SYSTEM PRACTICE 01300 IMG

TCX-128

Installation and Maintenance Manual For BT15 X10 Software

Issue 1-0 April 16, 1985

ATC &
1-214-257-1980
612 545-7111

This manual should be read in its entirety before attempting to install or program the system.

This manual has been developed by TIE/communications, Inc. It is intended for the use of its customers and service personnel.

Any comments or suggestions for improving this manual would be appreciated. Forward your remarks to:

TIE/communications, Inc.
5 Research Drive
Shelton, CT 06484

Attention: Manager, Technical Publications

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TCX-128

Installation and Maintenance Manual
For BTIS X10 Software

Issue 1-0 April 16, 1985

TCX-128

REVISION CONTROL

REVISION	DATE	CHANGE
0-1	08 MAR 85	Supercedes P/N 86046 (Issue 2-2). Rewritten throughout.
1-0	16 APR 85	Released for issue.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
INTRODUCTION

Section 1, SYSTEM DESCRIPTION, introduces the reader to the system. Section 1 contains general descriptive information about the system components, and details the telephone company, site and FCC requirements. It also includes a specification table.

Section 2, FEATURES, provides a detailed description of every feature available in the system. Additional data on key callouts, flash and signaling patterns, and display messages is also included.

Section 3, HARDWARE CONFIGURATION, allows the reader to develop the Order Sheet. The Order Sheet is used to record the equipment (hardware) requirements of the installation site.

Section 4, SOFTWARE CONFIGURATION, consists of the instructions necessary to configure the system programmable options. The data base developed in this section is entered on the Program Record Forms. The codes on the Program Record Forms are entered into system memory during installation.

Section 5, INSTALLATION, includes all the information required to successfully install the system.

Section 6, INSTALLATION OF OPTIONAL EQUIPMENT, contains description and installation data on each piece of optional equipment that can be used with the system.

Section 7, PROGRAM ENTRY, tells the reader how to enter the data base recorded on the Program Record Forms into system memory. All systems must be programmed to some degree before being operational.

Section 8, THEORY OF OPERATION, consists of the system and Printed Circuit Board (PCB) theory of operation for the system. This section is intended to be used with Section 9, MAINTENANCE, to allow service personnel to isolate system faults to the plug-replaceable unit.

Section 9, MAINTENANCE, is the final section of the manual and provides maintenance instructions for the system. The System Troubleshooting Flowchart, Operational Test Procedure, System Voltages table and the Replaceable Parts list are included in this section.

Appendixes A through E contain Operational Specifications (i.e., user instructions) for each telephone type.

Appendix F consists of the Off Premises Extension Description and Installation Manual.

TECHNICAL ASSISTANCE

When problems or questions arise during installation or servicing that cannot be resolved using this or related documents, then contact TIE Technical Service Department as follows:

For assistance between 8:30 AM and 5:00 PM, Eastern time, call:

(203) 926-2033

For assistance in the event of an ***ABSOLUTE*** emergency at other times than those listed, call:

(203) 929-7920

TCX-128

ABI

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TECHNICAL ASSISTANCE

TCX-128
COMPUTERIZED BRANCH EXCHANGE
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TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 1, SYSTEM DESCRIPTION

1. INTRODUCTION

1.01 The SYSTEM DESCRIPTION Section provides basic information about the TCX-128 Computerized Branch Exchange. It summarizes the various components of the system, available station instruments, specifications, site requirements and Federal Communications Commission (FCC)/telephone company requirements.

1.02 Following is a list of related system documents:

Description	Part Number
Attendant Telephone User Guide	01300AC
Multibutton Key Telephone User Guide	01300MB
Four Button Key Telephone User Guide	01300FB
One Button Single Line Telephone User Guide	01300OB
Single Line (2500 Type) Telephone User Guide	01300SL
Special Loud Ringing Tone Board Instructions	01042
Tie Electronic Ringer Instructions	01084
TELE-RECORD Description and Operation Manual	01026

2. SYSTEM DESCRIPTION

2.01 The TCX-128 is a sophisticated and flexible electronic telephone system. It uses a Z80 microprocessor for the main operating program. This system employs a space division matrix with stored program control to provide a full range of features. In addition, 6502 and 6504 microprocessors are used as traffic controllers and status reporters. This allows for task sharing between the Central Processing Unit (CPU) and the Station Printed Circuit Boards (PCBs).

2.02 This system has a maximum capacity of 32 lines, 128 stations and 32 talkpaths. Twenty talkpaths are reserved for Central Office (CO) lines, ten are available for Intercom (ICM) calls, and two are reserved exclusively for Paging and Background Music (BGM).

2.03 The following paragraphs provide a summary of the major components in a TCX-128 system.

KEY SERVICE UNIT AND EXPANSION CABINET

2.04 The TCX-128 Key Service Unit (KSU) and Expansion Cabinet (Figure 1-1) are wall-mounted, convection-cooled equipment cabinets. The KSU and the Expansion Cabinet contain all the replaceable Printed Circuit Boards used as the common control equipment for the system.

2.05 The PCBs installed in the KSU control the system. They include: a Central Processor Unit (B-CPU-B) PCB; a Tone Generator (B-TGU-B) PCB; an Auxiliary (B-AUX-A) PCB; Station Control Unit (B-8SCU-C) PCBs; Single Line Unit (B-8SLU-B) PCBs and Central Office Unit (B-4COU-A) PCBs. The Expansion Cabinet uses a Buffer (B-BUF-A) PCB and can accommodate additional B-8SCU-C, B-8SLU-B and B-4COU-A PCBs. Refer to Section 3 for the required quantities of these printed circuit boards, Section 5 for detailed installation procedures, and Section 8 for the PCB and system Theory of Operation.

2.06 External connections to the KSU are made by 25-pair cables using type 57 connectors. The KSU cabinet is equipped with standard phono jacks for connecting a customer-provided music source, and a four-wire test jack. An RS-232-C connector is provided for connecting a customer-provided programming terminal and/or Station Message Detail Recording (SMDR) equipment to the system.

POWER SUPPLY

2.07 The power supplies (Figure 1-2) are separate units that are wall-mounted next to the KSU and expansion cabinet. They provide the DC power requirements for the TCX-128.

TELEPHONES

2.08 The TCX-128 System uses the following telephones:

- Multibutton Key Telephone with Speakerphone (Handsfree)
- Multibutton Key Telephone without Speakerphone (Monitor)
- Display Multibutton Key Telephone
- Four Button Key Telephone
- One Button Single Line Telephone
- Standard single line (2500 type) telephone

2.09 System attendants use Multibutton Key Telephones (with or without display) programmed during installation with special attendant features. In addition, attendants can use Direct Station Selection (DSS) consoles for one-button access to all other telephones in the system.

2.10 Each telephone (except for the 2500 type) is available in either the MERITOR HX/DELPHI BX or ULTRACOM CX model.

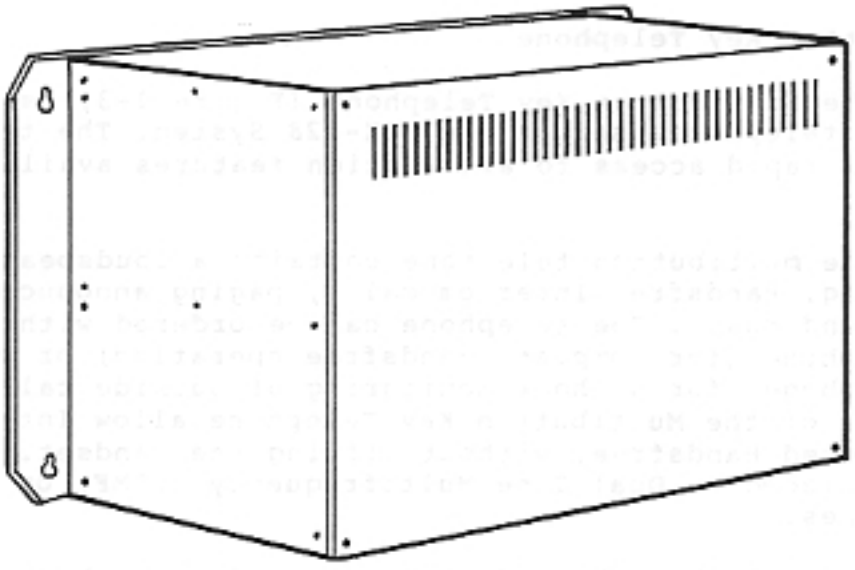


Figure 1-1 KSU AND EXPANSION CABINET, TCX-128

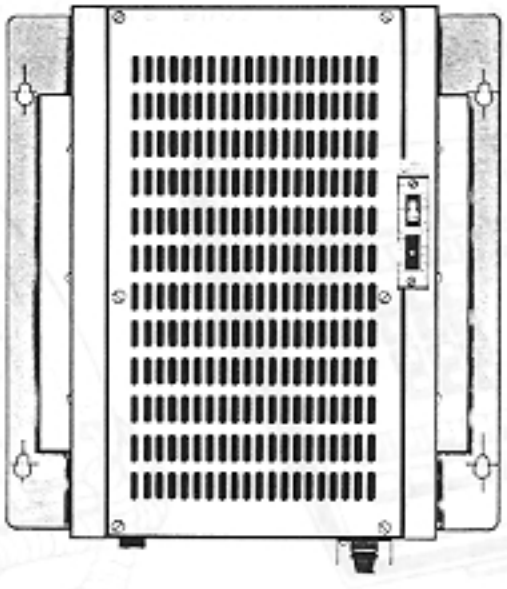


Figure 1-2 POWER SUPPLY, TCX-128

MULTIBUTTON TELEPHONES

Multibutton Key Telephone

2.11 The Multibutton Key Telephone (Figure 1-3) is the primary station telephone used in the TCX-128 System. The telephone provides rapid access to all station features available in the system.

