STEP	VOLTAGE/CONTINUITY	MEASURE BETWEEN
1.	0 VAC	TB1 terminal 14 and ground
2.	117 VAC	TB1 terminal 12 and TB1 terminal 13.
3.	117 VAC	TB1 terminal 12 and TB1 terminal 11.
4.	117 VAC	TB1 terminal 10 and TB1 terminal 11.
5.	117 VAC	TB3 terminal 6 and TB3 terminal 5.
6.	100 VAC (30 Hz) (not present with PCB's pulled)	TB2 terminal 14 and ground.
7.	10 VAC	TB1 terminal 8 and TB1 terminal 9.
8.	+24 VDC	TB2 terminal 7 and ground.
9.	+24 VDC	TB1 terminal 7 and ground.
10.	+24 VDC (pulsating, on 3 seconds and ground 1 second)	TB2 terminal 13 and ground.
11.	+10 VDC	TB1 terminal 1 and ground.
12.	+10 VDC	TB1 terminal 2 and ground.
13.	+10 VDC	TB3 terminal 1 and ground.
14.	+10 VDC	TB2 terminal 5 and ground.
15.	+10 VDC	TB2 terminal 8 and ground.
16.	+10 VDC	TB2 terminal 9 and ground.
17.	-12 VDC	TB1 terminal 4 and ground.
18.	Ground	TB2 terminal 2 and ground.
19.	Open	TB2 terminal 1 and ground.
20.	Ground	TB1 terminal 3 and ground.
21.	Ground	TB3 terminal 3 and ground.
22.	Open	TB3 terminal 4 and ground.
23.	Open	TB2 terminal 4 and ground.
24.	Shorted	TB3 terminal 4 and TB2 terminal 4.
25.	Shorted	TB2 terminal 3 and TB2 terminal 6.
26.	-48 VDC	TB4 terminal 2 and ground.
27.	-48 VDC	TB3 terminal 12 and ground.
28.	Ground	TB3 terminal 14 and ground.

NOTE: Remove only the power supply control box end of each wire.

i. Repeat step h. for each terminal on each block. Attach the labels to each freed wire end before advancing (from top to bottom) to the next terminal.

j. All power supply control box terminals should now be free of wires. At the front of the cabinet, remove the four slot head screws and cup washers that hold the power supply control box in the cabinet frame. If the lower right front cabinet cover retaining stud is located in front of the power supply control box, remove it at this time.

k. At the rear of the power supply, remove the power supply control box hold down screw.

l. The power supply control box should now be completely detached from (but still in) in the cabinet.

TABLE 1.04 Power Supply Control Box Tests (TD-4101766-005)

STEP	VOLTAGE/CONTINUITY	MEASURE BETWEEN
1.	0 VAC	TB1 terminal 14 and ground.
2.	Primary Input	TB1 terminal 12 and TB1 terminal 13.
3.	Primary Input	TB1 terminal 12 and TB1 terminal 11.
4.	Primary Input	TB1 terminal 10 and TB1 terminal 11.
5.	½ Primary Input	TB3 terminal 6 and TB3 terminal 5.
6.	Primary Input	TB3 terminal 8 and ground.
7.*	Primary Input	TB3 terminal 9 and ground.
8.*	Primary Input	TB3 terminal 13 and ground.
9.†	Primary Input	TB3 terminal 7 and ground.
10.†	½ Primary Input	TB3 terminal 9 and ground.
11.†	½ Primary Input	TB3 terminal 10 and ground.
12.†	Primary Input	TB3 terminal 11 and ground.
13.†	½ Primary Input	TB3 terminal 13 and ground.
14.†	½ Primary Input	TB3 terminal 14 and ground.
15.	Primary Input	TB3 terminal 12 and ground.
16.	-48 VDC	TB4 terminal 2 and ground.
17.	10 VAC	TB1 terminal 8 and TB1 terminal 9.
18.	+24 VDC	TB2 terminal 7 and ground.
19.	+24 VDC	TB1 terminal 7 and ground.
20.	+24 VDC (pulsating, on 3 seconds and ground 1 second)	TB2 terminal 13 and ground.
21.	+10 VDC	TB1 terminal 1 and ground.
22.	+10 VDC	TB1 terminal 2 and ground.
23.	+10 VDC	TB3 terminal 1 and ground.
24.	+10 VDC	TB2 terminal 5 and ground.
25.	+10 VDC	TB2 terminal 8 and ground.
26.	+10 VDC	TB2 terminal 9 and ground.
27.	-12 VDC	TB1 terminal 4 and ground.
28.	Ground	TB2 terminal 2 and ground.
29.	Open	TB2 terminal 1 and ground.
30.	Ground	TB1 terminal 3 and ground.
31.	Ground	TB3 terminal 3 and ground.
32.	Open	TB3 terminal 4 and ground.
33.	Open	TB2 terminal 4 and ground.
34.	Shorted	TB3 terminal 4 and TB2 terminal 4.
35.	Shorted	TB2 terminal 3 and TB2 terminal 6.

*NOTE: Potential present only when primary input is in 117 VAC range.

†NOTE: Potential present only when primary input is in 234 VAC range.

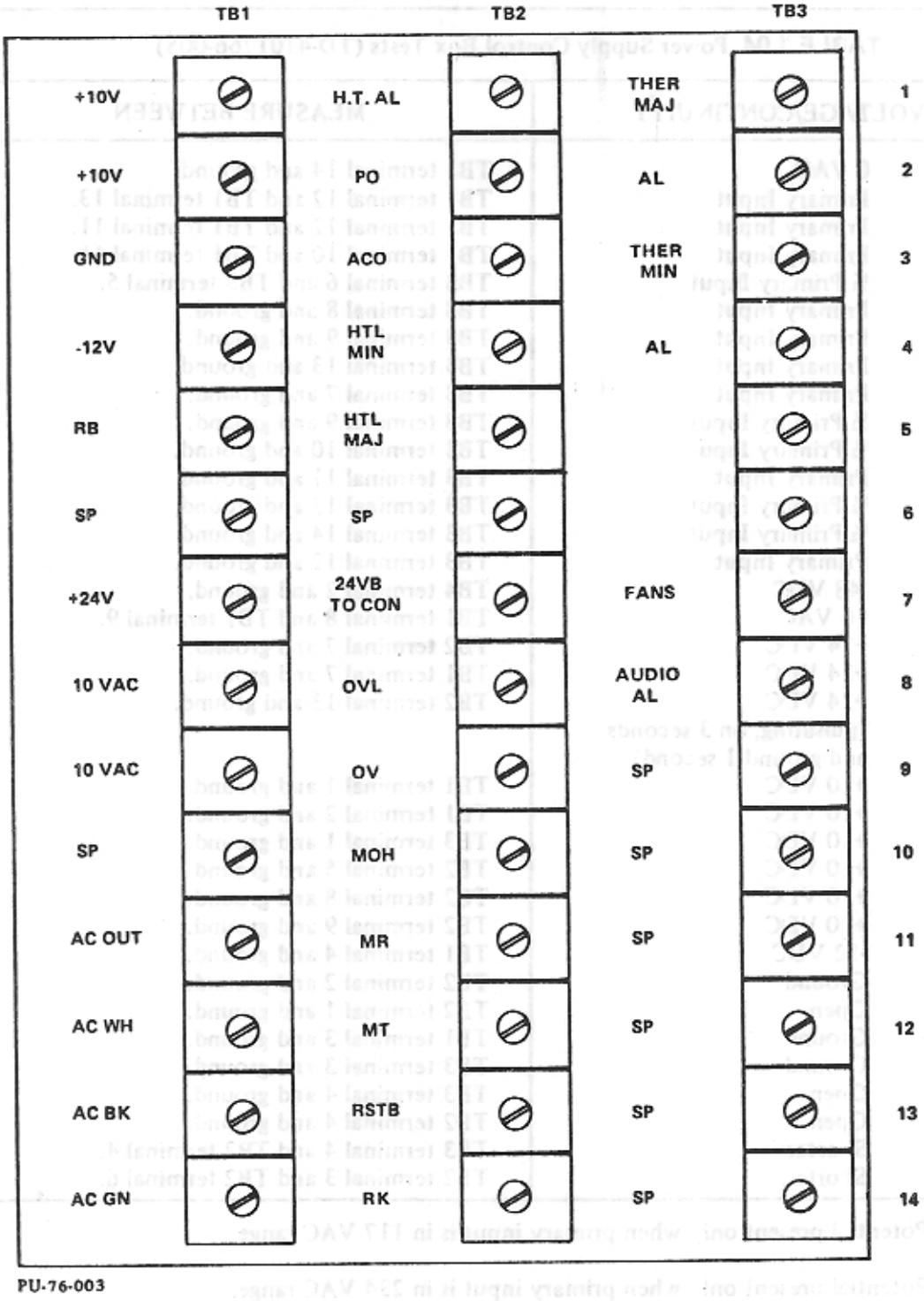

FIGURE 1.02 Power Supply Control Box Terminals (TD-4101766-003 and earlier)

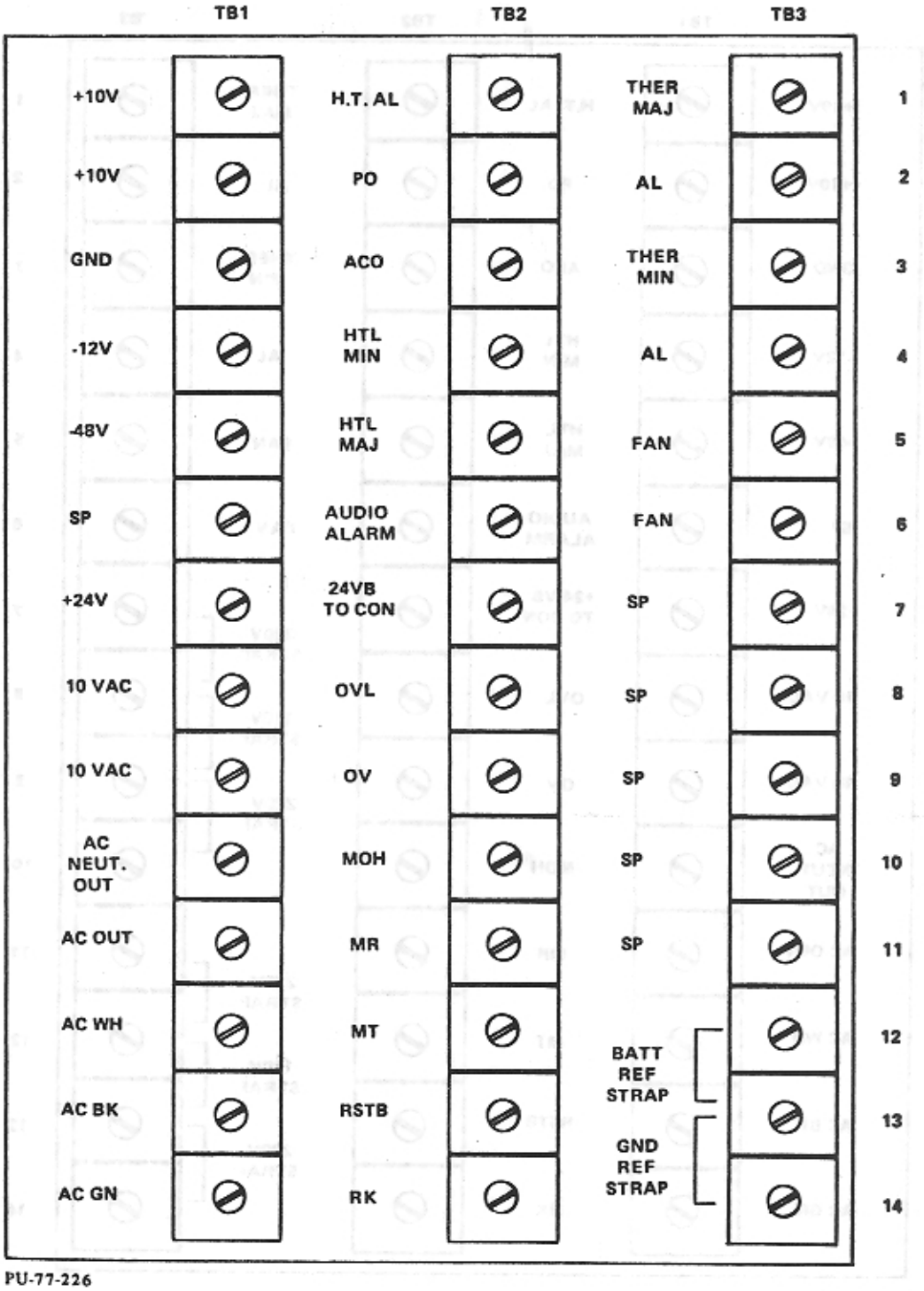

FIGURE 1.03 Power Supply Control Box Terminals (TD-4101766-004)

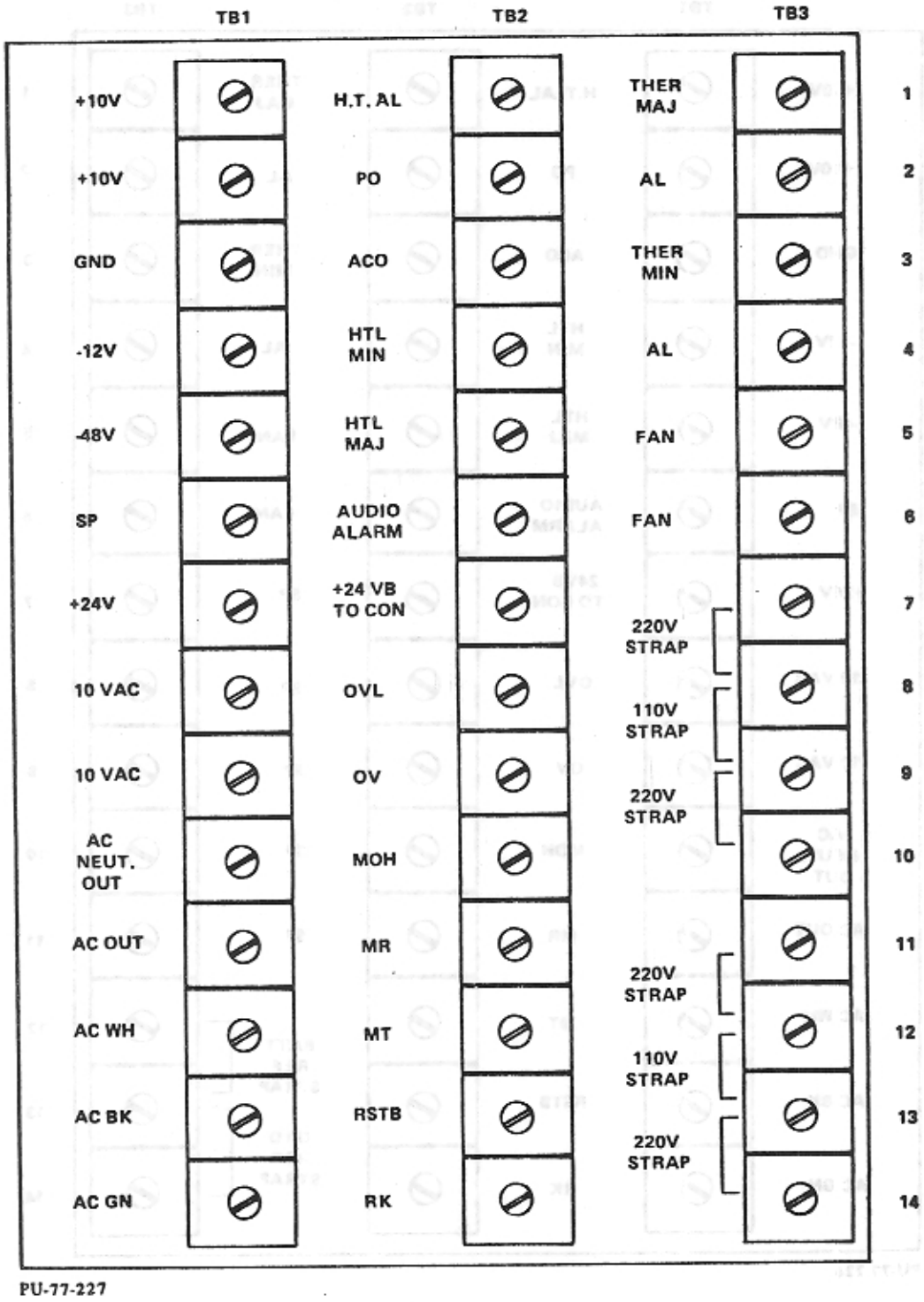

FIGURE 1.04 Power Supply Control Box Terminals (TD-4101766-005)

NOTE: The bail handles on the front of the power supply control box may be used to pull it toward the front of the cabinet, but should not be used to lift the entire power supply control box.

Slide the power supply control box toward the front of the cabinet and lift it from the cabinet.

m. Lift the replacement control box into the cabinet and slide it into position.

n. Re-install the hold down screw at the rear of the power supply control box.

o. Re-install the four retaining screws and cup washers at the front of the power supply control box. If it was removed in step j., replace the lower right front cabinet cover retaining stud.

p. Beginning at block 1, terminal 1, and working from top to bottom, reconnect the wires to the appropriate terminals. Work carefully to avoid placing wires on incorrect terminals and omitting wires. Tighten all terminal screws securely; all wire labels should be removed if field-installed.

q. Re-install the terminal block cover and the cabinet covers if post-installation testing is not to begin immediately.

CAUTION: Do not reconnect the AC power source or place the power switch in the ON position until time for post-installation testing.

If testing is to begin immediately, go to the power supply control box test procedure, paragraph 3.01, step g.

PCB COMPATIBILITY GUIDE

TD-100

ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 INTRODUCTION

1.01 Purpose of Section. This section serves as a compatibility guide for TD-100 EPABX printed circuit boards (PCB's) and subassemblies. It is provided to familiarize maintenance personnel with known areas of PCB and feature incompatibility, to eliminate the possibility of incurring system malfunction due to the use of incompatible PCB's, and to assist in identifying usable spare PCB's.

This section provides compatibility data on PCB's most widely used in TD-100 systems. It includes a cross-reference between assembly and schematic numbers, and where applicable, gives minimum recommended schematic and assembly issues. The following major areas of compatibility are discussed.

a. PCB's and features that are not compatible.

b. PCB's and features that are compatible only at a particular issue level.

c. PCB's and features necessitating modification kits for compatibility.

d. PCB's and features that are compatible only if the processor PROM's are of a particular issue level.

2.00 IDENTIFYING TD-100 ASSEMBLIES

2.01 General. To make use of the compatibility information in paragraph 3.00 of this section, maintenance personnel must be able to determine the level of motherboards in the equipment cabinet and the level and issue of the plug-in line, trunk, and channel PCB's. In some cases, it may also be necessary to determine the issue of the PROM's on the processor 1 and processor 2 PCB's. Information for determining motherboard, PCB, and PROM identity and issue levels is provided in the following paragraphs.

2.02 Motherboards. Currently, all TD-100 systems are equipped with trunk motherboards numbered TD-4101506-002 or TD-4101506-003, line motherboards numbered TD-4101566-002 or TD-4101566-003, and channel motherboards numbered TD-4101716-002 or TD-4101716-003. The three motherboards in a given cabinet will always have the same assembly level suffix. The title and assembly number (with level suffix) is etched on the lower edge of each motherboard and can be seen when the rear cabinet door is removed. The issue of each motherboard is stamped, in black ink, to the right of the assembly number.

> NOTE: In some cabinets, the shelf wiring may cover the identification data on the motherboards. In such cases, the wiring at the lower right hand edge of the board should be carefully separated to reveal the assembly number and issue of the motherboard.

2.03 Printed Circuit Boards (PCB's). Etched on each TD-100 PCB assembly is a board title, assembly number, and circuit number. The assembly number is a seven-digit number ending in "6" and followed by a three-digit level suffix (-001, -002, etc.). The schematic or circuit number is a seven-digit number ending in "7" and also followed by a three-digit level suffix. The first six digits of the assembly and schematic numbers are identical. (In some cases, only the last three digits of the schematic number are etched on the PCB. The number is readily identifiable as it ends in "7.") Immediately to the right of the assembly and schematic numbers, a one- or two-letter (alpha-

betic) designation is stamped in black ink. These letters correspond to the assembly and schematic issues.

On multiboard assemblies such as the Tel-Touch register (dial pulse register PCB with piggyback Tel-Touch receiver PCB), a three-digit number (100) is stamped on the parent board indicating it is part of a two-board assembly.

2.04 PROM's. There are two programmable read only memories (PROM's) on the processor 1 PCB and three PROM's on the processor 2 PCB. Each PROM is matched by its programming to a particular position on the respective processor PCB. A two-character (one number, one letter) designation appears on each PROM. The letter corresponds to the issue to which the PROM has been programmed; the number indicates the position of the PROM on the PCB. For example, the designation "2R" means that the PROM is programmed according to issue R for the PROM 2 position.

NOTE: It is absolutely essential that all PROM's on the processor 1 and processor 2 PCB's be programmed at the same issue.

3.00 COMPATIBILITY DATA

3.01 General. In the following paragraphs, all known compatibility data for each currently used TD-100 PCB is provided. Where applicable, minimum recommended assembly and schematic issue levels and modification kit numbers are listed. Where no information follows an assembly subheading, there are no known compatibility problems.

3.02 Trunk Motherboard, TD-4101506.

a. Assembly TD-4101506-002 (Schematic TD-4101507-002).

1. Not compatible with:

(a) Room Number Translator TD-4102946-001.

(b) Recorder Disconnect PCB TD-4102956-001.

(c) CFFM, BL, DA, and ANA PCB TD-4103086-001.

(d) Access Test Set TD-4103206-001.

(e) 2-Way Loop DID Trunk TD-4103266-001.

(f) 2-Way E & M DID Trunk TD-4103276-001.

(g) Executive Access TD-4103346-001.

(h) DID Number Translator TD-4103456-001.

(i) DID and Number Translator TD-4103546-001.

(j) Quad Transfer Trunk/Station Add-on Links TD-4104066.

(k) Tel-Touch to Dial Pulse Converter TD-4104376.

2. Mod kits required:

(a) Mod kit 16092( )79 is required (in cabinets with serial numbers 0-1000) for compatibility with Message Register (MMRIA) PCB TD-4102266-001 or Message Register Multiboard Assembly TD-4102266-101.

(b) Mod kit 16052( )79 is required for compatibility with Dial/Directed Call Pickup Multiboard Assembly TD-4103226-101.

(c) Mod kit 16052( )79 is required for compatibility with Dial/Directed Call Pickup PCB TD-4104306-001.

3. When cabinet is equipped with this motherboard:

(a) ANA/PNA (assigned night

answer/permanent night answer) service is not available.

(b) The system cannot accommodate 24 tie trunks.

b. Assembly TD-4101506-003 (Schematic TD-4101507-003).

1. Not compatible with trunk motherboard extender TD-4101816-001 or -002.

2. Mod kits required:

(a) Mod kit 16092( )79 is required (in cabinets with serial numbers 0-1000) for compatibility with Message Register (MMRIA) PCB TD-4102266-001 or Message Register Multiboard Assembly TD-4102266-101.

(b) Mod kit 16055( )79 is required for ANA/PNA feature.

(c) Mod kit 16058( )79 is required for compatibility with Tel-Touch to Dial Pulse Converter PCB TD-4104376-001.

3. Optional wiring is required if the system is to accommodate 24 tie trunks.

3.03 Line PCB, TD-4101516.

a. Assembly TD-4101516-003 (Schematic TD-4101517-002).

1. Minimum recommended level:

(a) Assembly issue AN.

(b) Schematic issue U.

b. Assembly TD-4101516-004 (Schematic TD-4101517-003).

1. For message waiting feature, line PCB must be assembly issue AR (Schematic issue V) or later.

2. Minimum recommended level:

(a) Assembly issue AV.

(b) Schematic issue Y.

c. Assembly TD-4101615-010 (Schematic TD-4101517-010).

1. No known compatibility problems.

3.04 Attendant Line and Control PCB, TD-4101526.

a. Assembly TD-4101526-002 or -003 (Schematic TD-4101527-001).

1. Not compatible with following features:

(a) Strappable attendant access code.

(b) Interrupted console buzzer.

2. Minimum recommended levels:

(a) Assembly issue AA.

(b) Schematic issue R.

b. Assembly TD-4101526-004 (Schematic TD-4101527-002).

1. For strappable attendant access code feature, PCB must be assembly issue AF (schematic issue V) or later.

2. For interrupted console buzzer feature, PCB must be assembly issue AF (schematic issue V) or later.

3. Minimum recommended levels:

(a) Assembly issue AB.

(b) Schematic issue S.

c. Assembly TD-4101526-010 (Schematic TD-4101527-010).

1. No known compatibility problem.

3.05 CO Trunk, TD-4101536.

a. Assembly TD-4101536-003 or -004 (Schematic TD-4101537-002).

1. Not compatible with the following features:

(a) Single burst of camp-on tone.

(b) 2-second automatic recall.

(c) Continuous answer supervision to tie trunks.

2. Minimum recommended levels:

(a) Assembly issue BG.

(b) Schematic issue AR.

b. Assembly TD-4101536-005 (Schematic TD-4101537-003).

1. Not compatible with following features.

(a) Single burst of camp-on tone.

(b) Remote busy back.

(c) 2-second automatic recall.

(d) Continuous answer supervision to tie trunks.

2. Minimum recommended levels:

(a) Assembly issue BL/BR.

(b) Schematic issue AU/AW.

c. Assembly TD-4101536-006 (Schematic TD-4101537-004).

1. For single burst of camp-on tone, PCB must be assembly issue BV (schematic issue AX) of later.

2. Minimum recommended levels:

(a) Assembly issue BG.

(b) Schematic issue AR.

3.06 Feature 2 PCB,TD-4101546.

NOTES:
1. This PCB is a parent board and should never be separated from the piggyback ANA PCB, TD-4101556.
2. This PCB is M.D. (manufacture discontinued).
3. See multiboard assembly TD-4101546-100 (paragraph 3.07) for replacement information.

a. Assembly TD-4101546-001 (Schematic TD-4101547-001).

1. Not compatible with ANA PCB TD-4101556-002 or TD-4101556-003.

2. Minimum recommended levels.

(a) Assembly issue S.

(b) Schematic issue F.

b. Assembly TD-4101546-002 (Schematic TD-4101547-001).

1. Not compatible with ANA PCB TD-4101556-001 or TD-4101556-003.

2. Minimum recommended levels:

(a) Assembly issue S.

(b) Schematic issue F.

c. Assembly TD-4101546-003 (Schematic TD-4101547-001).

1. Not compatible with ANA PCB TD-4101556-001 or TD-4101556-002.

2. Minimum recommended levels:

(a) Assembly issue S.

(b) Schematic issue F.

3.07 ANA Multiboard Assembly, TD-4101546-100.

NOTES:
1. This is a two-board assembly. The boards should never be separated.
2. This assembly is M.D. (manufacture discontinued).
3. Replaced by ANA PCB TD-4104046-001 in systems equipped with channel motherboard TD-4101716-003 or later.
4. Replaced by multiboard assembly TD-4102246-101 when both ANA and CFFM are required in systems equipped with channel motherboard TD-4101716-002 or later.
5. Replaced by CFFM, BL, DA and ANA PCB TD-4103086-001 when both ANA and CFFM features are required in systems equipped with channel motherboard TD-4101716-003 or later.

a. Assembly TD-4101546-101 (Feature 2 PCB TD-4101546-001 with ANA PCB TD-4101556-001).
   1. Provided as an option in early systems.
   2. CFFM feature is not available when this assembly is used.
   3. UNA/ANA service is not available when this assembly is used.
   4. Replaced by TD-4101546-102.

b. Assembly TD-4101546-102 (Feature 2 PCB TD-4101546-002 with ANA PCB TD-4101556-002).
   1. Provided as an option in early systems or as a replacement for TD-4101546-101.
   2. CFFM feature is not available when this assembly is used.
   3. UNA/ANA service is not available when this assembly is used.
   4. Replaced by TD-4101546-103.

c. Assembly TD-4101546-103 (Feature 2 PCB TD-4101546-003 with ANA PCB TD-4101556-003).
   1. Provided as an option in late systems or as a replacement for TD-4101546-101 or TD-4101546-102.
   2. CFFM feature is not available when this assembly is used.
   3. See Notes 3, 4, and 5 for replacement information.

3.08 ANA PCB, TD-4101556.

NOTES:
1. This PCB is a piggyback board and should never be separated from its parent board.
2. See multiboard assemblies TD-4101546-100 (pargraph 3.07) and TD-4102246-100 (paragraph 3.40) for replacment information.

a. Assembly TD-4101556-001 (Schematic TD-4101557-001).
   1. Not compatible with:
      (a) Feature 2 PCB TD-4101546-002 or -003.
      (b) CFFM PCB TD-4102246-001.
   2. Minimum recommended levels:
      (a) Assembly issue G.
      (b) Schematic issue F.

b. Assembly TD-4101556-002 (Schematic TD-4101557-001).
   1. Not compatible with:

(b) Schematic issue M.

b. Assembly TD-4101606-004 (Schematic TD-4101607-002).

1. PCB must be assembly issue AB (schematic issue T) or later for attendant to have dial access to a restricted feature.

2. PCB does not provide for day/night toll restriction.

3. Classes of service 7-14 must have single digit access codes.

4. Not compatible with 2-way DID trunks.

5. Minimum recommended levels:

(a) Assembly issue T.

(b) Schematic issue M.

c. Assembly TD-4101606-005 (Schematic TD-4101607-003).

1. PCB must be assembly issue X (schematic issue P) or later for day/night toll restriction.

2. PCB must be assembly issue AB (schematic issue T) or later for attendant to have dial access to a restricted feature.

3. Not compatible with 2-way DID trunks.

d. Assembly TD-4101606-010 (Schematic TD-4101607-010).

1. No known compatibility problems.

3.15 Memory, TD-4101616.

a. Assembly TD-4101616-003 or -004 (Schematic TD-4101617-001).

1. Not compatible with:

(a) CFFM, BL, DA and ANA PCB TD-4103086-001.

(b) Quad Transfer Trunk Station/Add-on Link TD-4103566-001.

(c) Busy Trunk/Busy Line Call Back PCB TD-4102966-001.

(d) 2-way Loop DID Trunk TD-4103266-001.

(e) 2-Way E & M DID Trunk TD-4103276-001.

2. PCB must be assembly issue AU (schematic issue AM) or later when used in cabinet equipped with DCPU multiboard assembly TD-4103226-101, or DCPU PCB TD-4104306-001.

3. Minimum recommended levels:

(a) Assembly issue AH.

(b) Schematic issue X.

b. Assembly TD-4101616-005 (Schematic TD-4101617-001).

1. PCB must be assembly issue AZ (schematic issue AU) or later when used in cabinet equipped with Quad Transfer Trunk/Station Add-on Links PCB TD-4104066-001.

2. Minimum recommended levels:

(a) Assembly issue AZ.

(b) Schematic issue AU.

3.16 Processor 1, TD-4101626.

NOTE: In a given system, PROM's on Processor 1 PCB and Processor 2 PCB should be the same issue level.

a. Assembly TD-4101626-003 or -004 (Schematic TD-4101627-003).

1. Not compatible with:

(a) CFFM, BL, DA, and ANA PCB TD-4103086-001.

(b) 2-Way Loop DID Trunk TD-4103266-001.

(c) 2-Way E & M DID Trunk TD-4103276-001.

(d) Quad Transfer Trunk/Station Add-on Link TD-4103566-001.

(e) Answer back to paging.

b. Assembly TD-4101626-005 (Schematic TD-4101627-004).

1. Not compatible with:

(a) CFFM, BL, DA and ANA PCB TD-4103086-001.

(b) 2-Way Loop DID Trunk TD-4103266-001.

(c) 2-Way E & M DID Trunk TD-4103276-001.

(d) Quad Transfer Trunk/Station Add-on Link TD-4103566-001.

2. For answer back to paging, the PCB must be equipped with PROM's programmed with TD-4900297 issue R or later.

c. Assembly TD-4101626-010 (Schematic TD-4101627-010).

1. No known compatibility problems.

3.17 Processor 2, TD-4101636.

NOTE: In a given system, the PROM's on Processor 1 and Processor 2 PCB's must be the same issue level.

a. Assembly TD-4101626-003 or -004 (Schematic TD-4101637-003).

1. Not compatible with:

(a) CFFM, BL, DA, and ANA PCB TD-4103086-001.

(b) 2-Way Loop DID Trunk TD-4103266-001.

(c) 2-Way E & M DID Trunk TD-4103276-001.

(d) Quad Transfer Trunk/Station Add-on Link TD-4103566-001.

(e) Answer back to paging.

2. Not compatible in systems having more than three tie trunk groups.

3. For attendant access code feature, PCB must be assembly issue AJ (schematic issue AD) or later.

4. For combined UNA/ANA service, PCB must be assembly issue AC (schematic issue Y) or later.

b. Assembly TD-4101636-005 (Schematic TD-4101637-004).

1. Not compatible with:

(a) CFFM, BL, DA, and ANA PCB TD-4103086-001.

(b) 2-Way Loop DID Trunk TD-4103266-001.

(c) 2-Way E & M DID Trunk TD-4103276-001.

(d) Quad Transfer Trunk/Station Add-on Link TD-4103566-001.

2. For attendant access code feature, PCB must be assembly issue AK (schematic issue AD) or later.

3. For combined UNA/ANA service, PCB must be assembly issue AD (schematic issue Z) or later.

4. For answer back to paging, the PCB must be equipped with PROM's programmed with TD-4900297 issue R or later.

(a) Feature 2 PCB TD-4101546-001 or -003.

(b) CFFM PCB TD-4102246-001.

2. Minimum recommended levels:

(a) Assembly issue H.

(b) Schematic issue F.

c. Assembly TD-4101556-003 (Schematic TD-4101557-001).

1. Not compatible with Feature 2 PCB TD-4101546-001 or -002.

2. Minimum recommended levels:

(a) Assembly issue J.

(b) Schematic issue F.

3.09 Line Motherboard, TD-4101566.

a. Assembly TD-4101566-002 (Schematic TD-4101567-002).

1. Not compatible with:

(a) Room Number Translator TD-4102946-001.

(b) Recorder Disconnect PCB TD-4102956-001.

(c) CFFM, BL, DA and ANA PCB TD-4103086-001.

(d) Access Test Set TD-4103206-001.

(e) 2-Way Loop DID Trunk TD-4103266-001.

(f) 2-Way E & M DID Trunk TD-4103276-001.

(g) 2-Way DID Trunk Translator TD-4103456-001.

(h) Combined DID and Number Translator TD-4103546-001.

(i) Quad Transfer Trunk/Station Add-on Links TD-4104066.

(j) Tel-Touch to Dial Pulse Converter TD-4104376.

2. Mod kit 16054( )79 required for compatibility with alarm PCB TD-4101786-005.

b. Assembly TD-4101566-003 (Schematic TD-4101567-003).

1. Not compatible with Line Motherboard Extender TD-4101806-001 or -002.

3.10 Conference Network, TD-4101576.

a. Assembly TD-4101576-001, -002 or -003 (Schematic TD-4101577-001).

1. No known compatibility problems.

b. Assembly TD-4101576-004 (Schematic TD-4101577-002).

1. No known compatibility problems.

c. Assembly TD-4101576-010 (Schematic TD-4101577-010).

1. No known compatibility problems.

3.11 Power Failure Transfer PCB, TD-4101586.

a. Assembly TD-4101586-001 or -002 (Schematic TD-4101587-001).

1. Minimum recommended levels:

(a) Assembly issue R.

(b) Schematic issue H.

3.12 Common Services PCB, TD-4101596.

a. Assembly TD-4101596-003 (Schematic TD-4101597-002).

1. This PCB is a parent board and should never be separated from the

piggyback Highway Amplifier PCB TD-4101856-003.

2. See multiboard assembly TD-4101596-100 (paragraph 3.13) for compatibility and replacement information.

b. Assembly TD-4101596-004 (Schematic TD-4101597-002).

1. This PCB is a parent board and should never be separated from the piggyback Highway Amplifier PCB TD-4101856-004.

2. See multiboard assembly TD-4101596-100 (paragraph 3.13) for compatibility and replacement information.

c. Assembly TD-4101596-005 (Schematic TD-4101597-003).

1. Provided in late systems, or as a replacement for TD-4101596-100, TD-4101596-103, or TD-4101596-104.

2. Not compatible with Highway Amplifier PCB TD-4101856-003 or -004.

d. Assembly TD-4101596-010 (Schematic TD-4101597-010).

1. Provided in late systems, or as a replacement for TD-4101596-103 or TD-4101596-104.

2. Not compatible with Highway Amplifier PCB TD-4101856-003 or -004.

3.13 Common Services Multiboard Assembly, TD-4101596-100.

NOTES:

1. This is a two-board assembly. The boards should never be separated.

2. This assembly is M.D. (manufacture discontinued).

3. Replaced by Common Services PCB TD-4101596-005.

a. Assembly TD-4101596-103 (Common Services PCB TD-4101596-003 with Highway Amplifier PCB TD-4101856-003).

1. Not compatible in systems with channel motherboard TD-4101716-003 or later.

2. Replaced by TD-4101596-005, TD-4101596-010 or TD-4101596-104.

b. Assembly TD-4101596-104 (Common Services PCB TD-4101596-004 with Highway Amplifier PCB TD-4101856-004).

1. Not compatible in systems with channel motherboard TD-4101716-003 or later.

2. Replaced by TD-4101596-005, or TD-4101596-010.

3. Replacement for TD-4101596-104.

3.14 Class of Service PCB, TD-4101606.

a. Assembly TD-4101606-002 or -003 (Schematic TD-4101607-001).

1. PCB must be assembly issue V (schematic issue N) or later for compatibility with toll restrictor PCB TD-4102286-001 or -010.

2. PCB must be assembly issue AB (schematic issue T) or later for attendant to have dial access to a restricted feature.

3. PCB does not provide for day/night toll restriction.

4. Classes of service 7-14 must have single digit access codes.

5. Not compatible with 2-way DID levels:

6. Minimum recommended levels:

(a) Assembly issue U.

c. Assembly TD-4101636-010 (Schematic TD-4101637-010).