2.12 The multibutton telephone contains a loudspeaker for tone signaling, Handsfree Intercom calls, paging announcements and Background Music. The telephone can be ordered with a speakerphone (for complete Handsfree operation) or without a speakerphone (for on-hook monitoring of outside calls). Both versions of the Multibutton Key Telephone allow Intercom calls to be answered Handsfree, without lifting the handset. Outside calls can be placed on Dual Tone Multifrequency (DTMF) or Dial Pulse (DP) lines.

2.13 The telephone has 28 easy to use feature keys for answering calls, placing calls and accessing system features. Keys 1-5 are used to answer incoming calls; keys 8-13 are used to place outgoing calls. The remaining keys on the telephone give one-button access to the various features. Keys 1-14 can also be Station Speed Dial memory bins and Direct Station Selection (DSS) keys. When used as DSS keys, a Busy Lamp Field for 14 internal stations is provided. The function of the key is assigned by the mode the telephone is in (i.e., outside line mode, DSS mode or Speed Dial mode), as determined by the user. Visual and audible indications provide flash and tone signals that help the user to determine feature status.

Figure 1-3 MULTIBUTTON KEY TELEPHONE, TCX-128

Display Multibutton Key Telephone

2.14 The Display Multibutton Key Telephone (Figure 1-4) provides all of the features of the Multibutton Key Telephone, plus a display window for a visual message reference. The dial pad has four additional keys which provide for Volume Control (VOL UP, VOL DN), Last Number Redial, and number Save (storage). The display telephone has full speakerphone (Handsfree) capability.

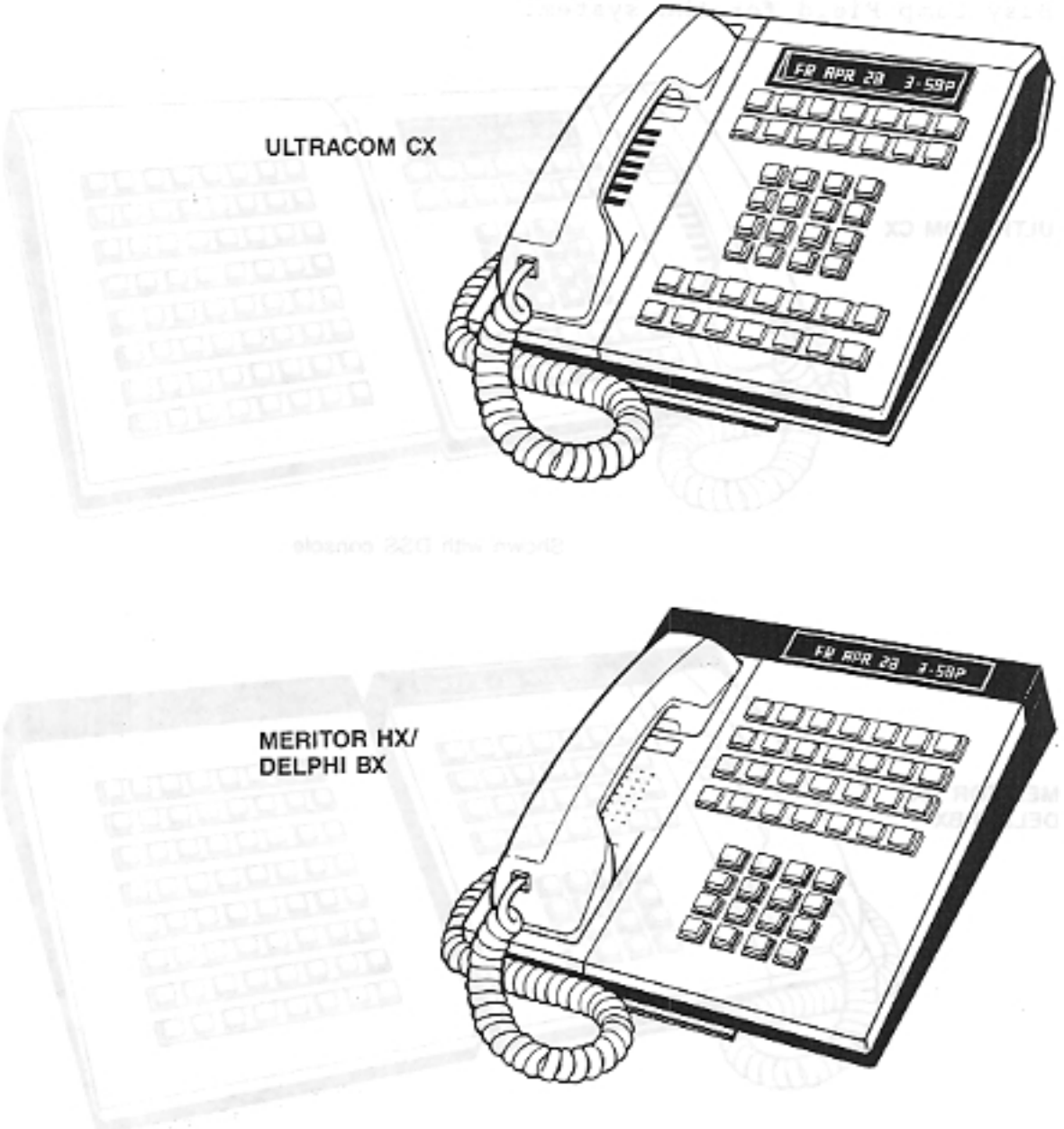


Figure 1-4 DISPLAY MULTIBUTTON KEY TELEPHONE, TCX-128

Attendant Positions (Multibutton Key Telephone and DSS Console)

2.15 The system attendants use Multibutton and Display Multibutton Key Telephones, programmed during installation with several unique attendant features. These features include Alternate Attendant Station, Handsfree Transfer and Release. The attendant telephone also allows the system to be put in the night mode (i.e., Night Service activated).

2.16 When the attendant's telephone is used with a Direct Station Selection (DSS) console (Figure 1-5), one button Intercom access to all stations is provided. The DSS console also serves as a Busy Lamp Field for the system.

Figure 1-5 MULTIBUTTON KEY TELEPHONE (FOR ATTENDANT), TCX-128

FOUR BUTTON KEY TELEPHONE

2.17 The Four Button Key Telephone (Figure 1-6) is used when the sophistication of the multibutton telephone is not required. It provides single button access to many of the commonly used features. Other features are available by dialing access codes. The LEDs in the feature keys provide a visual indication of feature status. Four Button Key Telephone users can answer Intercom calls Handsfree, with the Handsfree Answerback feature.