1. No known compatibility problems.

3.18 Loop Tie Trunk, TD-4101646.

a. Assembly TD-4101646-001 (Schematic TD-4101647-001).

1. Provides facilities for only three trunk groups.

2. Not arranged for attendant break-in feature.

3. Minimum recommended levels:

(a) Assembly issue K.

(b) Schematic issue J.

b. Assembly TD-4101646-002 (Schematic TD-4101647-002).

1. Minimum recommended levels:

(a) Assembly issue K.

(b) Schematic issue J.

c. Assembly TD-4101646-010 (Schematic TD-4101647-010).

1. No known compatibility problems.

3.19 Station Hunt PCB, TD-4101656.

a. Assembly TD-4101656-002 (Schematic TD-4101657-001).

1. No known compatibility problems.

b. Assembly TD-4101656-003 or -004 (Schematic TD-4101657-002).

1. No known compatibility problems.

c. Assembly TD-4101656-010 (Schematic TD-4101657-010).

1. No known compatibility problems.

3.20 Register PCB, TD-4101666.

NOTE: Refer to multiboard assembly TD-4101666-100 (paragraph 3.21) for Tel-Touch Register information.

a. Assembly TD-4101666-003 (Schematic TD-4101667-002).

1. PCB does provide strappable time-out feature or hundreds check digit feature.

2. Minimum recommended levels:

(a) Assembly issue AA.

(b) Schematic issue M.

b. Assembly TD-4101666-004 (Schematic TD-4101667-003).

1. PCB does not provide hundreds check digit feature.

2. Minimum recommended levels:

(a) Assembly issue AC.

(b) Schematic issue N.

c. Assembly TD-4101666-005 (Schematic TD-4101667-004).

1. Minimum recommended levels:

(a) Assembly issue AG.

(b) Schematic issue S.

3.21 Tel-Touch Register Multiboard Assembly, TD-4101666-100.

NOTE: This is a two-board assembly. The boards should never be separated.

a. Assembly TD-4101666-103 (Register PCB TD-4101666-003 with Tel-Touch Receiver PCB TD-4101676-003).

See register PCB TD-4101666-003 (paragraph 3.20a) for compatibility.

b. Assembly TD-4101666-104 (Register PCB TD-4101666-004 with Tel-Touch Receiver PCB TD-4101676-003).

See register PCB TD-4101666-004 (paragraph 3.20b) for compatibility.

c. Assembly TD-4101666-105 (Register PCB TD-4101666-005 with Tel-Touch Receiver PCB TD-4101676-003).

See register PCB TD-4101666-005 (paragraph 3.20c) for compatibility.

3.22 Tel-Touch Receiver PCB, TD-4101676.

NOTE: This PCB is a piggyback board and should never be separated from its parent board.

a. Assembly TD-4101676-003 (Schematic TD-4101677-002).

1. No known compatibility problems.

3.23 Link PCB, TD-4101686.

a. Assembly TD-4101686-001, -002, or -003 (Schematic TD-4101687-001).

1. No known compatibility problems.

b. Assembly TD-4101686-010 (Schematic TD-4101687-010).

1. No known compatibility problems.

3.24 Attendant Register and Links, TD-4101696.

a. Assembly TD-4101696-002 or -003 (Schematic TD-4101697-001).

1. Strappable attendant code feature is not applicable when this PCB is used.
2. Minimum recommended levels:
   (a) Assembly issue W.
   (b) Schematic issue T.

b. Assembly TD-4101696-004 (Schematic TD-4101697-002).

1. For strappable attendant access code feature, PCB must be assembly issue V (schematic issue S) or later.
2. Minimum recommended levels:
   (a) Assembly issue V.
   (b) Schematic issue S.

c. Assembly TD-4101696-010 (Schematic TD-4101697-010).

1. No known compatiblity problems.

3.25 Transfer and Add-on Links, TD-4101706.

a. Assembly TD-4101706-002 or -003 (Schematic TD-4101707-002).

1. Minimum recommended levels:
   (a) Assembly issue AB.
   (b) Schematic issue S.

b. Assembly TD-4101706-004 (Schematic TD-4101707-003).

1. Minimum recommended levels:
   (a) Assembly issue AE.
   (b) Schematic issue S.

3.26 Channel Motherboard, TD-4101716.

a. Assembly TD-4101716-002 (Schematic TD-4101717-002).

1. Not compatible with:
   (a) Number Translator PCB TD-4102946-001.

(b) Recorder Disconnect PCB TD-4102956-001.

(c) CFFM, BL, DA, and ANA PCB TD-4103086-001.

(d) Access Test Set TD-4103206-001.

(e) 2-Way Loop DID Trunk TD-4103266-001.

(f) 2-Way E & M DID Trunk TD-4103276-001.

(g) 2-Way DID Trunk Translator TD-4103456-001.

(h) Combined DID and Number Translator TD-4103546-001.

(i) ANA PCB TD-4104046-001.

(j) Quad Transfer Trunk/Station Add-on Link TD-4104066.

(k) Tel-Touch to Dial Pulse Converter TD-4104376.

2. Mod kits required:

(a) Mod kit 16056( )79 required for compatibility with Data Monitor Test Set TD-4102076-001.

(b) Mod kit 16053( )79 required for compatibility with Busy Line/Busy Trunk Call Back PCB TD-4102966-001.

(c) Mod kit 16051( )79 required for compatibility with Quad Transfer and Add-on Links, TD-4102586-001.

3. When cabinet is equipped with this motherboard:

(a) ANA/PNA service is not available.

(b) Automatic gain control is not available.

4. Channel motherboard must be assembly issue R (schematic issue x) or later for combined UNA/ANA service.

5. Channel motherboard must be assembly issue R (schematic issue Y) or later for day/night toll restriction.

b. Assembly TD-4101716-003 (Schematic 4101717-003).

1. Not compatible with:

(a) Common Services Multiboard Assembly TD-4101596-103 or -104.

2. Mod kits required:

(a) Mod kit 16192( )79 required for compatibility with Room Number Translator PCB TD-4102946-001.

(b) Mod kit 16155( )79 required for compatibility with Busy Line/Busy Trunk Call Back PCB TD-4102966-001.

(c) Mod kit 16055( )79 required for compatibility with CFFM, BL, DA, and ANA PCB TD-4103086-001.

(d) Mod kit 16015( )79 required for compatibility with DCPU Multiboard Assembly TD-4103226-101.

(e) Mod kit 16192( ) 79 required for compatibility with 2-Way DID Translator PCB TD-4103456-001.

(f) Mod kit 16192( )79 required for compatibility with combined 2-Way DID and Room Number Translator PCB TD-4103546-001.

(g) Mod kit 16015( )79 required for compatibility with DCPU PCB TD-4104306-001.

(h) Mod kit 16055( )79 required for compatibility with ANA/PNA feature.

3.27 E & M Tie Trunk, TD-4101726.

a. Assembly TD-4101726-001 (Schematic TD-4101727-001).

1. When used with Alarm Board TD-4101786-002 or -003, the alarm board must be assembly issue AN (schematic issue AC) or later.

2. PCB arranged for only three tie trunk groups.

3. PCB provides no remote busy control feature.

4. PCB provides no strappable momentary (200-600 ms) release feature.

5. Minimum recommended levels:

(a) Assembly issue G.

(b) Schematic issue H.

b. Assembly TD-4101726-002 (Schematic TD-4101727-002).

1. When used with Alarm Board TD-4101786-002 or -003, the alarm board must be assembly issue AN (schematic issue AC) or later.

2. Minimum recommended levels:

(a) Assembly issue L.

(b) Schematic issue H.

c. Assembly TD-4101726-010 (Schematic TD-4101727-010).

1. When used with Alarm Board TD-4101786-002 or -003, the alarm board must be assembly issue AN (schematic issue AC) or later.

3.28 Power Supply Control Box, TD-4101766.

a. Assembly TD-4101766-001 (Schematic TD-4101767-001).

1. No known compatibility problems.

b. Assembly TD-4101766-002 (Schematic TD-4101767-002).

1. No known compatibility problems.

c. Assembly TD-4101766-003 or -004 (Schematic TD-4101767-010).

1. No known compatibility problems.

d. Assembly TD-4101766-005 (Schematic TD-4101767-010).

1. No known compatibility problems.

NOTE: Special considerations must be made when replacing a PSCB; see OC-000-006 for detailed instructions.

3.29 DID Trunk, TD-4101776.

a. Assembly TD-4101776-001 (Schematic TD-4101777-001).

1. PCB does not provide camp-on-busy tone option.

2. PCB does not provide strappable CO release timing.

3. Minimum recommended levels:

(a) Assembly issue T.

(b) Schematic issue G.

b. Assembly TD-4101776-002 (Schematic TD-4101777-002).

1. No known compatibility problems.

3.30 Alarm Board, TD-4101786.

a. Assembly TD-4101786-002 or -003 (Schematic TD-4101787-002).

1. Must be assembly issue AN (schematic issue AC) or later for compatibility with E & M Tie Trunk TD-4101726-001, -002 or -010.

b. Assembly TD-4101786-004 (Schematic TD-4101787-003).

1. PCB does not provide for external console buzzer.

c. Assembly TD-4101786-005 (Schematic TD-4101787-004).

1. Mod kit 16054( )79 required if used in cabinet equipped with Line Motherboard TD-4101566-002.

2. Minimum recommended levels:

(a) Assembly issue AR.

(b) Schematic issue AD.

3.31 Line Motherboard PFT Extender, TD-4101796.

a. Assembly TD-4101796-001 or -002.

1. No known compatibility problems.

3.32 Line Motherboard Extender, TD-4101806.

a. Assembly TD-4101806-001 or -002 (Schematic TD-4101807-001).

1. Not compatible with Line Motherboard TD-4101566-003.

b. Assembly TD-4101806-003 (Schematic TD-4101807-001).

1. No known compatibility problems.

3.33 Trunk Motherboard Extender, TD-4101816.

a. Assembly TD-4101816-001 or -002 (Schematic TD-4101817-001).

1. Not compatible with Trunk Motherboard TD-4101506-003.

b. Assembly TD-4101816-003 (Schematic TD-4101817-001).

1. No known compatibility problems.

3.34 Highway Amplifier PCB, TD-4101856.

NOTES:
1. This PCB is a piggyback board and should never be separated from the parent board.
2. The PCB is M.D. (manufacture discontinued).
3. See multiboard assembly TD-4101596-100 (paragraph 3.13) for compatibility and replacement information.

a. Assembly TD-4101856-003 (Schematic TD-4101857-003).

1. Not compatible with Common Services PCB TD-4101596-004, -005 or -010.

2. Minimum recommended levels:

(a) Assembly issue L.

(b) Schematic issue K.

3. Should never be separated from Common Services PCB TD-4101596-003.

b. Assembly TD-4101856-004 (Schematic TD-4101857-004).

1. Not compatible with Common Services PCB TD-4101596-003, -005 or -010.

2. Minimum recommended levels:

(a) Assembly issue L.

(b) Schematic issue K.

3. Should never be separated from Common Services PCB TD-4101596-004.

3.35 Private Line and Manual Intercom PCB, TD-4101916.

a. Assembly TD-4101916-001 or -002 (Schematic TD-4101917-001).

1. Minimum recommended levels:

(a) Assembly issue K.

(b) Schematic issue H.

b. Assembly TD-4101916-010 (Schematic TD-4101917-010).

1. No known compatibility problems.

3.36 Paging Access PCB, TD-4101926.

a. Assembly TD-4101926-001 or -002 (Schematic TD-4101927-001).

1. Minimum recommended levels:

(a) Assembly issue K.

(b) Schematic issue G.

2. Not compatible with answer back operation.

b. Assembly TD-4101926-010 (Schematic TD-4101927-010).

1. No known compatibility problems.

3.37 Dictation Access PCB, TD-4101936.

a. Assembly TD-4101936-001 or -002 (Schematic TD-4101937-001).

1. Minimum recommended levels:

(a) Assembly issue H.

(b) Schematic issue F.

b. Assembly TD-4101936-003 (Schematic TD-4101937-002).

1. Minimum recommended levels:

(a) Assembly issue H.

(b) Schematic issue F.

3.38 Data Monitor Test Set, TD-4102076.

a. Assembly TD-4102076-001 (Schematic TD-4102077-001).

1. Mod kit 16056( )79 required to work in channel motherboard TD-4101716-002.

3.39 CFFM PCB, TD-4102246.

a. Assembly TD-4102246-001 (Schematic TD-4102247-001).

1. Not compatible with:

(a) ANA PCB TD-4101556-001 or -002.

2. Must be equipped with piggyback PCB TD-4101556-003 if ANA service is required.

3. Minimum recommended levels.

(a) Assembly issue C.

(b) Schematic issue B.

3.40 CFFM and ANA Multiboard Assembly, TD-4102246-100.

NOTE: This is a two-board assembly. The boards should never be separated.

a. Assembly TD-4102246-101 (CFFM PCB TD-4102246-001 with ANA PCB TD-4101556-003).

1. No known compatibility problems.

2. Replaces ANA Motherboard Assembly, TD-4101546-100, when both ANA and CFFM are required in systems equipped with Channel

Motherboard TD-4101716-002, or later.

3.41 Message Register (MMRIA) PCB, TD-4102266.

a. Assembly TD-4102266-001 (Schematic TD-4102267-001).

1. Mod kit 16092( )79 required (in cabinets with serial numbers 0-1000) for compatibility with trunk motherboard TD-4101506-002 or -003.

2. Use with piggyback MMRIB PCB when serving more that 75 lines, or when monitoring 3rd wire for answering supervision.

3.42 Message Register Multiboard Assembly, TD-4102266-100.

NOTE: This is a two-board assembly. The boards should never be separated.

a. Assembly TD-4102266-101 (MMRIA PCB TD-4102266-001 with MMRIB PCB TD-4102276-001).

1. Mod kit 16092( )79 required in cabinets with serial numbers 0-1000 for compatibility with trunk motherboard TD-4101506-002 or -003.

3.43 Message Register (MMRIB) PCB, TD-4102276.

NOTE: This PCB is a piggyback board and should never be separated from parent board TD-4102266.

a. Assembly TD-4102276-001 (Schematic TD-4102277-001).

1. See multiboard assembly TD-4102266-100 (paragraph 3.42) for compatibility information.

3.44 Toll Restrictor PCB, TD-4102286.

a. Assembly TD-4102286-001 (Schematic TD-4102287-001).

1. Class of Service PCB TD-4101606-002 or -003, must be assembly issue V (schematic issue N) or later.

b. Assembly TD-4102286-010 (Schematic TD-4102287-010).

1. Class of Service PCB, TD-4101606--002 or -003, must be assembly issue V (schematic issue N) or later.

3.45 Quad Transfer and Add-on Links, TD-4102586.

a. Assembly TD-4102586-001 (Schematic TD-4102587-001).

1. Mod kit 16051( )79 required for compatibility with channel motherboard TD-4101716-002.

3.46 Room Number Translator, TD-4102946.

a. Assembly TD-4102946-001 (Schematic TD-4102947-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

2. Mod kit 16192( )79 needed for compatibility with -003 channel motherboards.

3. PCB must be assembly issue D (Schematic issue D) or later for compatibility with DCPU multiboard assembly TD-4103226-101.

3.47 Recorder Disconnect PCB, TD-5102956.

a. Assembly TD-4102956-001 (Schematic TD-4102957-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

3.48 Busy Line/Busy Trunk Call Back PCB, TD-4102966.

a. Assembly TD-4102966-001 (Schematic TD-4102967-001).

1. Mod kit 16053( )79 required for compatibility with channel motherboard TD-4101716-002.

2. Mod kit 16155( )79 required for compatibility with channel motherboard TD-4101716-003.

3. Not compatible with Memory PCB TD-4101616-004 and earlier.

3.49 CFFM, BL, DA, and ANA PCB, TD-4103086.

a. Assembly TD-4103086-001 (Schematic TD-4103087-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

2. Not compatible with:

(a) Processor 1 PCB TD-4101626-003, -004 or -005.

(b) Processor 2 PCB TD-4101636-003, -004 or -005.

(c) Memory PCB TD-4101616-003 or -004.

3. Mod kit 16055( )79 required for compatibility with channel motherboard TD-4101716-003.

4. Replaces ANA Multiboard Assembly, TD-4101546-100, when both ANA and CFFM features are required in systems equipped with channel motherboard TD-4101716-003 or later.

3.50 Dial/Directed Call Pickup PCB, TD-4103116.

NOTES: 1. This PCB is a piggyback board and should never be separated from parent board TD-4103226.

2. See multiboard assembly TD-4103226-100 (paragraph 3.53) for additional compatibility information.

a. Assembly TD-4103116-001 (Schematic TD-4103117-001).

1. PCB must be assembly issue J (schematic issue J) or later for compatibility with Feature 3 PCB TD-4103226-001).

2. Minimum recommended levels:

(a) Assembly issue J.

(b) Schematic issue J.

3.51 Access Test Set, TD-4103206.

a. Assembly TD-4103206-001 (Schematic TD-4103207-001).

1. Not compatible is systems with -002 line, trunk, and channel motherboards.

3.52 Feature 3 PCB, TD-4103226.

NOTES: 1. This PCB is a parent board and should never be separated from piggyback DCPU PCB TD-4103116.

2. See multiboard assembly TD-4103226-100 (paragraph 3.53) for additional compatibility information.

a. Assembly TD-4103226-001 (Schematic TD-4103227-001).

1. PCB must be assembly issue C (schematic issue E) or later for compatibility with piggyback DCPU PCB TD-4103116-001.

3.53 DCPU Multiboard Assembly, TD-4103226-100.

NOTES: 1. This is a two-board assembly. The boards should never be separated.

2. This assembly mounts in the -002 trunk motherboard, or in the -003 channel motherboard.

a. Assembly TD-4103226-101 (Feature 3 PCB TD-4103226-001 with DCPU PCB TD-4103116-001).

1. Mod kit 16052( )79 required for compatibility with trunk motherboard TD-4101506-002.

2. Mod kit 16015( )79 required for compatibility with channel motherboard TD-4101716-003.

3. When used with Memory PCB TD-4101616-003 or -004, memory must be assembly issue AU (schematic issue AM) or later.

4. Requires PROM program 4900297, issue M or later.

5. When used with Room Number Translator TD-4102946-001, room number translator must be assembly issue D (schematic issue D) or later.

3.54 2-Way Loop DID Trunk, TD-4103266.

a. Assembly TD-4103266-001 (Schematic TD-4103267-001).

1. Not compatible with:

(a) Systems equipped with -002 line, trunk, and channel motherboards.

(b) Memory PCB TD-4101616-004 and earlier.

(c) Processor 1 PCB TD-4101626-005 and earlier.

(d) Processor 2 PCB TD-4101636-005 and earlier.

(e) Class of Service PCB TD-4101606-005 and earlier.

3.55 2-Way E & M DID Trunk, TD-4103276.

a. Assembly TD-4103276-001 (Schematic TD-4103277-001).

1. Not compatible with:

(a) Systems equipped with -002 line, trunk, and channel motherboards.