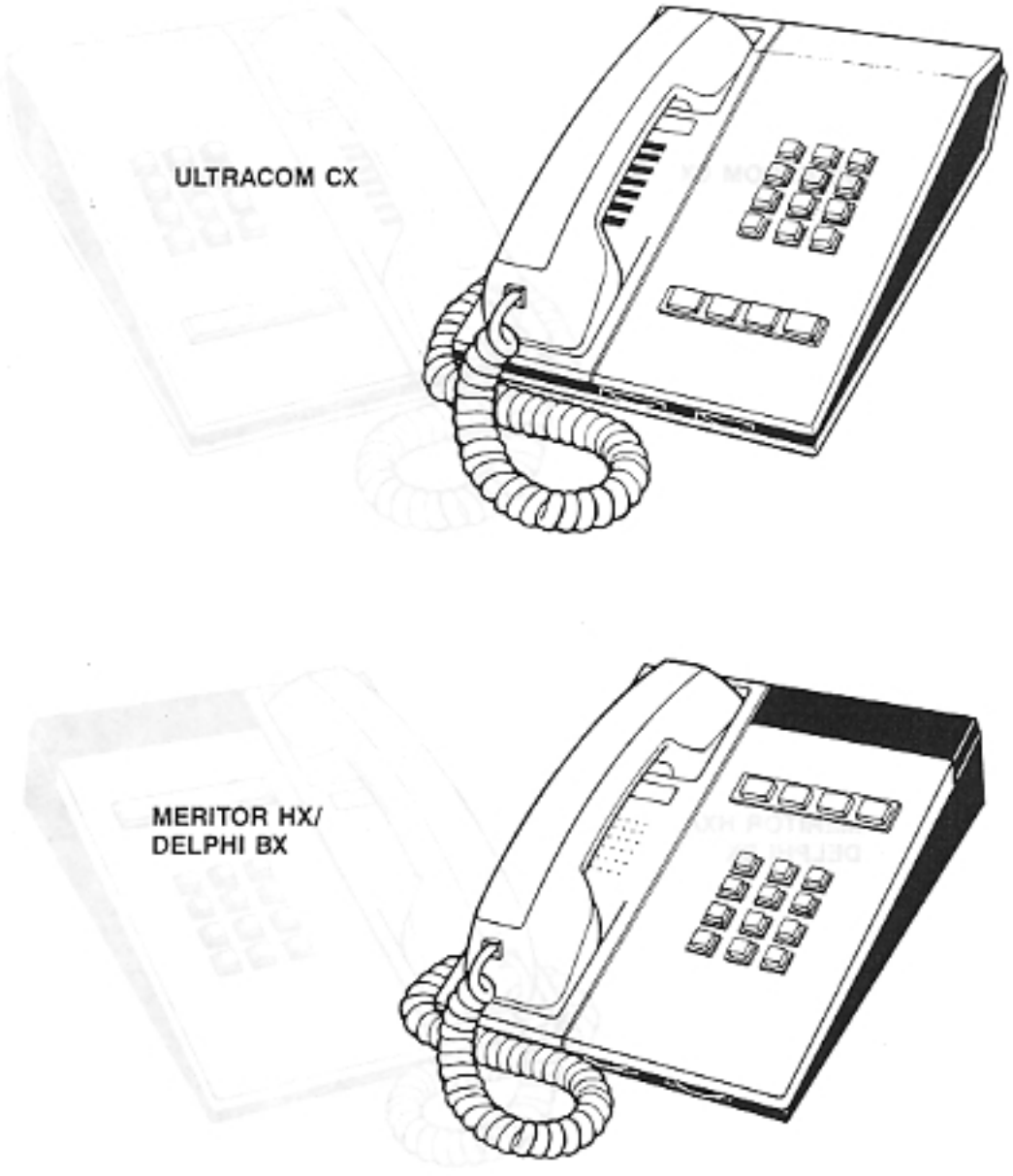


Figure 1-6 FOUR BUTTON KEY TELEPHONE, TCX-128

ONE BUTTON SINGLE LINE TELEPHONE

2.18 The One Button Single Line Telephone (Figure 1-7) is a single line telephone that allows a wide variety of system features to be accessed by dialing access codes or pressing the HOLD/TRANSFER bar. The One Button Single Line Telephone is automatically connected to an Intercom circuit when the telephone is idle and the handset is lifted.

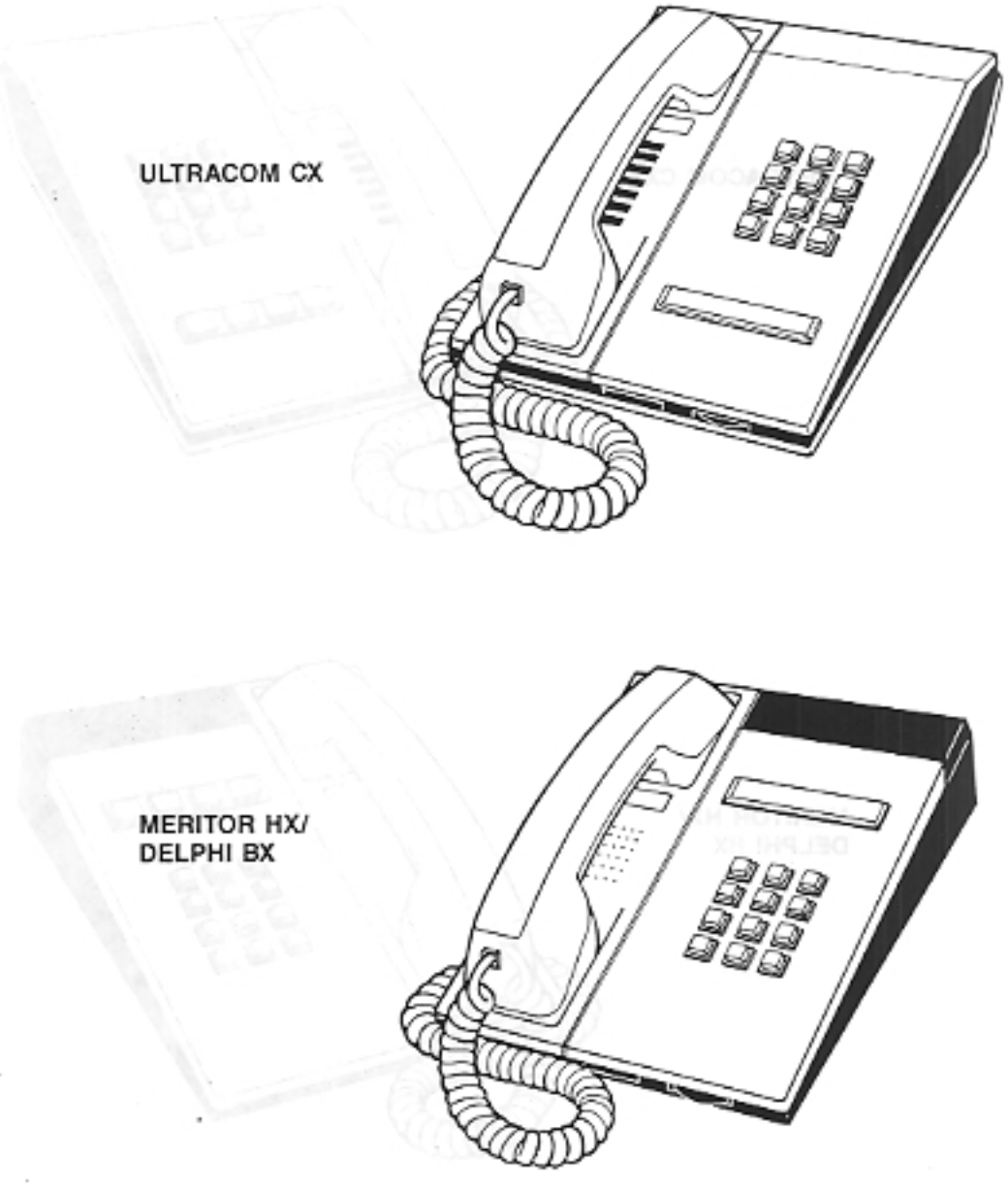


Figure 1-7 ONE BUTTON SINGLE LINE TELEPHONE, TCX-128

SINGLE LINE (2500 TYPE) TELEPHONE

2.19 A standard single line (2500 type) telephone (Figure 1-8) can be used with the TCX-128 system. Single line telephones access system features by using the hookswitch in conjunction with dialed access codes. These telephones are connected to an Intercom circuit when the telephone is idle and the handset is lifted.

NOTE: Single line (2500 type) telephones must be equipped with special tone ringers.

Figure 1-8 SINGLE LINE (2500 TYPE) TELEPHONE, TCX-128

3. SPECIFICATIONS

3.01 Refer to Table 1-1 at the end of this section for technical specifications pertaining to the TCX-128 system.

4. BASIC SYSTEM OPERATION

4.01 The TCX-128 (Figure 1-9) uses microprocessors in the KSU and in each key telephone to control the system. The microprocessors are "micro" sized computers which allow digital (microprocessor) commands to make the analog (voice) connections between the conversing parties. This design allows for sophisticated operation in a compact, economical system. It also allows the system to be customized from a programming terminal easily and quickly, without complex wiring or expensive hardware additions.

4.02 The B-CPU-B PCB, which is the Central Processing Unit, contains two microprocessors: an executive Z80 microprocessor and a 6502 traffic controller microprocessor. The executive Z80 microprocessor is the brain of the system. It constantly "talks" to the system memory (also contained on the B-CPU-B PCB), the 6502 traffic control microprocessor and all the other PCBs in the system to allow constant monitoring of the outside lines and internal stations. When the Z80 sees a change (such as a call ringing in), it analyzes what is happening and sends commands to the various PCBs to process the event.

4.03 The outside lines are connected to the B-4COU-A Central Office Unit PCBs, and the internal stations are connected to the B-8SCU-C Station Control Unit PCBs (or B-8SLU-B PCBs if single line or one button telephones are used). The various tones used by the system are generated on the B-TGU-B Tone Generator Unit PCB. If the system uses Least Cost Routing, which automatically places calls on the least expensive route, the B-AUX-A Auxiliary PCB is used.

4.04 When a call rings into a B-4COU-A PCB (Figure 1-9), the Z80 checks the system memory and tells the 6502 traffic controller to ring those stations programmed to get ringing for the line. When an internal station answers the call, the microprocessors switch an analog path between the line and the station so the parties can talk to each other. The inverse of this happens when a call is placed. If an Intercom call is made, the microprocessors switch an analog path between two stations.

4.05 The analog and digital networks are actually more complicated than this. Most calls are directly linked between the line port on a B-4COU-A PCB and a station port on a B-8SCU-C PCB through a single digitally controlled switch. Certain calls (specifically, on lines 21-32) require an additional digitally controlled switch on the B-TGU-B PCB. This is discussed in detail in Section 8, THEORY OF OPERATION.

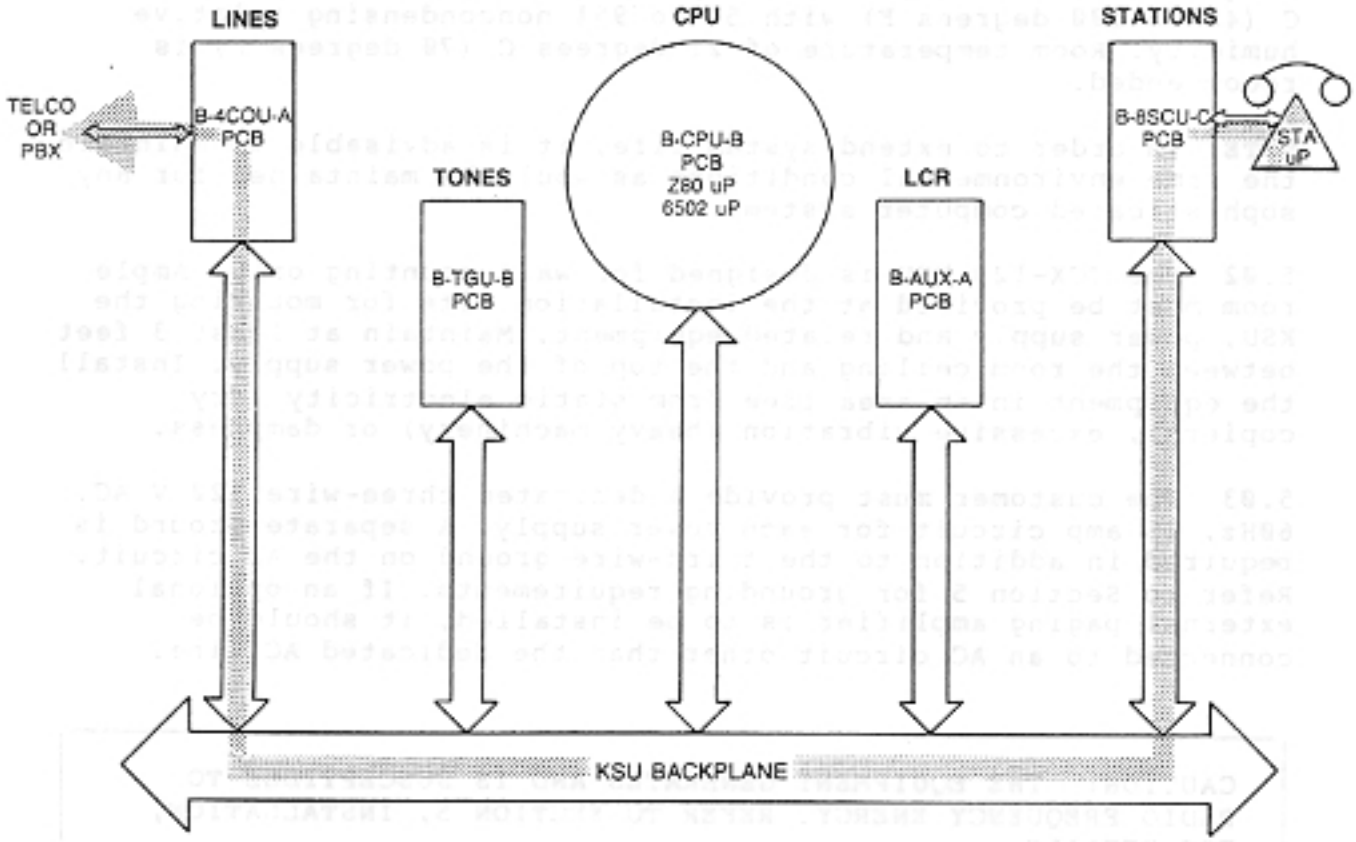


Figure 1-9 BASIC BLOCK DIAGRAM, TCX-128

5. SITE REQUIREMENTS

5.01 The TCX-128 KSU should be installed in a clean, dry and secure location that is not accessible to unauthorized personnel. This location, as detailed in Section 5, (paragraph 2.02) should comply with Bell Functional Product Class Criteria of September, 1978 in publication PUB 48002 as stated in 3.4.3.2, paragraph C--Indoors With Environmental Control. The room must have adequate ventilation, and a temperature range of 4 to 38 degrees C (40 to 100 degrees F) with 5% to 95% noncondensing relative humidity. Room temperature of 21 degrees C (70 degrees F) is recommended.

NOTE: In order to extend system life, it is advisable to maintain the same environmental conditions as would be maintained for any sophisticated computer system.

5.02 The TCX-128 KSU is designed for wall mounting only. Ample room must be provided at the installation site for mounting the KSU, power supply and related equipment. Maintain at least 3 feet between the room ceiling and the top of the power supply. Install the equipment in an area free from static electricity (dry copiers), excessive vibration (heavy machinery) or dampness.

5.03 The customer must provide a dedicated three-wire 120 V AC, 60Hz, 15 amp circuit for each power supply. A separate ground is required in addition to the third-wire ground on the AC circuit. Refer to Section 5 for grounding requirements. If an optional external paging amplifier is to be installed, it should be connected to an AC circuit other than the dedicated AC line.

CAUTION: THE EQUIPMENT GENERATES AND IS SUSCEPTIBLE TO RADIO FREQUENCY ENERGY. REFER TO SECTION 5, INSTALLATION, FOR DETAILS.

6. FCC AND TELCO REQUIREMENTS

6.01 Rules and regulations for the operation and installation of privately-owned telephone equipment have been established by the Federal Communications Commission (FCC). According to Part 68 (Connection of Terminal Equipment to the Telephone Network) and its amendments, several actions are required before and during installation of customer-provided telephone equipment. These actions are outlined below.

NOTIFICATION TO TELCO

6.Ø2 As owner of this telephone system, you must give the following information to the operating telephone company before connecting or disconnecting it:

(a) Sufficient notice of your intention to use privately owned telephone equipment.

(b) The particular lines to be used (telephone numbers xxx-xxxx through xxx-xxxx).

(c) Model: TCX-128
Manufacturer: TIE/communications, Inc.
FCC Registration Number: BJ286G-68925-MF-E
Ringer Equivalence: 2.6B
Registered Jack: RJ21X

FCC APPROVED CONNECTORS

6.Ø3 Connection of this system to telephone company lines must be made with FCC approved plugs and jacks.

INSTALLATION CLASSES

6.Ø4 Classes for installation are available through TIE/communications, Inc. and its regional offices.

INCIDENCE OF HARM

6.Ø5 The FCC requires that when trouble is experienced, the customer shall disconnect the registered equipment from the telephone line to determine if the registered equipment is malfunctioning. If the registered equipment is malfunctioning, the use of such equipment shall be discontinued until the problem has been corrected.

6.Ø6 When practical, the telephone company must notify the customer that service may be temporarily discontinued if customer provided equipment is causing harm to the telephone network. The telephone company must attempt to inform the customer that service is to be discontinued before actually terminating service. The telephone company must also provide customers with an opportunity to correct the problem and must advise customers of their right to bring complaint procedures before the FCC.

HEARING AID COMPATIBILITY

6.Ø7 FCC rules prohibit the use of non-hearing aid-compatible telephones in the following locations:

(a) Any public or semipublic location where coin-operated or credit card telephones may be found.

(b) Elevators, highways, and tunnels (automobile, subway, railroad, or pedestrian) where a person with impaired hearing might be isolated in an emergency.

(c) Places where telephones are specifically installed to alert emergency authorities such as fire, police, or medical assistance personnel.

(d) Hospital rooms, residential health care facilities, convalescent homes, and prisons, specifically where telephones are used for signaling life-threatening or emergency situations if alternative signaling methods are not available.

(e) Workstations for hearing impaired personnel.

(f) Hotel, motel, apartment lobbies; in stores where telephones are used by patrons to order merchandise; in public transportation terminals where telephones are used to call taxis, or to reserve lodging or rental automobiles.

(g) Hotel and motel rooms. At least ten percent of the rooms must contain hearing aid-compatible telephones; or contain jacks for plug-in hearing aid-compatible telephones which will be provided to hearing impaired customers upon request.

Table 1-1 SPECIFICATIONS, TCX-128 (1 of 2)

GENERAL SPECIFICATIONS

System Capacity:

	KSU	WITH EXPANSION CABINET
CO/PBX Lines	24	32
Stations	64	128
System Talk Paths	32	32
Private Lines	24	32
Hotlines	32 programmable	64 programmable
DSS Intercom Keys	14 per multibutton station *	
Attendant Consoles	6 DSS	6 DSS
Internal Paging Zones	9 (8 zones and All Call)	
External Paging Zones	8	8

* programmable for first 50 multibutton stations.

ELECTRICAL SPECIFICATIONS

Power Requirements:

1 KSU & Power Supply:
Input: 95 - 130 V AC, (120 V AC nominal); 59-61 Hz, single phase. Requires 15 AMPS service.
DC Output: +24 V, −24 V, +5 V*

1 Expansion Cabinet & Power Supply:
Input: 95 - 130 V AC, (120 V AC nominal); 59-61 Hz, single phase. Requires 15 AMPS service.
DC Output: +24 V, −24 V, +5 V*

* Power supply input and output current ratings are defined on the specifications label attached to the unit.

Power Dissipation:

1 KSU & Power Supply: 1150 BTUs/hr. *
1 Expansion Cabinet & Power Supply: 1150 BTUs/hr. *

Each Telephone: 10.0 BTUs/hr.

* Assuming nominal 120 V AC input and fully loaded system.