(b) Memory PCB TD-4101616-004 and earlier.

(c) Processor 1 PCB TD-4101626-005 and earlier.

(d) Processor 2 PCB TD-4101636-005 and earlier.

(e) Class of Service PCB TD 4101606-005 and earlier.

3.56 Executive Access Trunk, TD-4103346.

a. Assembly TD-4103346-001 (Schematic TD-4103347-001).

1. Not compatible with systems equipped with -002 line, trunk, and channel motherboards.

3.57 2-Way DID Trunk Translator, TD-4103456.

a. Assembly TD-4103456-001 (Schematic TD-4103457-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

2. Mod kit 16192( )79 needed for compatibility with -003 channel motherboards.

3.58 Combined DID and Number Translator, TD-4103546.

a. Assembly TD-4103546-001 (Schematic TD-4103547-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

2. Mod kit 16192( )79 needed for compatibility with -003 channel motherboards.

3.59 ANA PCB, TD-4104046.

a. Assembly TD-4104046-001 (Schematic TD-4104047-001).

1. Not compatible with:

(a) Channel motherboard TD-4101716-002.

2. Replaces ANA Multiboard Assembly, TD-4101546-100 in systems equipped with channel motherboard TD-4101716-003 or later.

3.60 Quad Transfer Trunk/Station Add-on Links, TD-4104066.

a. Assembly TD-4104066-001 (Schematic TD-4104067-001).

1. Not compatible in systems equipped with -002 line, trunk, and channel motherboards.

3.61 DCPU PCB, TD-4104306.

a. Assembly TD-4104306-001 (Schematic TD-4104307-001).

1. Mod kit 16052( )79 required for compatibility with trunk motherboard TD-4101506-002.

2. Mod kit 16015( )79 required for compatibility with channel motherboard TD-4101716-003.

3. When used with Memory PCB TD-4101616-003 or -004, memory must be assembly issue AU (schematic issue AM) or later.

4. Requires PROM program 4900297, issue M or later.

3.62 Tel-Touch to Dial Pulse Converter, TD-4104376.

a. Assembly TD-4104376-001 (Schematic TD-4104377-001).

1. Not compatible with systems equipped with -002 line, trunk, and channel motherboards.

2. Mod kit 16058( )79 required for compatibility with trunk motherboard TD-4101506-003.

3.63 Line Circuits with CO to CO Connection, TD-4104456.

a. Assembly TD-4104456-001 (Schematic TD-4104457-001).

1. No known compatibility problems.

USING THE DATA MONITOR TEST SET
(TD-4102077 - ISS A)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL

1.01 Purpose of Section. This section serves as an explanation of the capabilities and use of the Data Monitor Test Set PCB (printed circuit board) in the TD-100 EPABX. Also included is an explanation of the interpretation of the data collected. The documents and drawings applicable to this document are listed in table 1.00.

1.02 Purpose of Equipment. The Data Monitor Test Set (TD-4102077) is a single, self-contained printed circuit board that is inserted into the TD-100 cabinet when various functional tests are required. The PCB is used in the dictation 2 position in the channel subrack and is equipped with indicators and controls to monitor the flow of data to and from the system processor.

While the test set is not essential for system maintenance, its use greatly simplifies the observation of certain common control operations. Some test operations may be performed while the TD-100 is on-line; other tests require off-line status. The following paragraphs provide specific details.

2.00 TEST SET CAPABILITIES

2.01 General. Numerous capabilities are incorporated into the data monitor test set enabling a variety of system tests. The following paragraphs explain each of the capabilities in detail. Figure 1.00 is a block diagram of the data monitor set and its use will aid in understanding the PCB's operation.

A good working knowledge of the TD-100 operation is required to fully understand some of the test set capabilities. The information contained in ITT Practice OB-000-005, entitled TD-100 Trouble Analysis and PCB Replacement Guide, should be thoroughly understood before any attempt is made to use the data monitor test set.

2.02 Test Probe. Two test points are provided on the test set PCB for connection of a wire to be used as a test probe. These terminals are each

TABLE 1.00 Documents and Drawings

NUMBER	TITLE
OA-000-001	General Information, TD-100 EPABX
OC-000-005 w/Add. A	TD-100 Trouble Analysis and PCB Replacement Guide with Maintenance Flow Charts
OL-401-602	Introduction to Narratives, TD-100 EPABX
OL-410-XXX	Individual Circuit Narratives (as required)

associated with an LED (light emitting diode) indicator. The test points are labeled E1 and E2; the LED's are labeled DIRECT and STORE.

Test point E1 is associated with the DIRECT LED, CR2. With no connection to E1, the DIRECT LED will remain lit whenever the test set PCB is properly inserted into a TD-100 system under power. Application of a ground potential to terminal E1 will cause the DIRECT LED to extinguish. Thus, a test lead connected to E1 may be used as a logic level probe to verify the presence of a ground, or logic low signal.

Test point E2 is associated with the STORE LED, CR21. With the data monitor test set PCB properly inserted into a system under power, a test lead connected to terminal E2 may be used as a latching test probe. This enables logic level changes to be detected in relation to other system signaling as well as pulses of very short duration to be detected and stored. Logic pulses greater than one microsecond can be stored via terminal E2 regardless of when they occur. A pulse of less than one microsecond duration must occur in coincidence with the rising edge of $\overline{T4}$ in order to be stored.

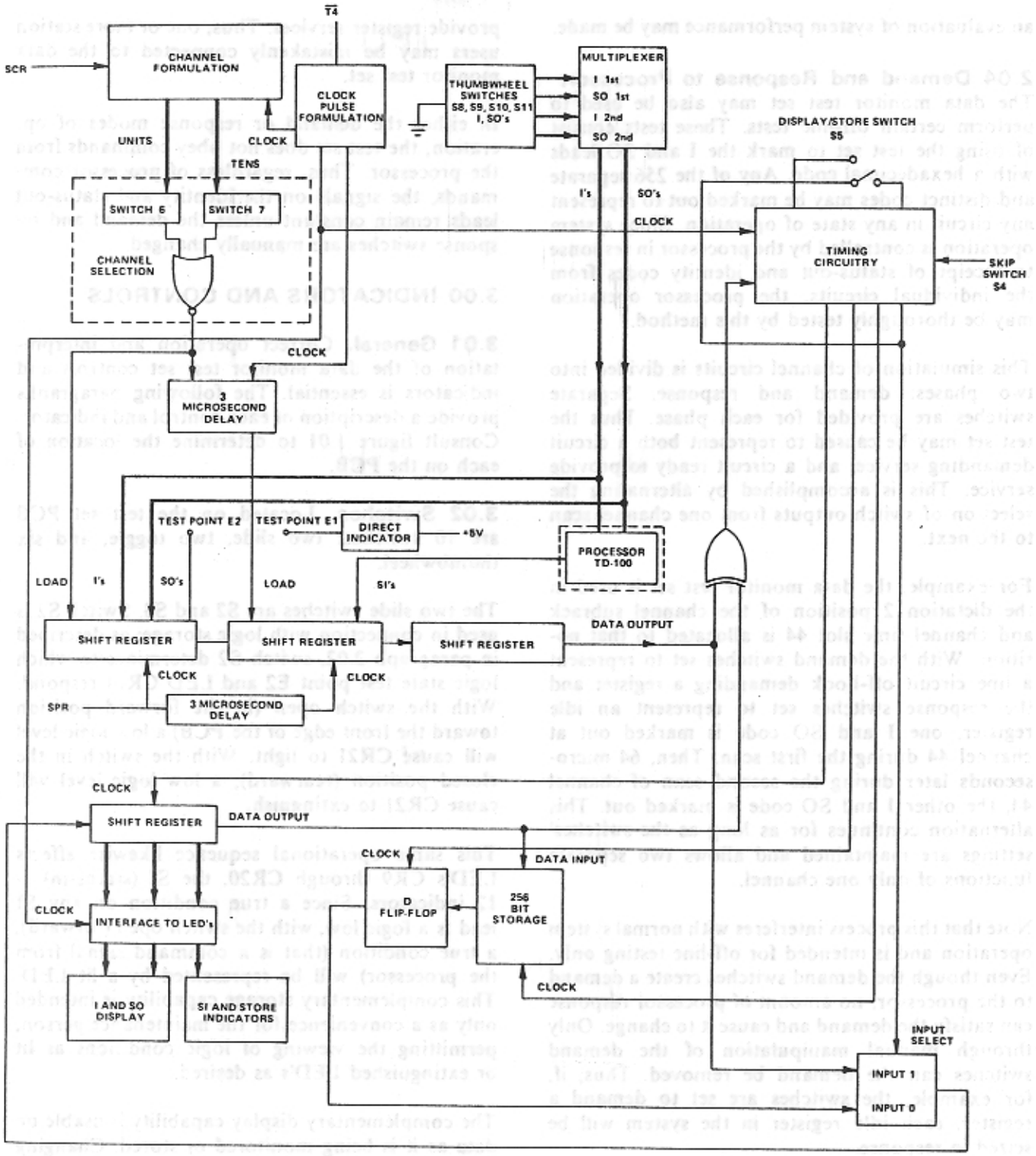
Dependent upon the setting of switch S2, the STORE LED can be caused to light or extinguish in response to a selected logic level. Note that operation of this switch affects other circuitry as well, as described in paragraph 3.02. Use of this latching probe also reduces the data storage available for other purposes as explained in paragraph 4.02.

2.03 Channel Data Monitor. One function of the test set is to passively monitor the flow of data to and from the system processor during any selected channel. In this mode of operation, the test set displays the logic status of each SI (status-in) lead and the hexadecimal equivalent of the I (identity) and SO (status-out) leads. (For an explanation of hexadecimal numbers and the status-in, status-out, and identity leads, see ITT Practice OL-401-602, entitled Introduction to Narratives.) Note that some changes in these signals occur with such speed that visual observation without storage is impossible.

2.04 Channel Data Storage. The capability is provided on the data monitor test set to collect and store the data flowing to and from the system processor during any selected channel. This makes possible the observation of rapid, sequential signal changes.

The test set has the capability to store up to eight separate sets of data. A set of data is considered to be the aggregate of all status-in, status-out, and identity leads. A change of any one, or more, bits therefore constitutes a new set of data and occupies one of the eight storage slots available. The test probe, when used in the latching mode, also requires one storage slot for each logic change that it senses.

When storage is complete (after eight or fewer sets of data have been collected) the data sets may be displayed for extended periods in the sequence they were received. When these are compared with correct data flow sequences (see paragraph 5.01),



PU-76-055

FIGURE 1.00 Data Monitor Test Set Block Diagram

an evaluation of system performance may be made.

2.04 Demand and Response to Processor. The data monitor test set may also be used to perform certain off-line tests. These tests consist of using the test set to mark the I and SO leads with a hexadecimal code. Any of the 256 separate and distinct codes may be marked out to represent any circuit in any state of operation. Since system operation is controlled by the processor in response to receipt of status-out and identity codes from the individual circuits, the processor operation may be thoroughly tested by this method.

This simulation of channel circuits is divided into two phases: demand and response. Separate switches are provided for each phase. Thus the test set may be caused to represent both a circuit demanding service, and a circuit ready to provide service. This is accomplished by alternating the selection of switch outputs from one channel scan to the next.

For example: the data monitor test set is used in the dictation 2 position of the channel subrack and channel time slot 44 is allocated to that position. With the demand switches set to represent a line circuit off-hook demanding a register and the response switches set to represent an idle register, one I and SO code is marked out at channel 44 during the first scan. Then, 64 microseconds later during the second scan of channel 44, the other I and SO code is marked out. This alternation continues for as long as the switches' settings are maintained and allows two separate functions of only one channel.

Note that this process interferes with normal system operation and is intended for off-line testing only. Even though the demand switches create a demand to the processor, no amount of processor response can satisfy the demand and cause it to change. Only through manual manipulation of the demand switches can the demand be removed. Thus; if, for example, the switches are set to demand a register, each idle register in the system will be seized in response.

Likewise, the response switches only simulate channel circuits. If, for example, the switches are set to simulate an idle register, the processor may select the test set to serve other outgoing calls needing an idle register, and the test set cannot provide register services. Thus, one or more station users may be mistakenly connected to the data monitor test set.

In either the demand or response modes of operation, the test set does not obey commands from the processor. Thus, regardless of processor commands, the signals on the identity and status-out leads remain constant unless the demand and response switches are manually changed.

3.00 INDICATORS AND CONTROLS

3.01 General. Correct operation and interpretation of the data monitor test set controls and indicators is essential. The following paragraphs provide a description of each control and indicator. Consult figure 1.01 to determine the location of each on the PCB.

3.02 Switches. Located on the test set PCB are 10 switches: two slide, two toggle, and six thumbwheel.

The two slide switches are S2 and S3. Switch S2 is used in connection with logic storage; as described in paragraph 2.02, switch S2 determines to which logic state test point E2 and LED CR21 respond. With the switch open (in the forward position toward the front edge of the PCB) a low logic level will cause CR21 to light. With the switch in the closed position (rearward), a low logic level will cause CR21 to extinguish.

This same operational sequence likewise affects LED's CR9 through CR20, the SI (status-in) 1-12 indicators. Since a true condition on any SI lead is a logic low, with the switch open (forward), a true condition (that is a command signal from the processor) will be represented by a lit LED. This complementary storage capability is intended only as a convenience for the maintenance person, permitting the viewing of logic conditions as lit or extinguished LED's as desired.

The complementary display capability is usable on data as it is being monitored or stored. Changing the switch position will not complement data previously stored.

Switch S3 is in series with the SI-2 input to the test set. Its function is merely to interrupt the SI-2 lead and prevent wasted storage when in its rear-

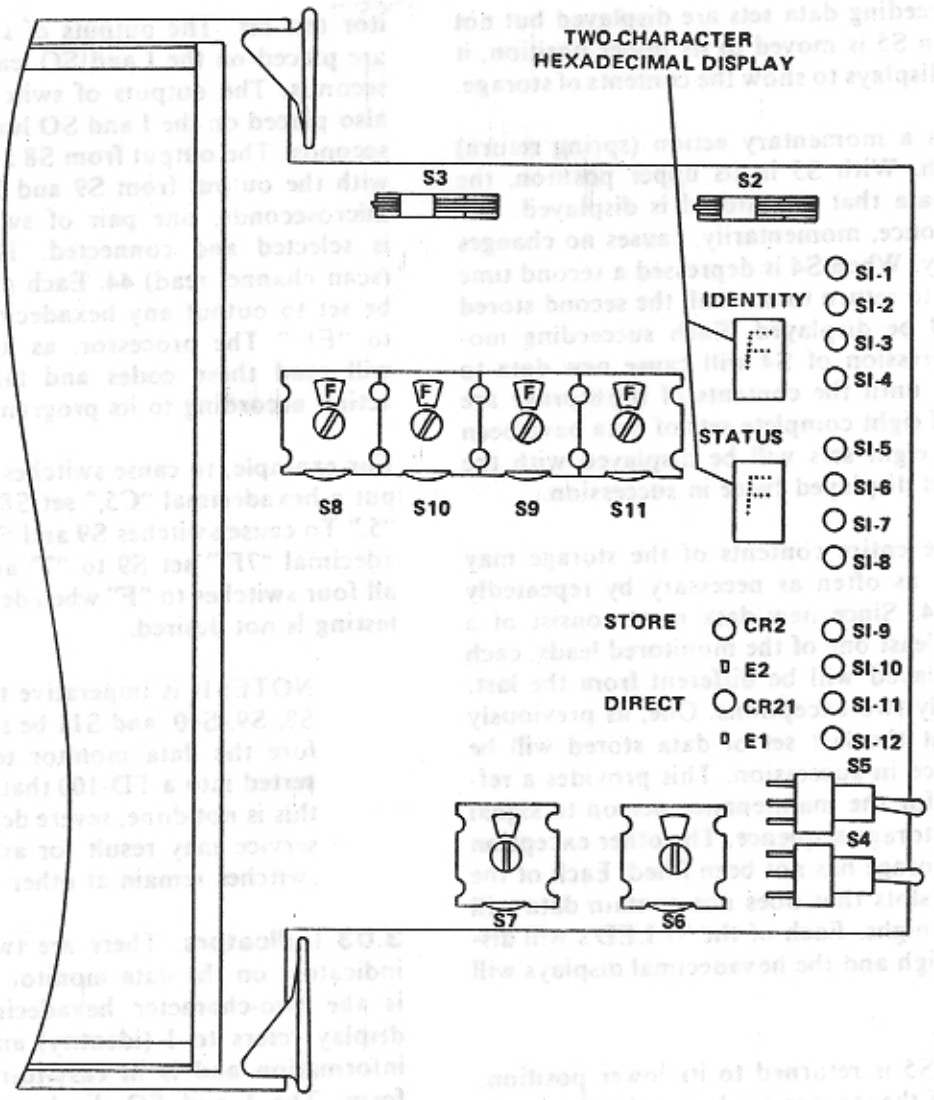


FIGURE 1.01 Data Monitor Test Set Control Panel

ward position. Since the SI-2 lead follows each dial pulse and since any change in the data received by the test set constitutes a new data set, each dial pulse would precipitate a new data set. Only eight data sets may be stored, thus it is necessary to open the SI-2 lead to the test set during dialing to avoid filling the entire storage with the first four dial pulses received.

The two miniature toggle switches are S4 and S5. Switch S5 is a two-position switch; in its lower position (toward the bottom of the PCB when it is inserted in the cabinet), it enables the test set to monitor the data flow on the selected channel. As new data is received, it is displayed on the two digit hexadecimal displays and LED's CR9 through CR21. The first eight sets of data are stored by the

test set; succeeding data sets are displayed but not stored. When S5 is moved to its upper position, it enables the displays to show the contents of storage.

Switch S4 is a momentary action (spring return) toggle switch. With S5 in its upper position, the last set of data that was stored is displayed. Depressing S4 once, momentarily, causes no changes to the display. When S4 is depressed a second time and allowed to return to normal, the second stored data set will be displayed. Each succeeding momentary depression of S4 will cause new data to be displayed until the contents of the storage are exhausted. If eight complete sets of data have been stored, then eight sets will be displayed with the last set stored displayed twice in succession.

Note that the entire contents of the storage may be examined as often as necessary by repeatedly depressing S4. Since new data must consist of a change in at least one of the monitored leads, each data set displayed will be different from the last. There are only two exceptions. One, as previously stated, is that the last set of data stored will be displayed twice in succession. This provides a reference point for the maintenance person to signal the end of a storage sequence. The other exception is when the storage has not been filled. Each of the eight storage slots that does not contain data will read all logic highs. Each of the SI LED's will display a logic high and the hexadecimal displays will show "FF".

When switch S5 is returned to its lower position, the contents of the storage are lost and a new monitor and storage sequence begins. Thus, to clear the storage contents, it is necessary only to move S5 up and, to resume monitor and storage, down. When S5 is in its lower position, S4 should not be depressed. No damage will occur to the equipment, but erroneous storage may result.

Switches S6 and S7 are thumbwheel switches used to select the channel (time slot) for monitoring and storage. Switch S6 sets the units digit and S7 sets the tens digit. For example, to cause the data monitor test set to monitor time slot 29, set S7 to 2 and S6 to 9.