Fusing:

Power Supply:
Input AC Fuse, 10 AMPS, Slow Blow

KSU and Expansion Cabinet:
F1, 15 AMPS, Fast Acting
F2, 15 AMPS, Fast Acting

Switching Principle:

Solid state, space-division matrix with stored program control.

Cable Requirements:

Four conductor quad station wire, 24 gauge (or equivalent). Maximum cable run up to 800 (244m) feet for display telephones, 2000 (610m) feet for keysets, and 10,000 (3050m) feet for 2500 type single line sets.

T200SP
March 1985

Table 1-1 TCX-128 SPECIFICATIONS (2 of 2)

ELECTRICAL SPECIFICATIONS (cont.)

External Relay Contacts:

SPST NO.:
Maximum Power: 50 VA/30 WATTS
Maximum Current: 1 A[1]
Maximum Voltage: 125 V AC or 150 V DC
Programmable for Night Ring and/or Page.
[1] Maximum allowable current at 125 V AC is 400mA.

Background Music:

Input Impedance: 22 K OHM
Input Level: −25 dBV
Maximum Input: 0.5 VRMS

Music-On-Hold:

Input Impedance: 22 K OHM
Input Level: −25 dBV
Maximum Input: 0.5 VRMS

External Paging:

Output Impedance: 600 OHM
Output Level: 20 dBM/600 OHM nominal
Maximum Output: 6 VRMS

MECHANCIAL SPECIFICATIONS

Dimensions and Weights:

KSU: & Exp. Cab.	27.75" W 71cm	17" H 44cm	13.5" D 35cm	55 lbs. 25 kg.
Power Supply:	14" W 36cm	14.75" H 38cm	6.5" D 17cm	40.5 lbs. 18.5 kg.

ENVIRONMENTAL SPECIFICATIONS

Environmental Operating Conditions:

Temperature: 4°-38° C (40°-100° F)
Humidity: 5-95% relative, non-condensing
(Reference Bell Functional Product Class Criteria of September 1978 publication PUB 48002)

FCC REGISTRATION

Model: TCX-128
FCC Registration Number: BJ286G-68925-MF-E
Ringer Equivalence: 2.6B
Registered Jack: RJ21X

T2009F
April 1985

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 2, FEATURES

1. INTRODUCTION

1.01 The FEATURES Section provides information on the features of the TCX-128 Computerized Branch Exchange. This section consists of detailed descriptions of each feature. Also included is reference information on LED and flash patterns (Figure 2-1), tone signaling patterns (Figures 2-2a and 2-2b), display messages (Table 2-1) and telephone key callouts (Figures 2-3 through 2-8).

2. FEATURES

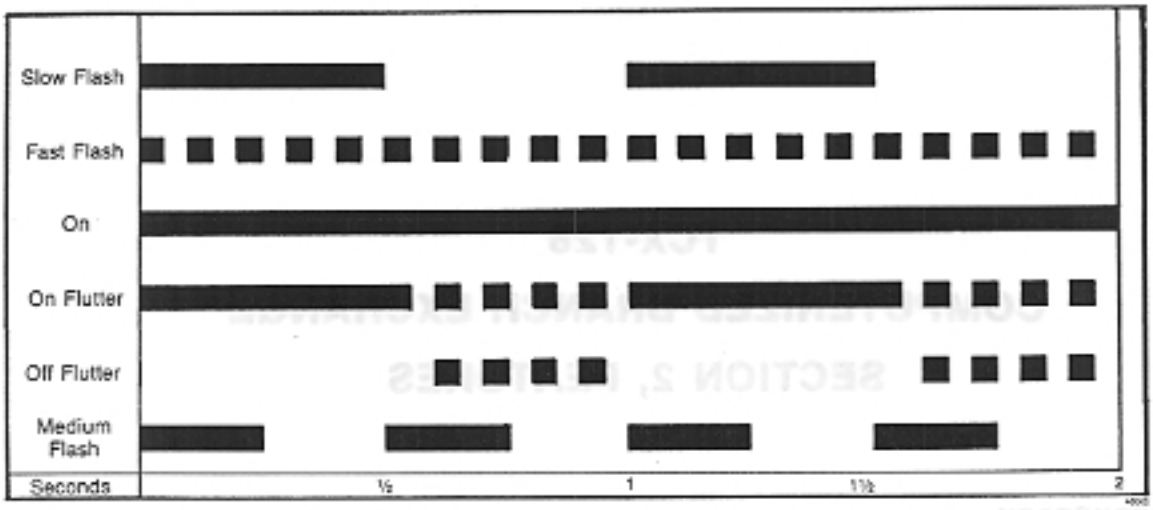
2.01 Each feature is described by the following headings: Description, Conditions, Required Programming and Feature Reference. The headings are defined as follows:

Description consists of a general feature definition, followed by an explanation of its application in the system.

Conditions provides the limits for the feature (e.g., maximum number of Message Waiting indications allowable at any one time). The Conditions heading also presents any qualifying information not covered in the Description heading, and any prerequisites that must be met before the feature can be used.

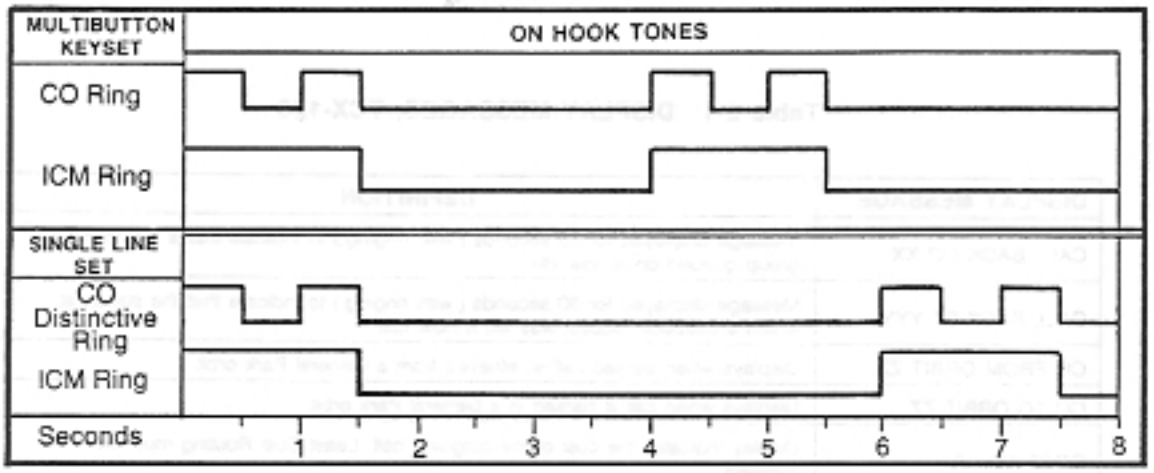
Required Programming includes any programming that must be done to provide for proper feature operation.

Feature Reference is a list of all features that may affect the feature being defined.



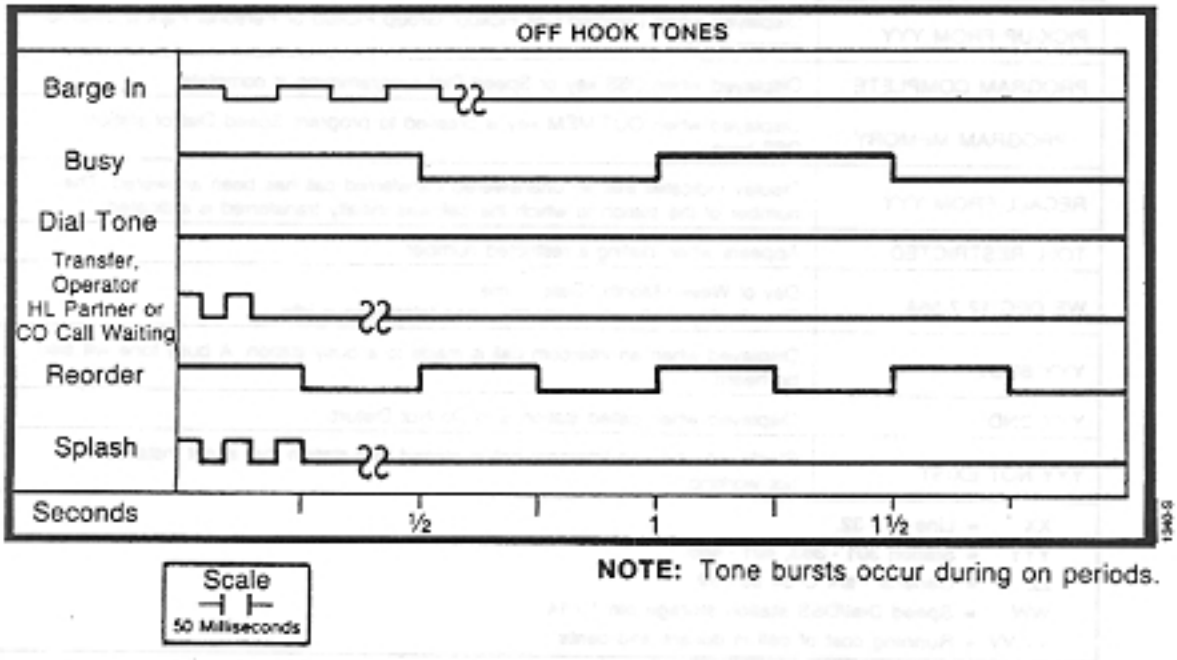
RATE	FUNCTION	KEY USED
1. LED ON	CALLBACK PLACED	C.BACK KEY, INITIATING STATION
	CO LINE CONFERENCE SET UP	CONF KEY
	CO LINE IN USE	CO LINE KEY
	DSS MODE ON	INT KEY
	HANDSFREE MODE ON	HF KEY
	HOTLINE CALL ORIGINATE	HL KEY, INITIATING STATION
	LINE QUEUE ORIGINATE	C.BACK KEY
	MEMORY DIAL IN USE	OUT/MEM KEY
	OTHER PHONE IN DND	HL KEY
	OTHER PHONE IS BUSY	DSS KEY OR HL KEY
	PAGE RECEIVED	PAGE KEY
2. SLOW FLASH	CALL FORWARDING MODE (SEND)	C.FWD KEY
	CALLBACK RING	C.BACK KEY
	CO INCOMING RING	CO LINE KEY
	DND ACTIVATED	DND/M.MUTE KEY
	INCOMING ICM RING	INT KEY
	MESSAGE WAITING	M.WAIT KEY AT CALLED STATION
	NIGHT MODE ON	NIGHT KEY ON ATTENDANT
	OTHER PHONE IN DND	DSS CONSOLE KEY
	OUTGOING PAGE	PAGE KEY, INITIATING STATION
3. MEDIUM FLASH	ALT MODE ON	ALT KEY OF ATTENDANT
	LINE QUEUE CALL BACK	C.BACK KEY
	MEMORY DIAL IN USE	MEMORY DIAL BIN KEY
	MIC MUTE/CUTOFF ON	DND/M.MUTE KEY
4. FAST FLASH	CALL FORWARDING MODE	C.FWD KEY, RECEIVING STATION
	CALLBACK WAITING	C.BACK KEY
	DSS CALL ORIGINATE	DSS KEY, INITIATING STATION
	EXCLUSIVE HOLD	CO LINE KEY ON HOLDING STATION
	MEMORY DIAL PROGRAMMING	OUT/MEM KEY AND BIN KEY
	VOICE ANNOUNCE CALL RECEIVED	HF KEY
5. OFF/ FLUTTER	CO LINE TRANSFER RECEIVED	CO LINE KEY
	HOLD RECALL	CO LINE KEY
6. ON/ FLUTTER	PRIVACY RELEASED	CO LINE KEY (ON ADDED STATION)