Switches S8, S9, S10 and S11 are also thumbwheel switches used only in conjunction with the demand and response functions of the data monitor test set. The outputs of switches S8 and S10 are placed on the I and SO leads every 128 microseconds. The outputs of switches S9 and S11 are also placed on the I and SO leads every 120 microseconds. The output from S8 and S10 is alternated with the output from S9 and S11 so that each 64 microseconds, one pair of switches or the other is selected and connected. This occurs at SCR (scan channel read) 44. Each pair of switches may be set to output any hexadecimal code from "00" to "FF." The processor, as it scans channel 44, will read these codes and take the appropriate action according to its programming.

For example, to cause switches S8 and S10 to output a hexadecimal "C5," set S8 to "C" and S10 to "5." To cause switches S9 and S11 to output a hexadecimal "7F," set S9 to "7" and S11 to "F." Set all four switches to "F" when demand and response testing is not desired.

> NOTE: It is imperative that switches S8, S9, S10, and S11 be set to "F" before the data monitor test set is inserted into a TD-100 that is on-line. If this is not done, severe degradation of service may result for as long as the switches remain at other than "FF."

3.03 Indicators. There are two types of lighted indicators on the data monitor test set PCB. One is the two-character hexadecimal display. This display refers to I (identity) and SO (status-out) information and is in easy-to-read alphanumeric form. The I and SO displayed is controlled by switches S4, S5, S6, and S7 as described in paragraph 2.02.

Information is also displayed by a series of single light emitting diodes. Twelve of the indicators are directly related to the SI-1 through SI-12 leads from the system processor. Whether they are lit or extinguished to indicate a true condition is dependent upon switch S2. (See paragaph 2.02). The two remaining LED's, labeled DIRECT and STORE, are explained in conjunction with their associated test points in paragraph 2.02.

4.00 OPERATING PROCEDURE

4.01 General. The wide range of capabilities of the data monitor test set makes it a versatile piece of test equipment. Its capabilities may be divided

into two broad categories: on-line testing and off-line testing.

4.02 On-Line Testing. Included in the category of on-line testing are use of the test probe (both latching and non-latching), channel data monitor, and channel data storage. Use of the test probe is explained in paragraph 2.02 of this publication.

The following paragraphs provide a step-by-step procedure for using the on-line monitor and storage test capabilities to test the TD-100 register selection and release operation by the processor. This test is presented here only as an example of the capabilities of the test set, since the number of separate tests that may be performed is very large. Using this procedure as a guide, the maintenance person will be able to determine other remaining test procedures as required.

a. Provide a test telephone located near to the TD-100 cabinet. This may be an ordinary station line instrument, or the access test set if available.

b. Before inserting the data monitor test set into the cabinet, set switches S8, S9, S10, and S11 to "F." This disables the demand and response capabilities of the test set.

c. Insert the test set PCB into the dictation 2 position of the channel subrack.

d. Set switch S7 to 1 and S6 to 5. This selects channel 15, the time slot of register 1.

e. Set switch S5 to its lower position (toward the bottom of the PCB), the MONITOR/STORE setting.

f. Observe the BUSY LED on the register PCB. When it is extinguished, operate the BUSY switch on the register PCB to make it busy to normal traffic.

g. Observe the two-character hexadecimal display. It should read "FF," reflecting the status of a made-busy register.

h. Restore the register to service by releasing the BUSY switch.

i. Observe the two-character hexadecimal display. It should read "7F," reflecting the status of an idle register. This confirms that the data monitor test set is reading the I and SO leads at SCR 15, the time slot of register 1.

j. Observe the BUSY LED on the register PCB to be certain that other system traffic has not caused the register to be seized. When it is idle, operate switch S5 to its upper position and then return it to its lower position. This clears the storage in the test set and prepares it for new storage.

k. Go off-hook at the test telephone. Verify that the BUSY LED on the register PCB lights. (Note that it may be necessary to momentarily make all other registers busy in order for the test call to seize the desired register. Return all other registers to service immediately when the desired register is seized by the test call.)

l. Go on-hook at the test telephone. Verify that the BUSY LED on the register PCB extinguishes.

m. Set switch S5 to its upper position, the DISPLAY/STORE setting.

n. Observe the hexadecimal display. It should read "7F," reflecting an idle register.

o. Momentarily depress the SKIP switch, S4. The hexadecimal display again reads "7F." This reading is identical to the previous reading and signals the end of a storage sequence.

p. Momentarily depress the SKIP switch. The hexadecimal display reads "FF," signifying that this storage slot is empty.

q. Repeat step p. above; the results are the same.

r. Momemtarily depress the SKIP switch. The hexadecimal display reads "7F," the I and SO of an idle register. This status was recorded at the beginning of the storage sequence before the test telephone came off-hook.

s. Momentarily depress the SKIP switch. The hexadecimal display reads "7F." The SI-1 and SI-10 LED's indicate a true condition. This shows that the processor recognized the idle register and marked the SI-1 and SI-10 leads to seize it to serve the test call.

t. Momentarily depress the SKIP switch. The hexadecimal display reads "77," the I and SO of a register seized to serve a local station. The SI-1 and SI-2 LED's show a true condition, indicating that the register is to remain seized and the call originator is off-hook.

u. Momentarily depress the SKIP switch. The hexadecimal display reads "77," and the SI-1 indication is true, but the SI-2 indication is not true. This indicates that the originator went on-hook.

v. Momentarily depress the SKIP switch. The hexadecimal display reads "71." This I and SO shows that the originator is on-hook and is preparing to return to idle.

w. Momentarily depress the SKIP switch. The hexadecimal display reads "7F," the I and SO of an idle register. This "7F" is the same storage set that was read in step n., above. Note that the display may be observed as many times as desired merely by continuing to operate the SKIP switch. The storage will be cleared and new storage begun when switch S5 is returned to its lower (MONITOR/STORE) position.

The range of additional tests that may be performed using the channel data monitor and storage capabilities of the test set is very large. In fact, every channel circuit during every cycle of its operation may be tested.

Many system operations will present more than eight sets of data that must be stored. When this is the case, break the operations into smaller segments and test each segment. It is not necessary to repeat the test situation time and again to test each segment. Simply begin the test and when a stable state is reached, such as a register providing dial tone, called station ringing, etc., stop the storage and operate the SKIP switch to read it from the displays. Then place switch S5 back in its lower position and continue with the test call and new data storage.

Whatever the type of operation to be tested, the function of the data monitor test set is two-fold. It checks the operation of the processor and of the channel circuit under test.

Fullest use of the data monitor test set can be made when it is used in conjunction with ITT Practice OB-000-005, entitled Trouble Analysis and PCB Replacement Guide. The information contained in the body of this document is very useful to the TD-100 maintenance person. Also of great utility is addendum A to OB-000-005, entitled Maintenance Flow Charts; this addendum contains detailed flow charts of system operation during many different call sequence types. Studying the flow chart pertaining to the call type to be tested with the data monitor test set will provide the maintenance person with a guide of what data will be displayed and/or stored.

Individual circuit narratives of the processors as well as the channel circuits should be consulted. Circuit schematics are available for each circuit in the system when needed.

4.03 Off-Line Testing. Off-line testing consists of utilization of the demand and response capabilities of the data monitor test set. Since the test set is used in the channel subrack in the dictation 2 position, it is scanned like any other channel circuit. The SCR of this position is 44; the SCW is 47. Thus, the test set may mark the I and SO leads during the SCR. See paragraph 2.4 of this publication for additional details.

Switches S8, S9, S10, and S11 control the demand and response capabilities of the test set. The functions of the switches are fully explained in paragraph 3.02 of this publication.

To use the demand function, set switches S8 and S10 to the demand desired. For example, "73" is the I and SO of a register requesting a local link. With "7" on switch S8 and "3" on switch S10, the processor will receive a demand for a local link, and will seize the first idle link it scans. Since the test set demand remains set to "73," the processor will continue to seize local links until they are all busy.

To prevent the seizure of a particular local link, its BUSY switch must be operated or the PCB on which it is located must be removed. It is for these reasons that use of the data monitor test set demand function must be considered off-line testing.

Switches S9 and S11 may be set to represent a response code. For example, "BF" is the I and SO of an idle local link. If all local links in the system are made busy, and switches S8 and S10 are set to "73," and switches S9 and S11 set to "BF," the processor will recognize the "73," and, at the next scan of channel 44, will recognize the "BF." The processor will attempt to satisfy the "73" demand with a "BF" response. This may be confirmed by setting the channel selector switches S7 and S6 to 44, and using the monitor and storage capabilities as described in paragraph 4.02 of this publication.

Be certain to remove the data monitor test set PCB, or set switches S8, S9, S10, and S11 to "F" before returning the TD-100 to on-line status.

5.00 DATA INTERPRETATION

5.01 General. The TD-100 is controlled chiefly by the processor 1 and 2 PCB's. There are five PROM's (programmable read only memories) contained within the processor that contain the system's operational program. To determine the correct operational sequence, it is necessary to interpret that program.

Table 1.01 is a list of the PROM programming (issue R). In column 2, a list of status-out conditions is presented and in column 3 is a list of channel circuit names. Taken together, these comprise a work description of the hexadecimal address code shown in column 4.

For example, in line 019, column 2 of table 1.01, the listing is BUSY. ATTENDANT LINK is listed in column 3 and hexadecimal "13" is listed in column 4. This means that the I (identity) and SO (status-out) of a busy attendant line circuit is "13." Note that not all codes listed in column 4 have equivalent word meanings. These codes are used internally by the processor but do not appear on the I and SO leads.

Beginning at line 192, column 2 lists several ACCESS CODE entries. The hexadecimal code in column 4 is produced by the processor whenever the access code is dialed for the corresponding feature listed in column 3. For example, in line 195, column 3, the listing is TRUNK GROUP 1. When the access code for trunk group 1 is dialed, the processor marks out a "C3." This code does not appear on the I and SO leads, but is used to initiate a program to locate and connect an idle trunk in group 1.

To initiate processor action, receipt of an active code is required. The active codes are the boxed entries in the address column in table 1.01. Any boxed code will serve as the starting point for processor action.

The method of generating a routine is shown in figure 1.02. The sample active code is "C5," the code generated to indicate an off-hook originator demanding dial tone. The active codes for each program routine are different as are the out-puts, but the general method of routine generation is the same.

In figure 1.02, the active code "C5" is fed into PROM 2 and PROM 1. (See line 197 of table 1.01.) PROM 2 outputs an "FF," which can be disregarded. Prom 1 outputs a "OC." This output determines whether the next output from PROM 1 will be a WSS (write search status), WNS (write new status), or W# (write number). If the least significant byte, in this case a "C," is a "C," "D," "E," or "F," then the next output from PROM 1 will be a WSS. If the least significant byte is a "0," "1," "2," "3," "4," or "5," then the next output from PROM 1 will be a WNS. If the least significant byte is a "6," "7," "8," "9," "A," or "B," the next output will be a W#.

Since the least significant byte in the example is a "C," the next output from PROM 1 will be a WSS.

The "OC" is fed into PROM's 1 and 2. (See line 12 of table 1.01.) PROM 1 outputs a "7F," which is the WSS. PROM 2 outputs a "00." The least significant byte, "0," dictates that the next output from PROM 1 will be a WNS.

The "00" is now fed into PROM's 1 and 2. (See line 000 of table 1.01.) PROM 1 outputs a "01," which is the WNS. PROM 2 outputs a "06." The least significant byte, "6," dictates the next output from PROM 1 will be a W#.

TABLE 1.01 PROM Program – Issue R

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
000			00	06	01				
001			01	07	04	7F	BF	FB	SI-1, 10 (Reset CW)
002			02	0D	04	FF	F7	FB	BLO (Reset CW)
003			03	7E	05	FF	FF	FB	(Reset CW)
004			04	DF	04	7F	FF	FF	SI-1
005			05	7E	09	FF	F7	FF	BLO
006			06	E1	0C	7F	DF	7C	SI-1, 11 IDT (CLRO)
007			07	F9	04	6E	FD	FF	SI-1, 8
008			08	7F	06	7F	FF	6C	SI-1, 4 IDT (CLRO)
009			09	04	01	FF	FF	3F	IDO IDT
010			0A	7F	0B	79	FF	7D	SI-1, 6, 7 IDT (CLRT)
011			0B	F1	01	7F	9F	C7	SI-1, 10, 11 CNE
012			0C	00	7F	7F	DF	6C	SI-1, 4, 11 IDT (CLRO)
013			0D	07	1F	7F	EF	FF	SI-1, 12
014			0E	D1	BF	6F	FF	FF	SI-1 (F/B-4/8)†
015			0F	F9	E5	7F	73	FD	SI-1, 9 BLO ULO (CLRT)
016	Inhibit Decode Terminator	Attendant Link	10			7F	FF	7F	SI-1 IDT
017	Connect	Attendant Link	11	FF	1A	7F	FF	FF	SI-1
018	Lockout	Attendant Link	12			FF	F7	FF	BLO
019	Busy	Attendant Link	13	FF	0A	7F	FF	FF	SI-1
020			14	7C	06				
021			15	0F	06				
022	Lockout	Attendant Link	16			FF	F7	FF	BLO
023	Ring Tone Enable	Attendant Link	17	3D	2F	7F	FF	F9	SI-1 RTE
024			18	85	04	6C	FF	FF	SI-1, 7, 8
025			19	2D	04	DD	FF	EF	SI-3, 4, 7
026			1A	15	00	7F	FF	DF	SI-1 ST
027			1B	EB	3F				
028			1C	09	6F				
029			1D	F9	EC				
030			1E	20	7F				
031	Idle	Attendant Link	1F	FD	3F				
032			20	0B	76				
033			21	7E	07				
034			22	27	07				
035			23	7E	EC				
036			24	29	04				
037			25	7E	60				
038	Write Attendant Number	Trunk	26	FF	14				
039			27	1D	2F				
040			28	41	24				
041			29	1F	04				
042			2A	43	24				
043			2B	33	04				
044			2C	19	04				
045	Idle	Trunk Group 4	2D	E9	5F				
046			2E	FF	EC				
047	Idle	Trunk Group 3	2F	F9	EF				
048	Transfer Terminator To Trunk	Transfer Link	30	FF	28	7F	F7	7F	SI-1 BLO IDT
049	Add-On Required (Add-On Busy)	Transfer Link	31	7E	0F	7F	FF	FA	SI-1 BTE

*Whenever SI-1 is generated, so will be $\overline{SZ}$, C'LRO and C'LRT. (C'LRO) or (C'LRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

† (F/B-4/8) checks F/B lead and marks SI-4 (Free) or SI-8 (Busy).

TABLE 1.01 PROM Program – Issue R (Cont.)

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
050			32						
051	Busy	Transfer Link	33	FB	77	7F	FF	FF	SI-1
052			34	19	04				
053			35	2E	EE				
054	Add-On Request (Add-On Free)	Transfer Link	36	FF	34	7F	FF	FF	SI-1
055	Ring Tone Enable	Transfer Link	37			7F	FF	F9	SI-1 RTE
056	Transfer Originator To Trunk	Transfer Link	38	FF	40	7F	F7	BD	SI-1 BLO IDO (CLRT)
057			39						
058			3A	51	01				
059			3B						
060	Transfer Originator To Trunk	Transfer Link	3C	FF	40	7F	F7	BD	SI-1 BLO IDO (CLRT)
061			3D	F9	EE				
062			3E	09	AF				
063	Idle	Transfer Link	3F	EB	DF				
064			40	27	04				
065			41	1D	06				
066			42	17	04				
067			43	3D	06				
068			44	46	04				
069			45	7E	0A				
070			46	3F	19				
071			47	5F	18				
072			48	4C	1B				
073			49						
074			4A	55	61				
075			4B						
076			4C	FF	E9				
077			4D	7E	E0				
078			4E	87	00				
079			4F	01	B8				
080	Transfer Originator	Add-On Link	50	FF	42	3F	F7	BD	SI-1, 2 BLO IDO (CLRT)
081			51	2F	06				
082			52	27	0D				
083			53	7E	78				
084			54	7C	0C				
085			55	0F	59				
086			56	35	2F				
087	Busy	Add-On Link	57	FF	56	7F	FF	F7	SI-1 $\overline{AOE + IE}$
088	Transfer Terminator To Trunk	Add-On Link	58	FF	2A	5F	F7	7F	SI-1, 3 BLO IDT
089	Transfer Originator To Trunk	Add-On Link	59	FF	42	3F	F3	BD	SI-1, 2 BLO ULO IDO (CLRT)
090			5A	5D	30				
091		Call Pick-Up	5B			7D	FF	FF	SI-1, 7
092			5C	09	2F				
093			5D	FF	01				
094			5E	69	E2				
095	Idle	Add-On Link	5F	F9	DF				
096			60	47	04	66	F7	BD	SI-1, 5, 8 BLO IDO (CLRT)
097			61	1D	08				
098			62	48	0B				
099			63	CD	A2				

*Whenever SI-1 is generated, so will be $\overline{SZ}$, CLRO and CLRT. (CLRO) or (CLRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

TABLE 1.01 PROM Program – Issue R (Cont.)

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
100			64	EF	B3				
101			65	DF	04				
102	Write Attendant Number	Trunk	66	FF	14				
103			67	61	24				
104			68	8D	04				
105			69	65	01				
106			6A	4F	FF				
107			6B						
108			6C	09	2D				
109	Idle	Trunk Group 5	6D						
110			6E	09	6D				
111	Idle	Tk Gp 1 - Tie Tk Gp 4	6F						
112	Terminate	Register–Trunk	70	FF	22	66	FF	FF	SI-1, 5, 8
113	Terminate	Register–Station	71			FF	F7	7F	BLO IDT
114	Transfer To Link	Register–Trunk	72	FF	24	77	FF	FF	SI-1, 5
115	Transfer To Link	Register–Station	73	FF	0E	7F	FF	FF	SI-1
116	Busy	Register–Trunk	74	FF	22	66	FF	FF	SI-1, 5, 8
117	Busy	Register–Station	75			FF	F7	7F	BLO IDT
118	Seized	Register–Trunk	76			77	FF	CF	SI-1, 5 DTE (XFR)
119	Seized	Register–Station	77			7F	FF	F8	SI-1 DTE
120	Toll Restriction	Register–Trunk	78		D6	77	7F	FF	SI-1, 5, 9
121			79						
122	Digit In	Register–Trunk	7A			77	FF	FF	SI-1, 5
123	Digit In	Register–Station	7B			7F	FF	FF	SI-1
124			7C	0A	FF				
125			7D	7E					
126	Terminate	Toll Restriction	7E	FF	4A	77	7F	FF	SI-1, 5, 9
127	Idle	Register	7F	FF	FF				
128			80	0D	72				
129			81	7E	18				
130			82	7E	0A				
131			83	7E	19				
132			84	86	04				
133			85	8F	06				
134			86	7D	0E				
135			87	E9	3F				
136			88						
137			89			7F	FF	F6	SI-1 $\overline{AOE + IE}$
138			8A						
139			8B						
140			8C	09	AD				
141			8D	01	8F				
142			8E	01	BB				
143			8F	E9	E5				
144			90	DD	1A				
145	Conference Transfer Request	Attendant Register	91	FF	44	7F	FF	FF	SI-1
146			92						
147	Ring Tone Enable	Attendant Register	93			7F	FF	F9	SI-1 RTE
148			94						
149	Inhibit Decode Originator	Attendant Register	95			6F	FF	BF	SI-1 (F/B-4/8)†

*Whenever SI-1 is generated, so will be $\overline{SZ}$, CLRO and CLRT. (CLRO) or (CLRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

† (F/B-4/8) checks F/B lead and marks SI-4 (Free) or SI-8 (Busy).

TABLE 1.01 PROM Program – Issue R (Cont.)

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
150	Lockout	Attendant Register	96			FF	F7	FF	BLO
151	Dial Tone Enable	Attendant Register	97	FF	08	7F	FF	78	SI-1 IDT DTE
152			98						
153	Intrude	Attendant Register	99		5A	6F	FF	62	SI-1 (F/B-4/8) ETXT IDT BTE†
154			9A						
155	Busy	Attendant Register	9B			7F	FF	FF	SI-1
156			9C	01	BD				
157	Busy Tone Enable – Inhibit Decode Terminate	Attendant Register	9D			6F	FF	7A	SI-1 (F/B-4/8) IDT BTE†
158	Connect	Attendant Register	9E	FF	18	6F	FF	FF	SI-1 (F/B-4/8)†
159			9F						
160			A0						
161			A1						
162			A2			5F	7F	FF	SI-1, 3, 9
163			A3	7E	89				
164			A4						
165			A5						
166	Write Attendant Number	Trunk	A6	FF	14				
167	Attendant Page		A7		84				
168			A8	04	03				
169	Busy	Paging with Answer Back	A9			7F	FF	FF	SI-1
170	Attendant	Paging with Answer Back	AA	FF	84				
171			AB						
172			AC	01	BE				
173	Idle	Trunk Group 6	AD						
174			AE	69	F2				
175	Idle	Trunk Group 2	AF						
176			B0						
177			B1						
178	Lockout	Link	B2			FF	F7	FF	BLO
179	Busy	Link	B3			7F	7F	FF	SI-1, 9
180			B4						
181			B5						
182	Lockout	Link	B6			FF	F7	FF	BLO
183	Ring Tone Enable	Link	B7			7F	FF	F9	SI-1 RTE
184	Idle	Dictation Access	B8						
185	Page	Paging with Answer Back	B9			7F	FF	FF	SI-1
186			BA						
187	Idle	Paging 1	BB						
188			BC	69	F5				
189	Idle	Paging 2	BD						
190	Idle	Paging 3	BE	A8	B9				
191	Idle	Link	BF						
192	Access Code	Tie Trunk Group 2	C0		AE				
193	Access Code	Dial "0"	C1	FF	02				
194	Access Code	Attendant Transfer	C2	FF	52				
195	Access Code	Trunk Group 1	C3	FF	1C				
196	Access Code	Unassigned Night Answer	C4	FF	3A				
197	Access Code	Call Waiting	C5	FF	0C				
198	Access Code	Tie Trunk Group 1	C6	FF	5E				
199	Access Code	Meet-Me Conference	C7	FF	60				

*Whenever SI-1 is generated, so will be $\overline{SZ}$, CLRO and CLRT. (CLRO) or (CLRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

† (F/B-4/8) checks F/B lead and marks SI-4 (Free) or SI-8 (Busy).

TABLE 1.01 PROM Program Issue R (Cont.)

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
200	Access Code	Tie Trunk Group 3	C8		BC				
201	Access Code	Trunk Group 2	C9	FF	3E				
202	Access Code	Trunk Group 3	CA	83	5C				
203	Access Code	Trunk Group 4	CB	81	6C				
204	Access Code	Trunk Group 5	CC	CB	6E				
205	Access Code	Trunk Group 6	CD	CD	8C				
206	Access Code	Paging 1	CE		8E				
207	Assigned Night Answer	Trunk	CF						
208	Access Code	Paging 2	D0	67	9C				
209	Access Code	Paging 3	D1	01	AC				
210	Lockout	Conference Link	D2			FF	F7	FF	BLO
211	Busy	Conference Link	D3			7F	FF	C7	SI-1 CNE
212	Access Code	Dictation Access	D4	F9	6A				
213	Access Code	Call Hold Exit	D5	63	82				
214	Lockout	Conference Link	D6	4A		FF	F7	FF	BLO
215	Ring Tone Enable	Conference Link	D7	D9		7F	FF	C1	SI-1 CNE RTE
216	Access Code	Spare	D8	05	68				
217	Access Code	Call Hold - Enter	D9	FF	40				
218	Access Code	Paging with Answer Back	DA	53	BE				
219	Access Code	Spare	DB	03					
220	Access Code	Spare	DC	DB					
221	Access Code	Call Forward-Follow Me	DD	DD					
222		Attendant Intercept	DE	90	80				
223	Idle	Conference Link	DF	D4					
224	Off-Hook	Tie Trunk	E0	4D		7F	FF	FF	SI-1
225	Clear Station Number	Trunk	E1	FF		7F	F7	FD	SI-1 BLO (CLRT)
226	Idle	Tie Trunk Group 1	E2	05	FF				
227	Ring Tone Enable - Camp-on	Trunk	E3	A3	FF	7E	FF	F9	SI-1 (F/B-4) RTE[O]
228	CO Release	Trunk	E4	45	FF	FF	F7	FF	BLO
229	Write Station Number	Trunk	E5	FF		7F	FF	FF	SI-1
230	Write Attendant Number	Trunk	E6	FF	54	7F	FF	7F	SI-1 IDT
231	Busy	Trunk	E7			7F	FF	FF	SI-1
232	Clear Terminator Number	DID Trunk	E8	E3	FF	7F	FF	FD	SI-1 (CLRT)
233	Conference Request	Trunk	E9	E9	62	7F	FF	FF	SI-1
234	Consultation Hold Request	Trunk	EA	E5	1E	7F	FF	FF	SI-1
235			EB	EB	FF				
236	Consultation Hold	Trunk	EC			5B	DF	3F	SI-1, 3, 6, 11 IDO IDT
237	Inhibit Decode Terminator - Ring Tone Enable	Trunk	ED			7F	FF	7F	SI-1 IDT
238	Add-On	Trunk	EE	31	FF	5D	FE	67	SI-1, 3, 7 AOE IDT ETXT
239	Incoming Call	Trunk	EF	7E	FF				
240			F0	2B	FF				
241	Write Attendant Number	Trunk	F1	FB	14	7F	F7	FD	SI-1 BLO (CLRT)
242	Idle	Tie Trunk Group 2	F2	05	FF				
243	Camp-On		F3	03	4E	7E	FF	D7	SI-1 (F/B-4) BRX[O]
244			F4	23	FF				
245	Idle	Tie Trunk Group 3	F5	21	FF				
246	Write Attendant Number	Tie Trunk	F6	05	54				
247			F7	25	FF				
248	Connect	Tie Trunk	F8	F3	1A	7F	FF	FF	SI-1
249			F9	F9	FF				

*Whenever SI-1 is generated, so will be SZ, CLRO and CLRT. (CLRO) or (CLRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

[O](F/B-4) checks F/B lead and marks SI-4 (free) or does not mark SI-4 (Busy).

TABLE 1.01 PROM Program — Issue R (Cont.)

LINE	CONDITION	CIRCUIT	ADDRESS	OUTPUT					CHANNEL COMMANDS*
				PROM 2	PROM 1	PROM 3	PROM 4	PROM 5	
250			FA	F5	FF				
251			FB	FB	FF				
252	Called Subscriber Answered	Trunk	FC	F7	64	7F	FF	FF	SI-1
253			FD	FD	FF	7F	FF	FD	SI-1 (CLRT)
254			FE						
255			FF						

*Whenever SI-1 is generated, so will be SZ, CLRO and CLRT. (CLRO) or (CLRT) shown in parenthesis indicates that memory store for the originator or terminator is inhibited in this time slot.

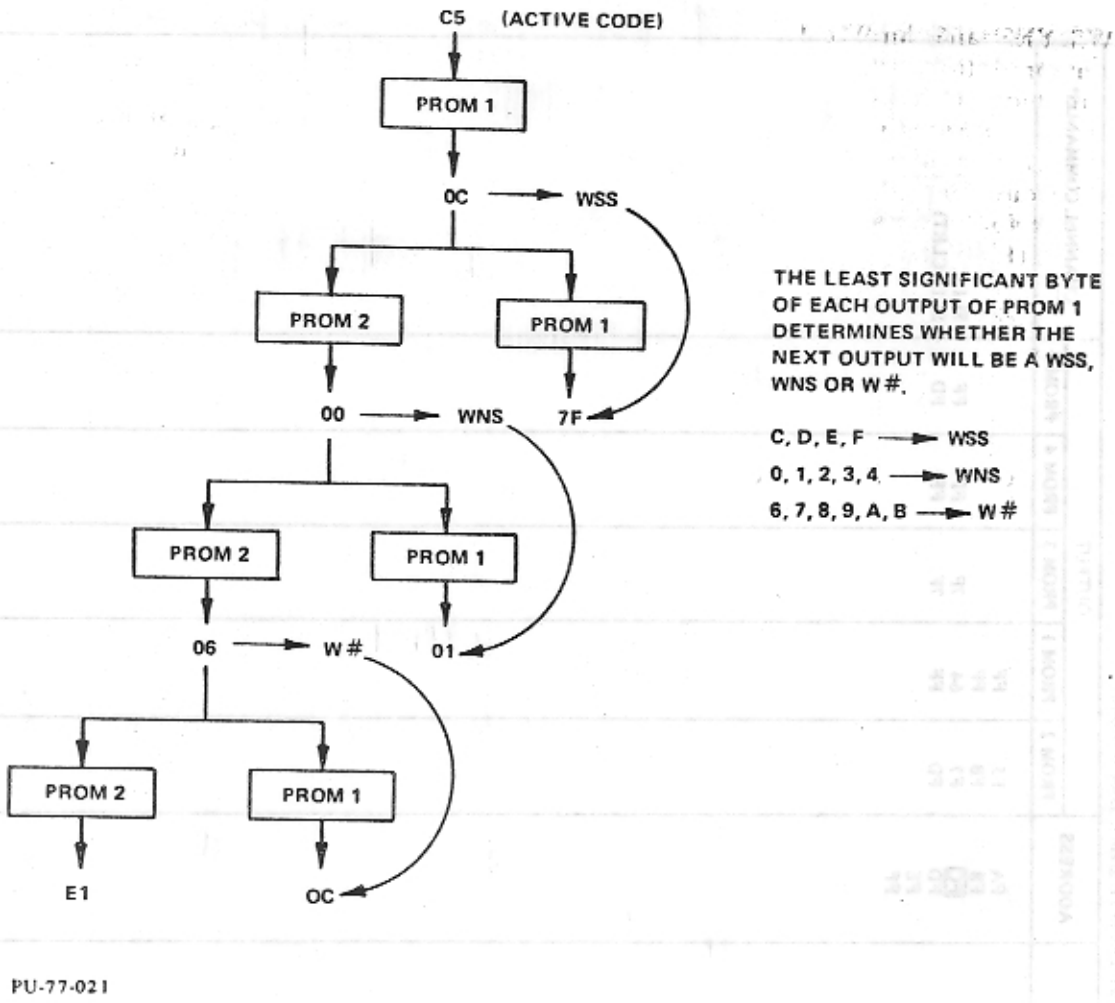


FIGURE 1.02 Derivation of WSS, WNS and W#

The "06" is now fed into PROM's 1 and 2. (See line 006 of table 1.01.) PROM 1 outputs a "OC," which is the W#. PROM 2 outputs an "E1," which may be disregarded.

Although the routine may continue, for the purpose of using the data monitor test set, the required information has been obtained.

a. An originator is off-hook demanding a register.

b. The active code for this condition is "C5."

c. "C5" initiates a processor routine.

d. From the routine, the WSS ("7F"), the WNS ("01"), and the W# ("0C") have been determined.

NOTE: Each of these items, the WWS the WNS, and the W# will be generated in most TD-100 routines as three successive hexadecimal codes. They will not always appear in the same order.

Of the WWS, the WNS, and the W#, the first two are most important to the maintenance person using the data monitor test set. The WSS, or write search status determines what the processor is searching for; in this case, the WSS "7F" is the identity and status-out of an idle register. The processor is therefore searching for an idle register. (See line 127 of table 1.01.)

The WNS, or write new status, determines what commands the processor will send when the search status is satisfied. The function of PROM's 3, 4, and 5 is to translate the WNS code, in this case "01," into command signals. Of greatest concern to the maintenance person using the data monitor test set are the SI-1 through SI-12 leads which can be monitored by the test set. Note from line 001 of table 1.01 that a WNS of "01" fed into PROM's 3, 4, and 5 produces codes that translate into channel commands SI-1, SI-10, and reset CW (call waiting) signal.

This same program routine derivation technique may be applied to any active code and the results verified through the use of the storage capabilities of the data monitor test set. Note that a call sequence will contain several active codes and will therefore produce several program routines. Each of these routines may then be checked as required with the data monitor test set.

LINE CIRCUIT
(410151)
TD-100
ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

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1.00 GENERAL DESCRIPTION 1
General 1
2.00 DETAILED DESCRIPTION 1
General 1
Sample Operation 1
Strapping 5

FIGURES

1.00 Line Circuit Waveforms 3
1.01 Effect of Dial Pulses on OHO Lead . 4

TABLES

1.00 Line Circuit Terms 2

1.00 GENERAL DESCRIPTION

1.01 General. Each TD-100 line circuit printed circuit board (PCB) contains five line circuits. Each circuit consists of an analog portion which provides the transmission path and a (digital) logic portion which controls the voice path and provides signaling. Leads R (ring), T (tip), RT (ringing), L (lamp), and A (return ground) are connected to the station instrument; leads RXT (transmit terminate), TXO (transmit originate), RXT (receive terminate), and RXO (receive originate) are connected to the common services highway amplifier. Table 1.00 lists additional line circuit abbreviations and their meanings.

2.00 DETAILED DESCRIPTION

2.01 General. Leads T and R are the voice carrying leads; signals transmitted across the T and R leads appear at the secondary of transformer, T101 (pin 5), with a -8 dB gain. They are applied through the low pass filter, consisting of Q101, Q102, and associated circuitry, to the inputs of the field effect transistor (FET) switches, Q103 and Q104.

NOTE: Each line circuit is designated as either the originator or terminator of a call. The sequence of logic operation is effected by this designation but the end result is not changed.

Depending on whether the transmitting party is the terminator or the originator, either Q103 or Q104, respectively, conducts and the voice signal will appear at the TXT or TXO inputs of the common services highway amplifier. These signals are sent for 1 microsecond every 64 microseconds.

Signals received at the line circuit along the common services highway amplifier are applied through the emitter-follower circuit of Q603 or Q604 to the input of FET switch Q105 or Q106. Depending upon whether the receiving party is the terminator or the originator, Q105 or Q106, respectively, conducts.

U111 operates as an amplifier and hold circuit (first stage) and as a low pass filter (second stage) to provide an overall gain from U111-5 to T101-7 of +11 dB. The voice signals are received at T with a -8 dB gain across the transformer, thus the overall gain for a line to line call is (-8) + (-8) + 11, or -5 dB.

2.02 Sample Operation. In a station-to-station call using key telephones, when the originator goes off-hook, the DC loop across T and R is closed. The L101 contacts close, applying low levels at U109-4, 5, and 1; U103-5; and U110-2 and 3. This results in a low at U109-11 and highs at U108-9, U103-6, U103-8, U110-9, and U103-11 which cause a low at U140-2. The LED, CR113, lights: Q109 conducts; and the lamp, L, on the station instrument lights. (Figure 1.00 shows some line circuit waveforms.)

At the SCO (scan channel zero) signal, the line is scanned by the line scanner in the memory. U102-5

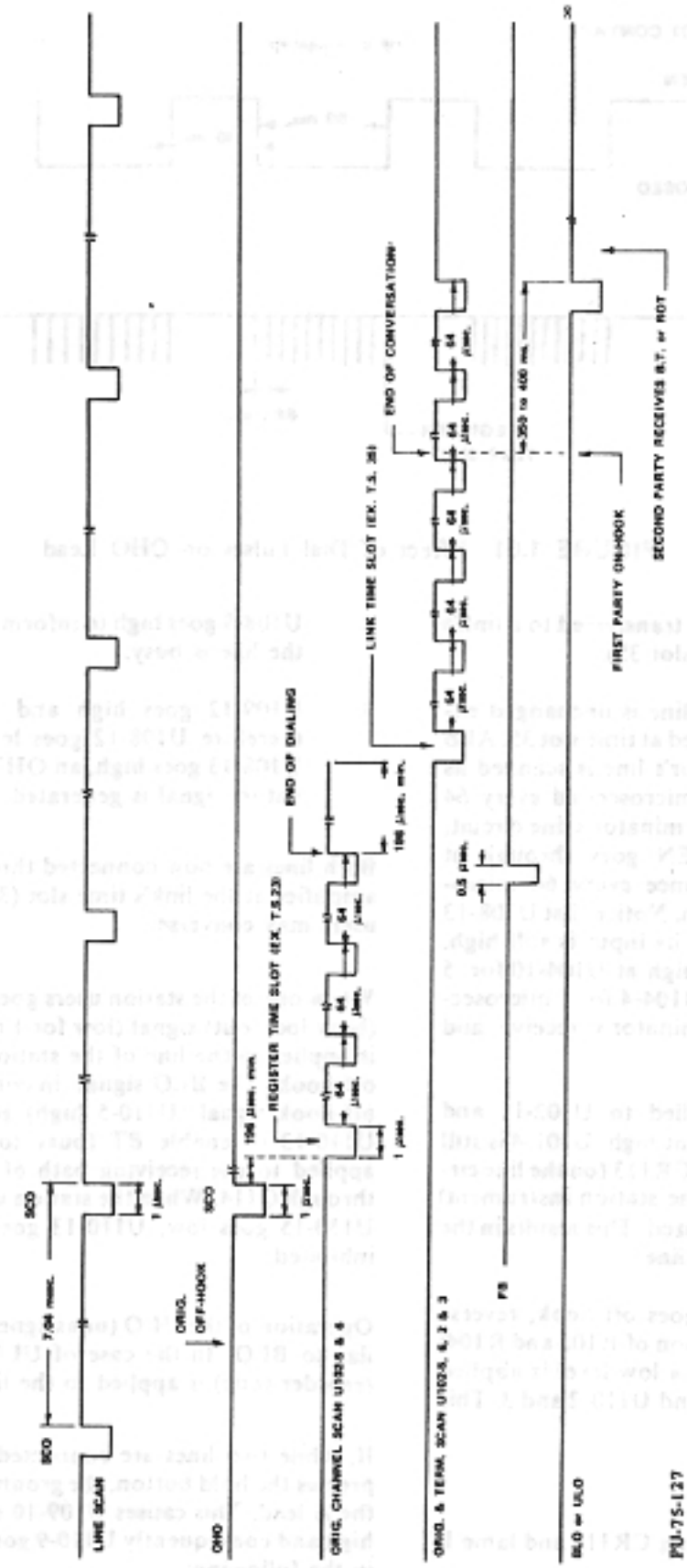

FIGURE 1.00 Line Circuit Waveforms
(On a station-to-station call)