Figure 2-1 FLASH PATTERNS TCX-128



NOTE: Tone bursts occur during on periods.

Figure 2-2a ON-HOOK TONE PATTERNS, TCX-128



NOTE: Tone bursts occur during on periods.

Figure 2-2b OFF-HOOK TONE PATTERNS, TCX-128

Table 2-1 DISPLAY MESSAGES, TCX-128

DISPLAY MESSAGE	DEFINITION
CALL BACK CO XX	Message displayed for 15 seconds (with ringing) to indicate that a line in the line group queued on is now idle.
CALL BACK ST YYY	Message displayed for 30 seconds (with ringing) to indicate that the station at which a Callback request was left is now idle.
CO FROM ORBIT ZZ	Displays when parked call is retrieved from a General Park orbit.
CO TO ORBIT ZZ	Displays when call is parked in a General Park orbit.
COST $VV.VV	Display indicates the cost of the outgoing call. Least Cost Routing must be installed.
DIGITS	The digits dialed when placing an outside call are displayed, as they are dialed.
EXT YYY CALLING	Display indicates number of station calling on Intercom.
EXTENSION YYY	Display of the station called on the Intercom.
FORWARD TO YYY	This message is displayed once every 2 minutes (with audible tone) to indicate that calls are forwarded.
LINE XX	When selecting an outgoing line or answering an incoming line, the line number will appear in "XX."
MSG FROM EXT YYY	Displayed once every 2 minutes (with audible tone) at station where message has been left.
NUMBER TO BIN WW	Displayed after pressing OUT/MEM key and one of the 14 storage location keys.
PICK-UP FROM YYY	Displayed when Directed Call Pickup, Group Pickup or Personal Park is used to answer a call.
PROGRAM COMPLETE	Displayed when DSS key or Speed Dial programming is complete.
PROGRAM MEMORY	Displayed when OUT/MEM key is pressed to program Speed Dial or station DSS keys.
RECALL FROM YYY	Display indicates that an unanswered transferred call has been answered. The number of the station to which the call was initially transferred is indicated.
TOLL RESTRICTED	Appears when dialing a restricted number.
WE DEC 12 7-56A	Day of Week / Month / Date / Time This display is shown constantly when telephone is idle.
YYY BUSY	Displayed when an Intercom call is made to a busy station. A busy tone will also be heard.
YYY DND	Displayed when called station is in Do Not Disturb.
YYY NOT EXIST	Displayed when an Intercom call is placed to a station that is not installed or is not working.

XX = Line 01 - 32.
YYY = Station 301 - 363, 401 - 465.
ZZ = General Park Orbit 50 - 59.
WW = Speed Dial/DSS station storage bin 1 - 14.
VV.VV = Running cost of call in dollars and cents.

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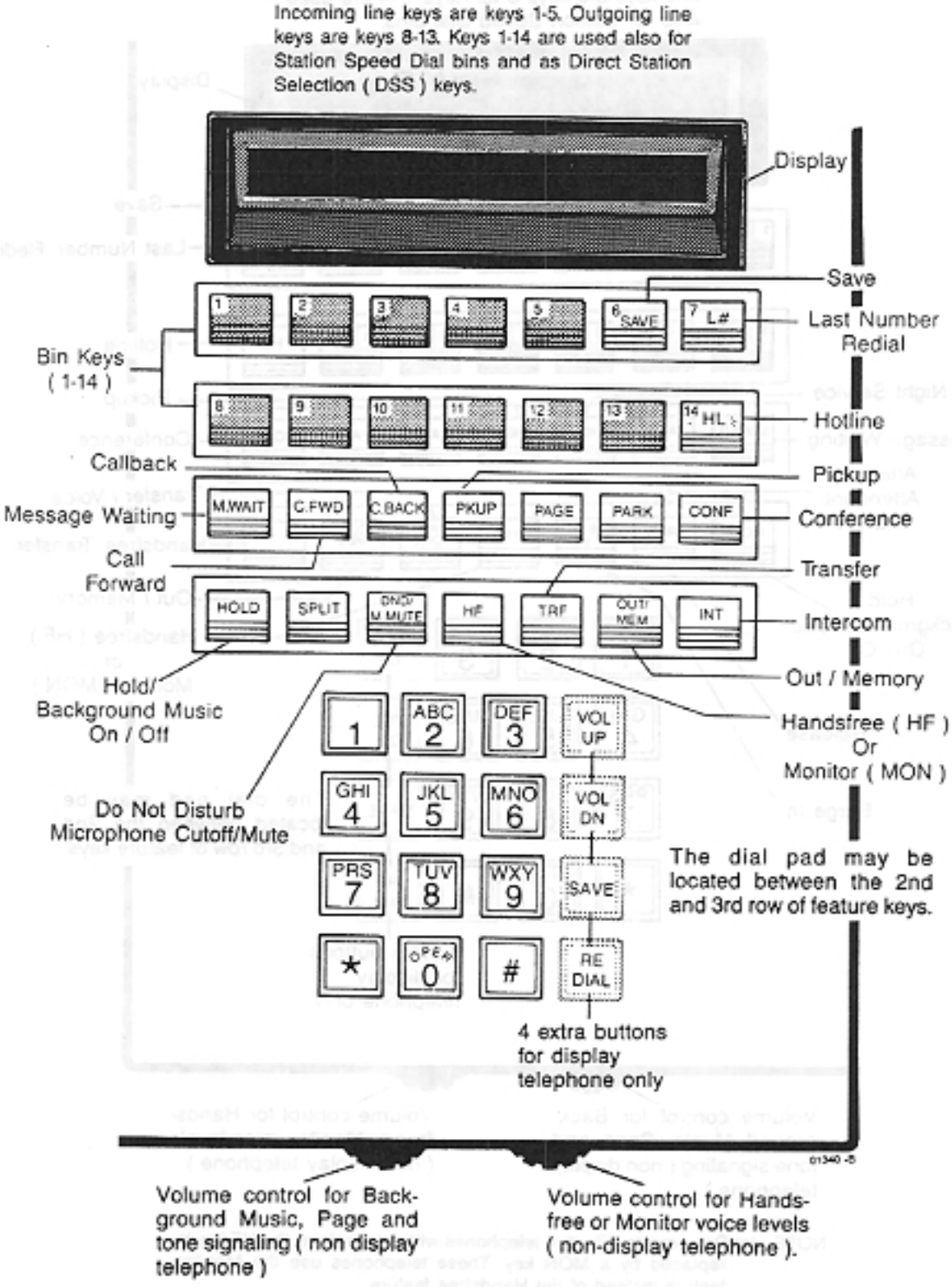
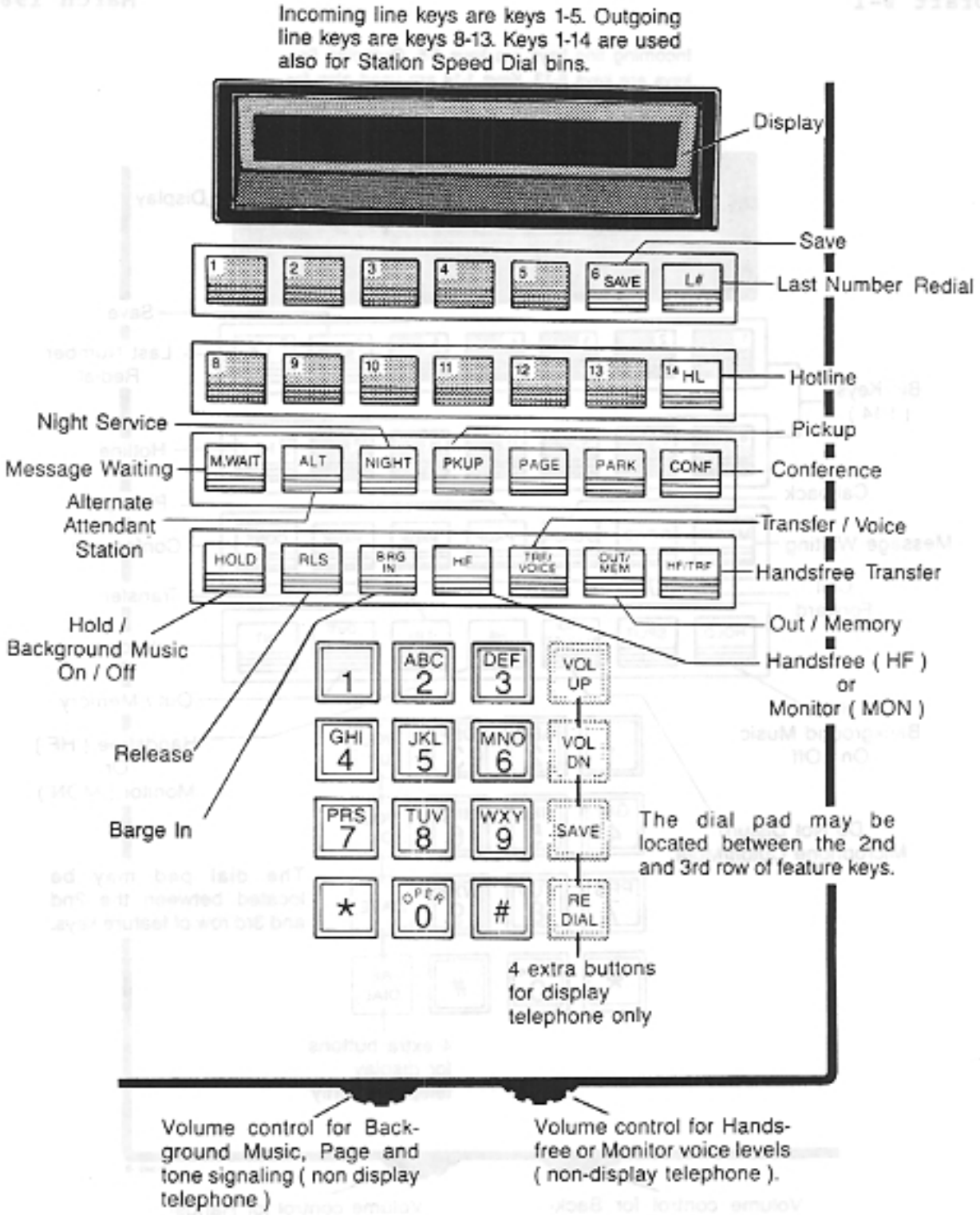