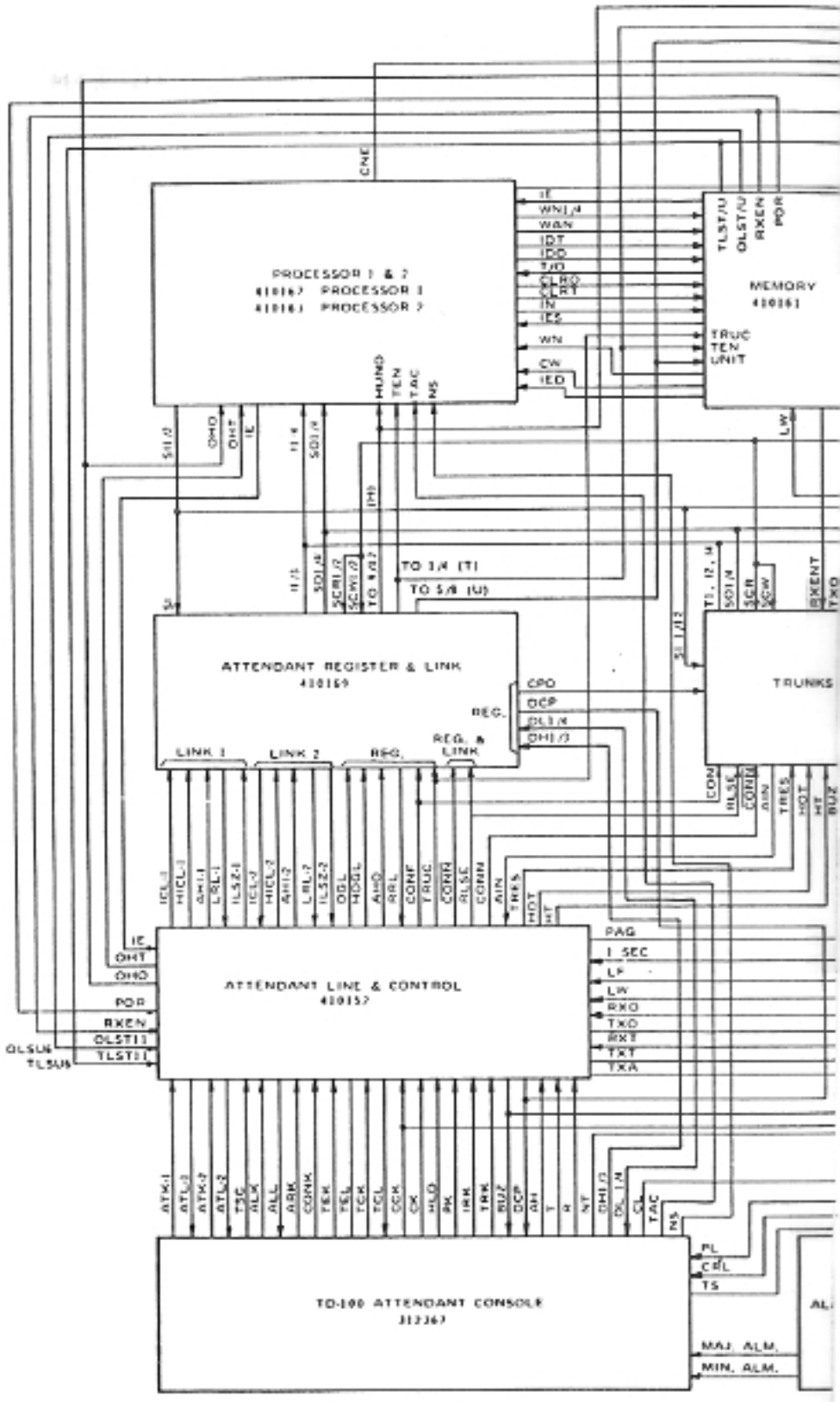

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FIGURE 1.00 At

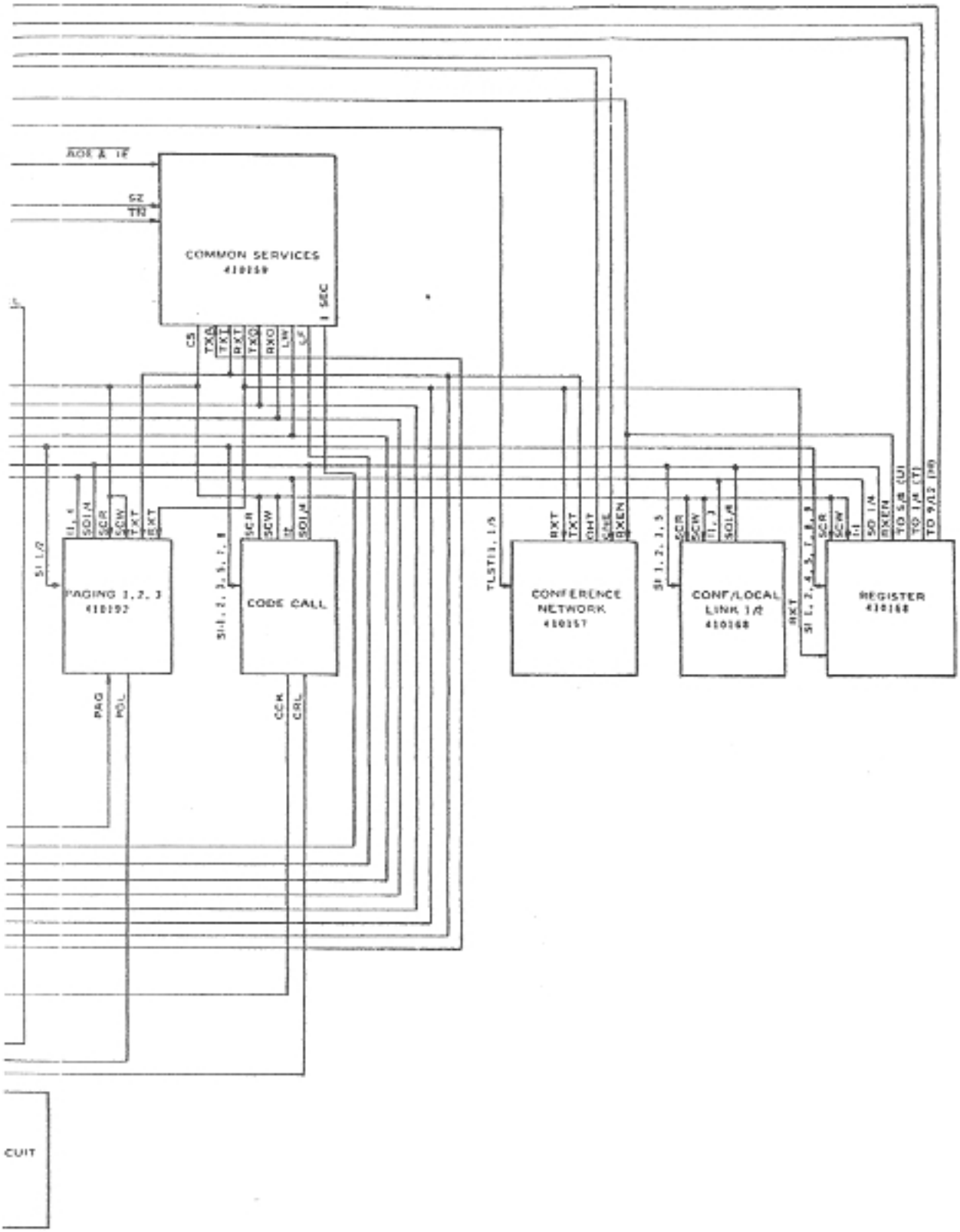
COMMON SERVICES
410159
1 SEC
CS
TXA
TXT
RXT
TXO
RXO
LW
LF
PAGING 1, 2, 3
410192
CODE CALL
CONFERENCE
NETWORK
410157
CONF/LOCAL
LINK 1/2
410168
REGISTER
410168
PAG
POL
CCK
CRL
CUIT

TABLE 1.04 Primary Internal Lead Abbreviations

ABBREVIATION	MEANING	312367( )68	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410-159
A-Q	Data leads from processor I and II									
AH	Attendant hookswitch flash	X	X							
AHI 1 + 2	Automatic hold incoming 1 and 2		X							
AHO	Automatic hold outgoing		X							
AIN	Artificial intrude		X	X						
ALK	Attendant line key	X	X							
ALL	Attendant line lamp	X	X							
ALMC	Alarm master clock								X	
AOB	Add-on busy									
AOE	Add-on enable									
$\overline{\text{AOE + IE}}$	Add-on enable and intrude enable (inverted)								X	
ARK	Attendant release key	X	X							
AS 1 + 2	Attendant switch 1 and 2	X						X		
ATK 1 + 2	Attendant trunk key 1 and 2	X	X							
ATL 1 + 2	Attendant link 1 and 2	X	X							
BLO	Busy lock-out		X							
BRD	Battery reversal deny									X
BRX	Bar receive									
BT	Busy tone		X		X				X	
BTE	Busy tone enable								X	
BUZ	Buzzer	X	X	X						
CCK	Code call key	X	X							
CK	Conference key	X	X							
CL	Conference lamp	X								
CLRO	Clear originator									
CLRT	Clear terminator									
CNC	Channel number compare						X		X	
CNE	Conference network enable						X			
COB	Camp-on busy									
CONF	Conference		X	X						
CONK	Connect key	X	X							
CONN	Connect									

ASSOCIATED WITH CIRCUIT NUMBER

;10-162	TD-410-163	TD-410-164	TD-410-165	TD-410-166	TD-410-167	TD-410-168	TD-410-169	TD-410-170, -258	TD-410-172	TD-410-177	TD-410-178	TD-410-186	TD-410-191	TD-410-192	TD-410-193	TD-410-207	TD-410-224	TD-410-225	TD-410-226	TD-410-228	TD-410-229	TD-410-295	TD-410-296	TD-410-297	TD-410-298	TD-410-302	TD-410-304
X																										
						X																				
						X																				
	X							X	X																X	
										X																
							X																			
X							X																			
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	X							X	X																X	
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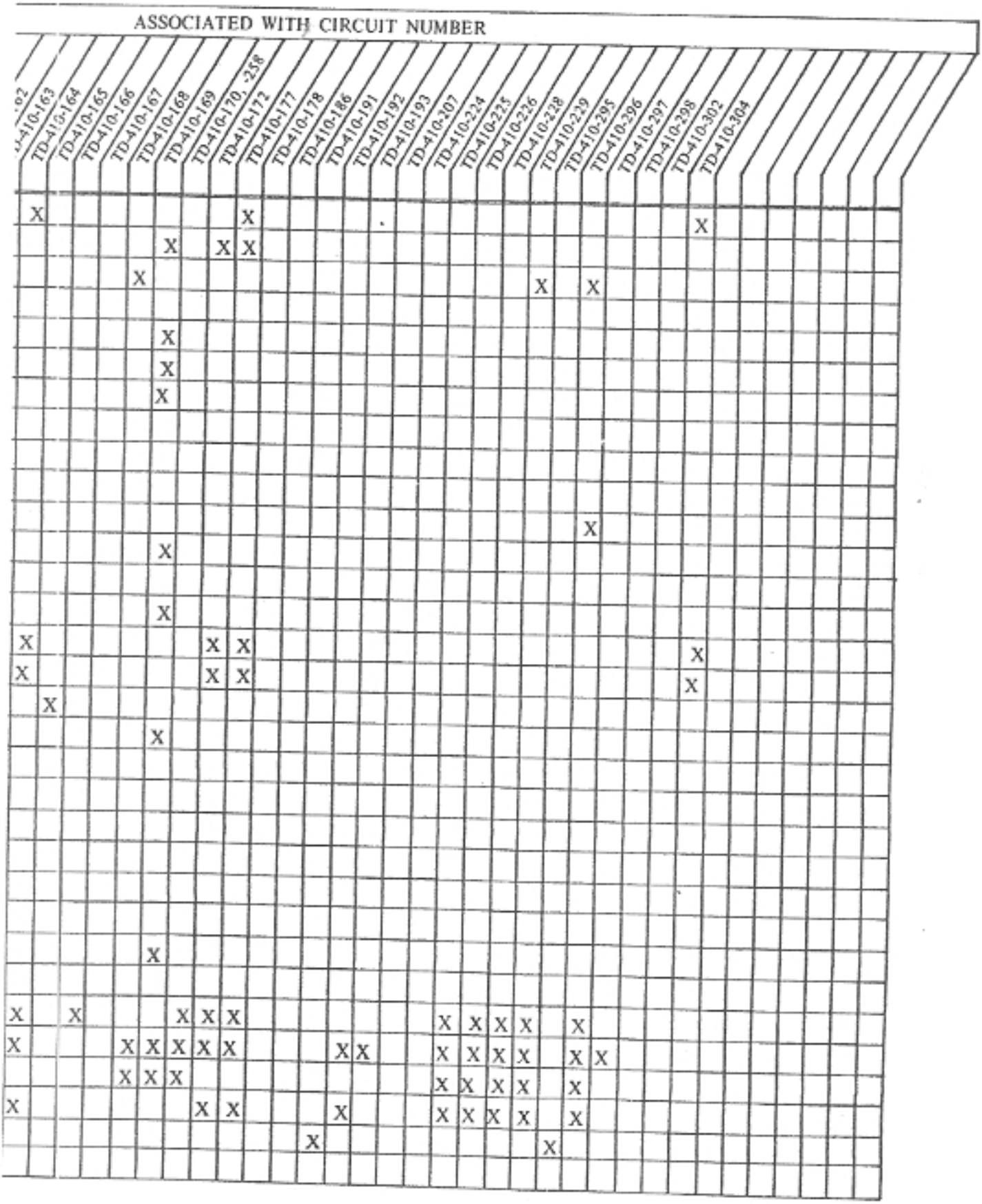
X																										
	X					X			X																X	
						X		X																		

TABLE 1.04 Primary Internal Lead Abbreviations (Cont.)

ABBREVIATION	MEANING	3123671( )68	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410-159	TD-410-160	TD-410-
$\overline{\text{CONN}}$	Connect		X	X								
CPO	Camp-on			X								
$\overline{\text{CS = 2}}$	Channel scan twice (inverted)											
CW	Call waiting										X	
DCP	D.C. Pulse	X	X									
DH1-3	Dial horizontal 1-3	X										
DL1-4	Dial longitudinal 1-3	X										
DTE	Dial tone enable								X			
ETXT	Enable terminator transmit										X	
ES	Enable search											X
FB	Free/busy											
HICL 1 +2	Hold incoming link 1 and 2		X									
HLD	Hold	X	X									
HOGL	Hold outgoing link (or line)		X									
HOT	Hold trunk (automatic)		X	X								
HT	Hold trunk		X	X								
IB	Inhibit busy									X		
ICL 1 + 2	Incoming link 1 and 2		X									
IDO	Inhibit decoder originator									X		
IDT	Inhibit decoder terminator									X		
IE	Intrude enable								X	X		
IED	Intrude enable delayed									X		
IES	Intrude enable start									X	X	X
IIE	Inhibit intrude enable									X		
IL 1 + 2	Intercept lamp 1 and 2	X										
ILSZ 1 + 2	Incoming link seize 1 and 2	X	X									
I1	Identity 1			X								X
I2	Identity 2			X								X
I3	Identity 3											X
I4	Identity 4			X								X
LF	Lamp flash		X	X					X			
LP	Last pulse									X	X	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TD-410-165
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TD-410-167
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TD-410-169
TD-410-170, -258
TD-410-172
TD-410-177
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TD-410-186
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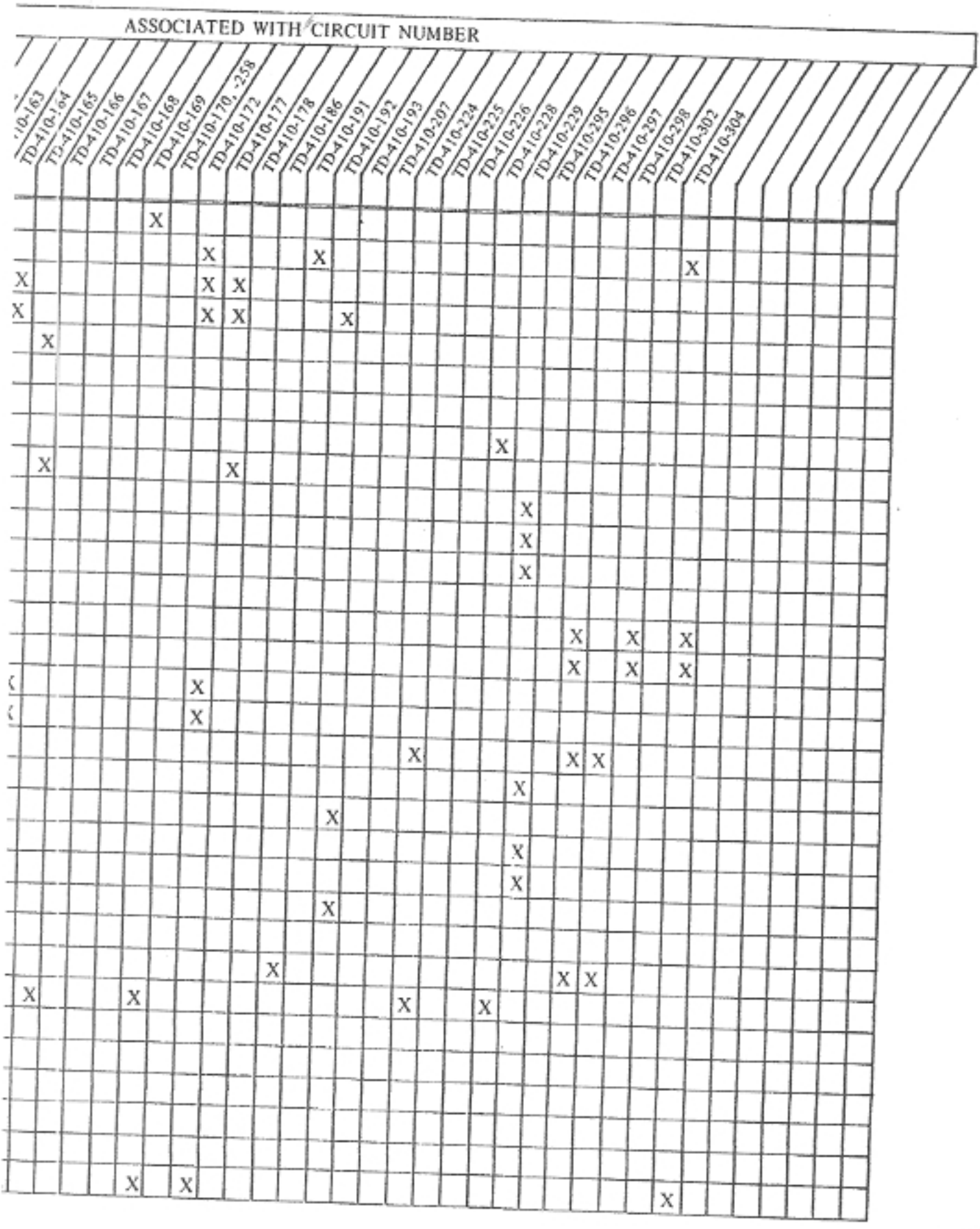
TD-410-193
TD-410-207
TD-410-224
TD-410-225
TD-410-226
TD-410-228
TD-410-229
TD-410-295
TD-410-296
TD-410-297
TD-410-298
TD-410-302
TD-410-304

TABLE 1.04 Primary Internal Lead Abbreviations (Cont.)

ABBREVIATION	MEANING	3123671 368	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410-159	TD-410-160
LRL 1 + 2	Link release 1 and 2		X								
LW	Lamp wink		X	X					X		X
LWT	Lamp wink (trunk)			X					X		
MOH	Music on hold			X							
NE	Number enable										X
NIC	Night incoming call				X	X					
NM	Number match										X
NS	Night switch	X									
NT	Night	X		X							X
OCCTM 1-24	Occupancy time 1-24										
OFE	Overflow enable										
OFI 1-4	Overflow information 1-4										
OGL	Outgoing link (or line)		X								
OHO	Off-hook originator		X								
OHT	Off-hook terminator		X				X				
OLST 0-11	Originator line scan 0-11 (tens)		X								X
OLSU 0-9	Originator line scan 0-9 (units)		X								X
OOI-8	Originator out 1-8								X	X	
OVFL	Overflow										
PAG	Paging		X								
PC	Peg-count										
PCGP 22&23	Peg-count group 22 and 23										
PGL	Page lamp	X									
PK	Page key	X	X								
PL	(for future use)	X									X
POR	Power-on reset		X								X
R	Ring	X	X								
RC	Restricted code								X		
RD 1	Ring drop 1 (line side)	X					X				
RD 2	Ring drop 2 (line side)		X				X				
RH	Register hold								X		
RLSE	Release		X	X							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TD-410-172
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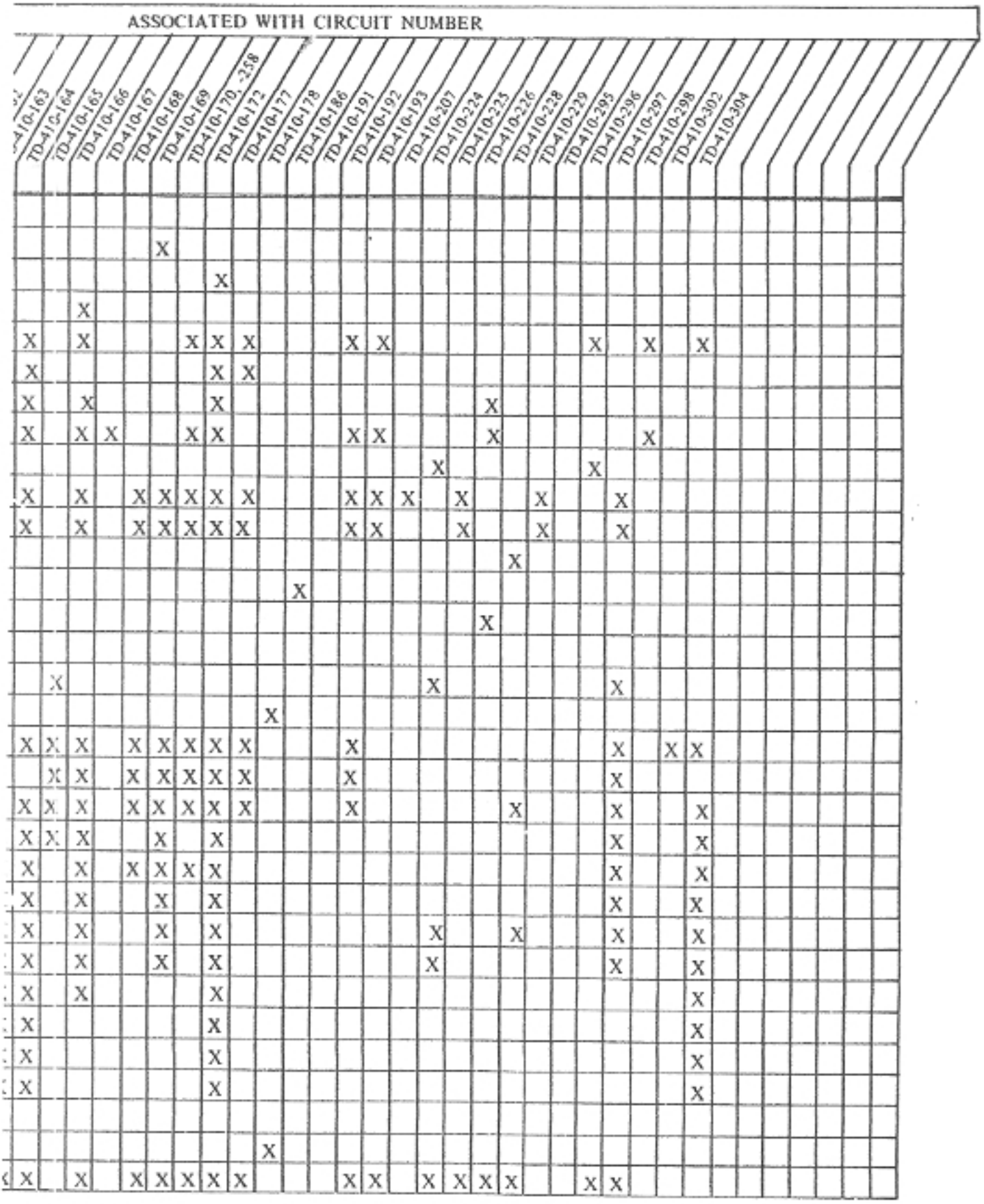
TD-410-178
TD-410-186
TD-410-191
TD-410-192
TD-410-193
TD-410-207
TD-410-224
TD-410-225
TD-410-226
TD-410-228
TD-410-229
TD-410-295
TD-410-296
TD-410-297
TD-410-298
TD-410-302
TD-410-304

TABLE 1.04 Primary Internal Lead Abbreviations (Cont.)

ABBREVIATION	MEANING	3123671 J68	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410-159	TD-410-16
ROT	Reorder tone		X							X	
RRL	Register release			X							
RTE	Ringback tone enable								X		
RXA	Receive add-on								X		
RXEN	Receive enable			X			X				X
RXENT	Receive enable (trunks)			X							X
RXO	Receive originator		X	X	X				X		
RXT	Receive terminator		X	X			X		X		
SCN	Store channel number								X		
SCR	Scan channel read			X	X	X			X		X
SCW	Scan channel write			X	X	X			X		
SCO	Scan channel zero								X		
SC1	Scan channel 1								X		
SC60	Scan channel 60								X		
SC62	Scan channel 62								X		X
SH	Station hunting										X
SIN	Status-in										
SI1	Status-in 1, Seize			X							
SI2	Status-in 2, Off-hook originator										
SI3	Status-in 3, Off-hook terminator			X							X
SI4	Status-in 4, Free (not busy)			X							
SI5	Status-in 5, Intrude			X							
SI6	Status-in 6, Consultation hold			X							
SI7	Status-in 7, In add-on			X							
SI8	Status-in 8, Found busy channel			X							
SI9	Status-in 9, Called subscriber ans.--reset			X							
SI10	Status-in 10, Conference			X							
SI11	Status-in 11, New station number			X							
SI12	Status-in 12, Attendant recall			X							
SN	Store number										X
SOD	Status-out delayed										
SO1	Status-out 1			X							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TD-410-170, -258
TD-410-172
TD-410-177
TD-410-178
TD-410-186
TD-410-191
TD-410-192
TD-410-193
TD-410-207
TD-410-224
TD-410-225
TD-410-226
TD-410-228
TD-410-229
TD-410-295
TD-410-296
TD-410-297
TD-410-298
TD-410-302
TD-410-304

TABLE 1.04 Primary Internal Lead Abbreviations (Cont.)

ABBREVIATION	MEANING	3123671 J68	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410-159	TD-410-160
SO2	Status-out 2			X							
SO3	Status-out 3			X							
SO4	Status-out 4			X							
SPR	Status pulse record			X							X
$\overline{SZ}$	Seize (inverted)								X		
SZD	Seize delayed										X
T	Tip	X		X							
TA	Trunk (key) lamp	X		X							
TB	Trunk lamp	X		X							
TCK	Talk city key	X		X							
TCL	Talk city lamp	X		X							
TD1	Tip (console during PFT)	X						X			
TD2	Tip (attendant line during PFT)		X					X			
TEK	Talk extension key	X		X							
TEL	Talk extension lamp	X		X							
TK	Trunk group key										
TL	Tie line										X
TLST 0-11	Terminator line scan 0-11 (tens)		X				X				X
TLSU 0-9	Terminator line scan 0-9 (units)		X				X				X
$\overline{TN}$	Terminator number (inverted)								X		X
T/O	Terminator/originator										X
TO 1-4	Terminator out 1-4 (tens digit)				X					X	X
TO 5-8	Terminator out 5-8 (units digit)				X					X	X
TO 9-12	Terminator out 9-12 (hundreds digit)									X	
TOC 1-8	Terminator out 1-8 (class of service)									X	X
TR	Tip (to dictation recorder)										
TRAC	Trunk access control	X									
TRES	Trunk reservation			X	X						
TRK	Trunk reservation key	X		X							
TRO	Terminator register output										X
TRUC	Busy verification			X							X
TS	Trunk switch	X			X						

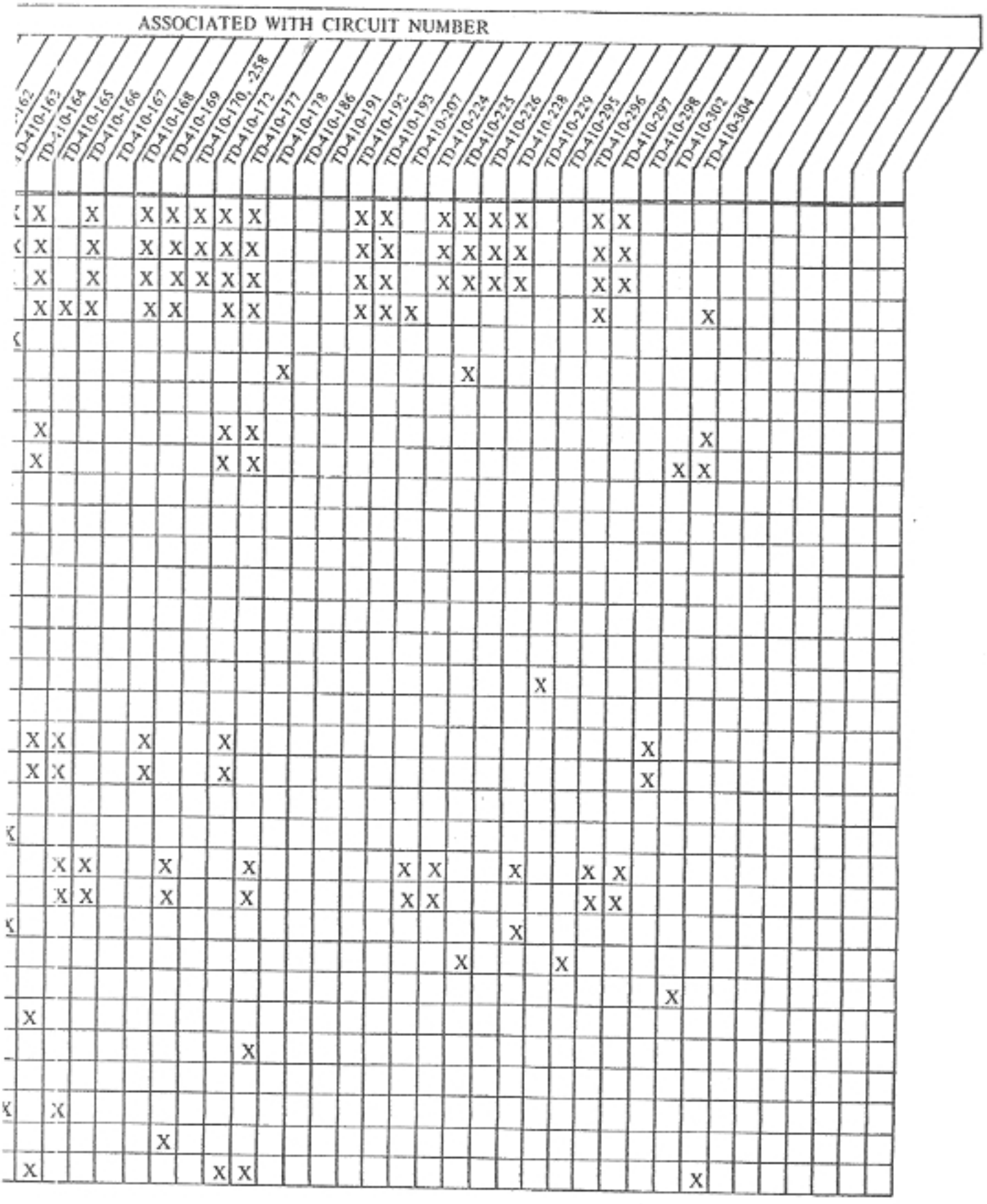
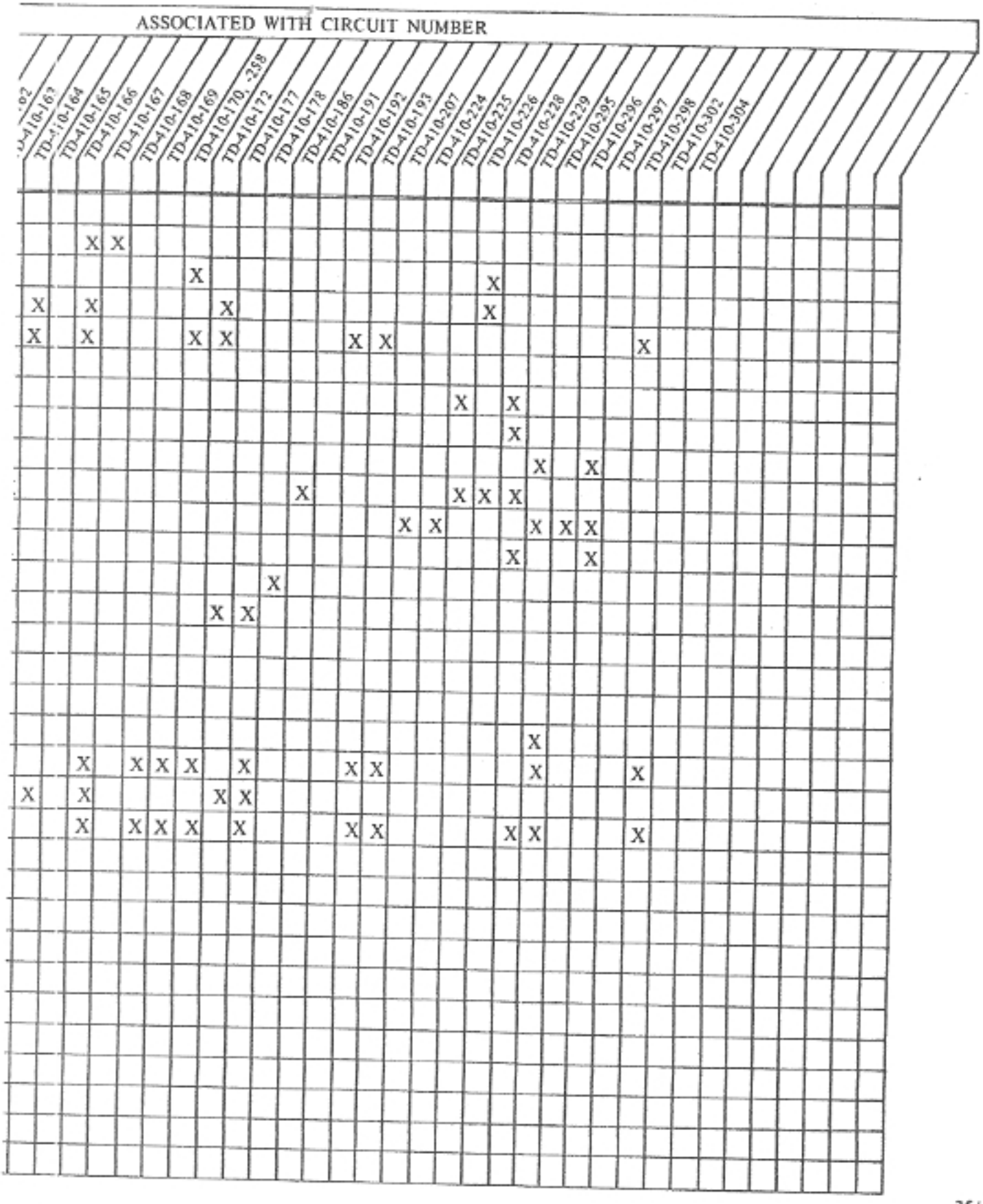

ASSOCIATED WITH CIRCUIT NUMBER
TD-410-162
TD-410-163
TD-410-164
TD-410-165
TD-410-166
TD-410-167
TD-410-168
TD-410-169
TD-410-170, -258
TD-410-172
TD-410-177
TD-410-178
TD-410-186
TD-410-191
TD-410-192
TD-410-193
TD-410-207
TD-410-224
TD-410-225
TD-410-226
TD-410-228
TD-410-229
TD-410-295
TD-410-296
TD-410-297
TD-410-298
TD-410-302
TD-410-304

TABLE 1.04 Primary Internal Lead Abbreviations (Cont.)

ABBREVIATION	MEANING	3123671 368	TD-410-151	TD-410-152	TD-410-153	TD-410-154	TD-410-155	TD-410-157	TD-410-158	TD-410
TSC	Trunk switch common	X			X					
TTE	Tel-Touch enable									
TXA	Transmit add-on			X						
TXO	Transmit originator		X	X	X				X	
TXT	Transmit terminator		X	X				X	X	
T1	8 megahertz timing clock								X	
T2	4 megahertz timing clock								X	
T3	2 megahertz timing clock								X	
$\overline{T3}$	2 megahertz timing clock (inverted)									
T4	1 megahertz timing clock								X	
$\overline{T4}$	1 megahertz timing clock (inverted)									X
ULO	Unassigned lockout		X							
UNAE	Unassigned night answer enable									
VNI	Vacant number intercept									X
VNI/COS	Vacant number intercept/class of service									X
WAN	Write attendant number									
WN1-4	Write number 1-4									
XFER	Transfer									
1SEC	1 second timing pulse				X					
10MS	10 millisecond timing pulse								X	
50MS	50 millisecond timing pulse				X				X	


ASSOCIATED WITH CIRCUIT NUMBER
-92
TD-410-163
TD-410-164
TD-410-165
TD-410-166
TD-410-167
TD-410-168
TD-410-169
TD-410-170, -258
TD-410-172
TD-410-177
TD-410-178
TD-410-186
TD-410-191
TD-410-192
TD-410-193
TD-410-207
TD-410-224
TD-410-225
TD-410-226
TD-410-228
TD-410-229
TD-410-295
TD-410-296
TD-410-297
TD-410-298
TD-410-302
TD-410-304