NOTE: (a) On some multibutton telephones without displays, the HF key is replaced by a MON key. These telephones use the Monitor feature instead of the Handsfree feature.
(b) If Least Cost Routing (LCR) is installed, outgoing line keys 12 and 13 are used to place LCR calls.

Figure 2-3 MULTIBUTTON TELEPHONE KEY CALLOUTS, TCX-128



NOTE: (a) On some multibutton telephones without displays, the HF key is replaced by a MON key. These telephones use the Monitor feature instead of the Handsfree feature.
(b) If a DSS console is not assigned in programming, keys 1-14 function as Direct Station Selection (DSS) keys.
(c) If Least Cost Routing (LCR) is installed, outgoing line keys 12 and 13 are used to place LCR calls.

Figure 2-4 ATTENDANT TELEPHONE KEY CALLOUTS, TCX-128

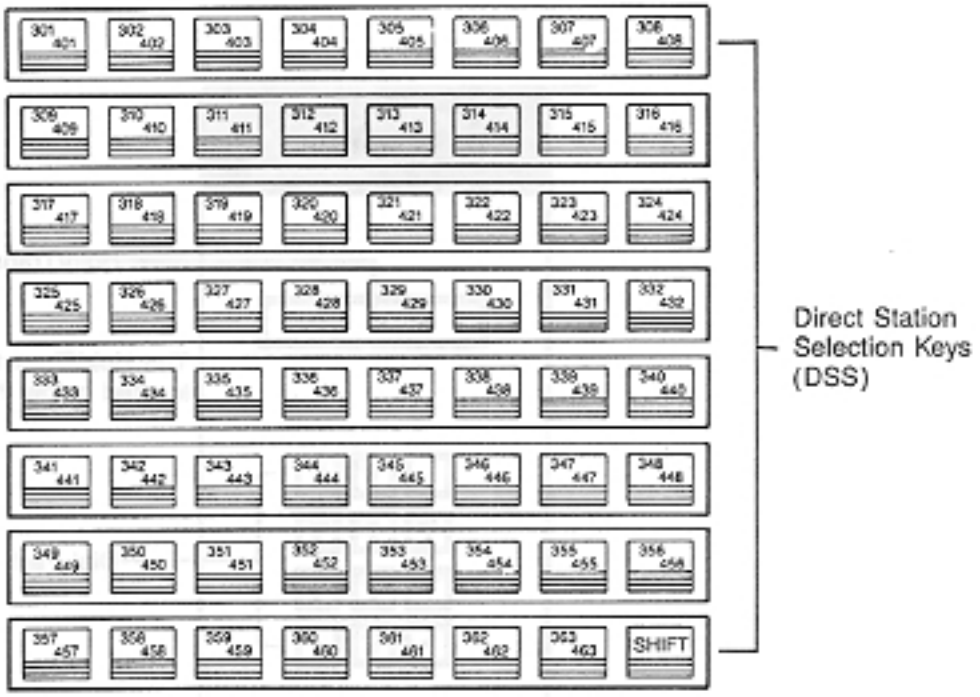


Figure 2-5 DSS CONSOLE KEY CALLOUTS, TCX-128

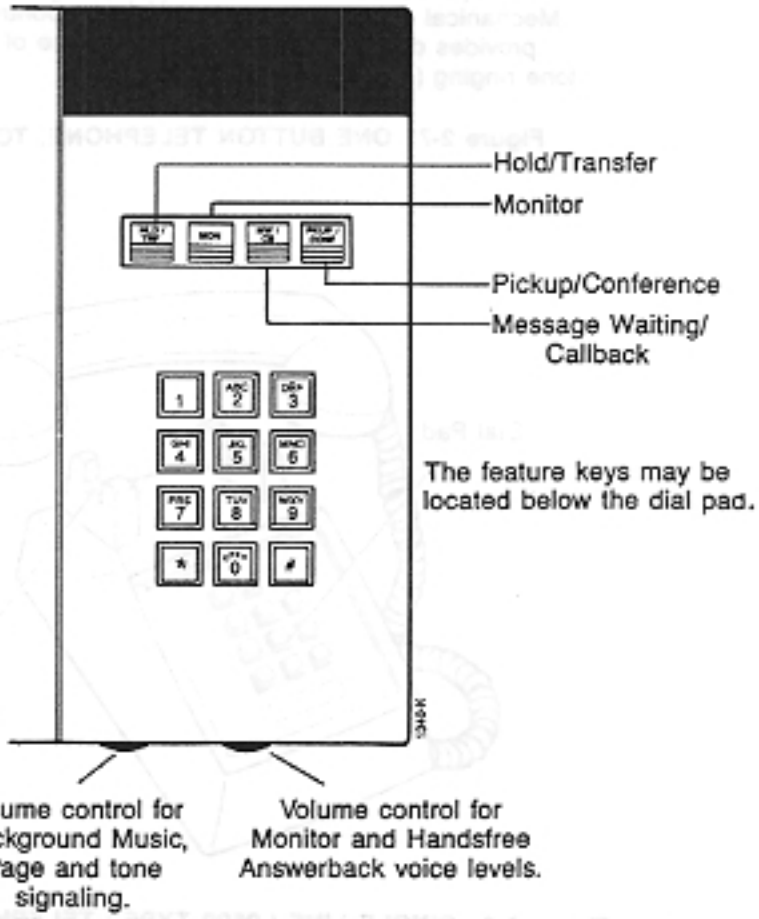


Figure 2-6 FOUR BUTTON TELEPHONE KEY CALLOUTS, TCX-128

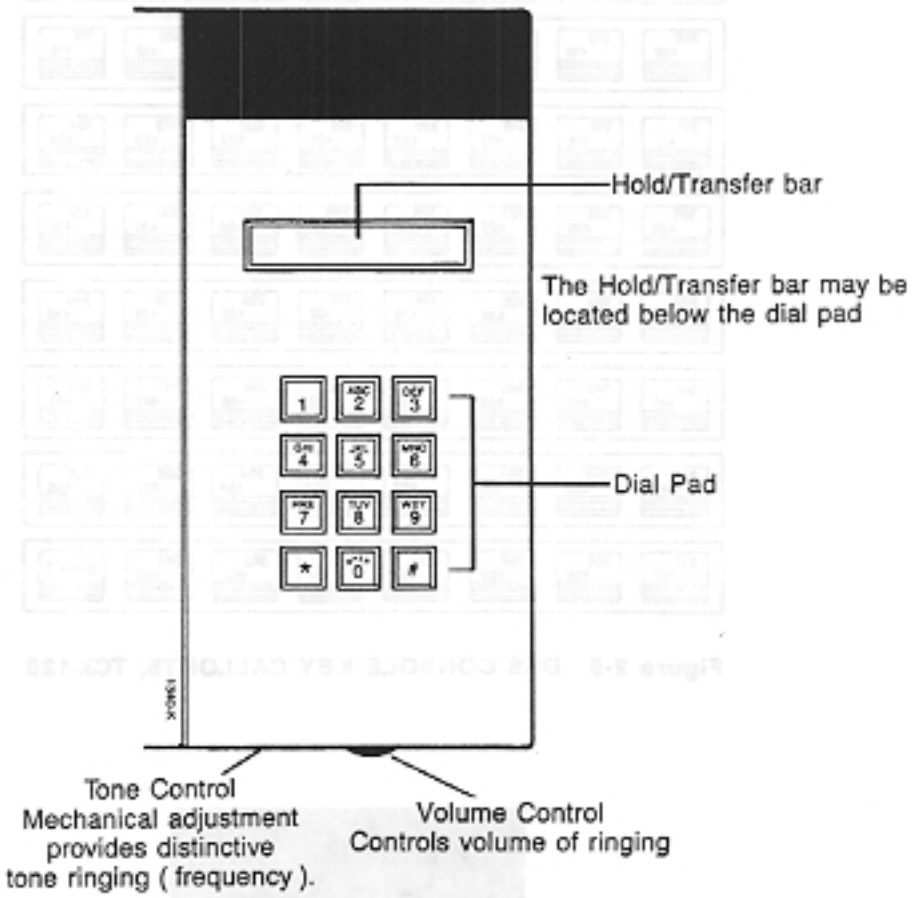


Figure 2-7 ONE BUTTON TELEPHONE, TCX-128

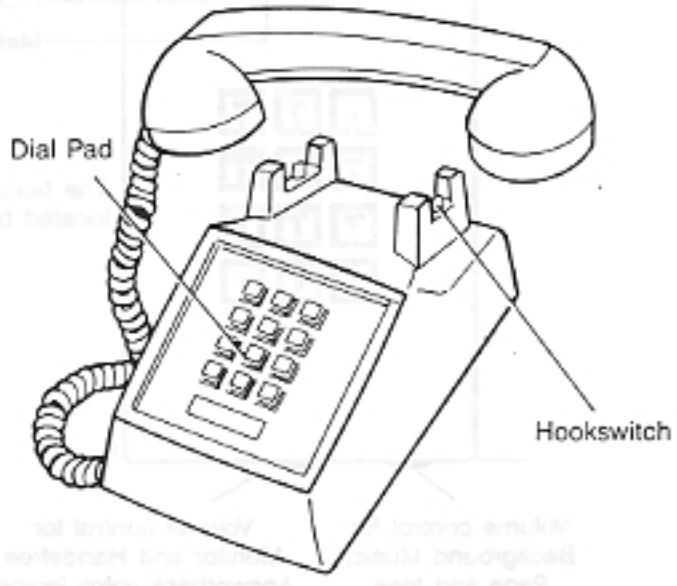


Figure 2-8 SINGLE LINE (2500 TYPE) TELEPHONE, TCX-128

2.Ø2 The following features are available with the TCX-128 system. The features are arranged in alphabetical order.

NOTE: When the system is used behind a Private Branch Exchange (PBX), some of the features may not function exactly as described.

ACCOUNT CODE CAPABILITY

Description:

The system permits Account Codes to be used to categorize all calls for Station Message Detail Recording (SMDR) purposes. An Account Code is a number, of up to nine digits, that is printed on the SMDR device to aid in identifying calls. This feature allows an accurate record of calls to be maintained for billing purposes.

Account codes can be assigned to outgoing calls as they are being placed.

Conditions:

(a) Account Codes can be assigned by any station in the system, at any telephone type. Account Codes must be entered manually from the telephone instrument.

(b) Station Message Detail Recording requires a Call Accounting System (such as the TIE TELE-RECORD) or an SMDR printer.

Required Programming: not applicable

Feature Reference:

Placing a Call
Station Message Detail Recording (SMDR)

ALTERNATE ATTENDANT STATION

Description:

Alternate Attendant Station allows the attendant to direct all calls, initially intended for the attendant, to the alternate attendant.

Conditions:

(a) Each attendant may share the same alternate attendant.

(b) In a system with more than one attendant, one attendant can be the alternate of another.

(c) The alternate attendant should be be a multibutton or display telephone. The alternate attendant does not require a DSS console. If the alternate attendant does not have a DSS console assigned to it, it will function as a multibutton telephone (i.e., without special attendant features).

(d) When the attendant invokes Alternate Attendant Station, the alternate attendant cannot use Call Forwarding to pass transferred calls (intended for the attendant) to a third station. In addition, Alternate Attendant Station cannot forward the attendant's outgoing access ('E' --> STATIONS FEATURES [CO ACCESS]) assignments.

Required Programming:

'S' --> SYSTEM FEATURES
  'O' --> OPERATORS & DSS to assign attendants and alternate attendants.
'E' --> STATIONS FEATURES
  TYPE OF PHONE..... to assign circuit type to DSS consoles.

Feature Reference:

Answering a Call
Direct Station Selection
Intercom
Transfer

ANSWERING A CALL

Description:

An incoming call can be answered at any station programmed to receive audible (ringing) for the line. On a multibutton telephone, a ringing call will also cause the first available incoming line key to flash. Calls can be answered with the handset, or Handsfree (if the telephone is a multibutton station equipped with a speakerphone).

Conditions:

(a) CO ACCESS programming allows calls to be placed on specified lines, regardless of CO AUDIBLE programming. Lines assigned with only CO ACCESS will not ring.

(b) Universal Night Answer (UNA) allows calls to be answered from any station when the system is in the night mode, even if denied by CO AUDIBLE programming.

Required Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN].. to program ringing and incoming access for lines.
'S' --> SYSTEM FEATURES
'P' --> CO TYPE to assign Universal Night Answer lines.

Feature Reference:

Handsfree
Split Ringing
Night Service

BARGE IN

Description:

Barge In permits specified stations to intrude into a conversation in progress at another station. Three splash tones are heard by all parties as the Barge In occurs.

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

Conditions:

(a) Only multibutton telephones can Barge In. Single line (25ØØ type), one button and four button telephones cannot Barge In, although they can be Barged In upon.

(b) Barge In is blocked or enabled on a station-by-station basis. If a station is assigned to block Barge In, it cannot be overridden by any other station.

(c) If either party in the original call hangs up, the call is terminated. The party which Barged In cannot stay on the line with only one of the original callers.

(d) A Barge In can be terminated only by the party that initiated Barge In, unless the original call is terminated.

Required Programming:

```
'E' -->  STATIONS FEATURES
  BARGE   IN   ENABLED.... to permit stations to Barge In.
  BLOCK BARGE  ENABLED.... to allow stations to block Barge In.
```

Feature Reference:

Privacy

BUSY OUT LINES

Description:

Busy Out Lines allows the attendant to take a CO line out of service. Busied out lines cannot be accessed by any station in the system. Only the attendant can return a line to service if it was removed from service using the Busy Out Lines facility.

Conditions:

(a) Lines cannot be busied out at the programming terminal.

(b) Lines that are busied out do not show a busy LED indication at multibutton telephones.

Required Programming: not applicable

Feature Reference:

Placing a Call

CALL FORWARDING

Description:

Call Forwarding permits any multibutton or display telephone to forward all calls to another station or to the attendant.

Conditions:

(a) Call Forwarding is denied to single line (2500 type), one button and four button telephones; however, these telephones can receive forwarded calls.

(b) A station can receive forwarded calls that are normally inaccessable (i.e., E --> STATIONS FEATURES [CO AUDIBLE] assignments are transferred to the station receiving the forwarded calls).

(c) The attendant can cancel all Call Forwarding in the system.

(d) Call Forwarding can be canceled by the station which initiated the forward and the station to which the calls were forwarded.

(e) Call Forwarding can be chained (passed from station to station) up to four times. The Call Forwarding chain will forward both Intercom and transferred CO calls. Incoming CO calls will be forwarded only to the second station in the chain.

(f) The station to which calls are forwarded is the only one in the system that can call the station which initiated the call forward. This relationship does not exist, however, in Call Forwarding chains.

(g) When a station has initiated Call Forwarding (i.e., all calls have been forwarded to another station), the speaker in the telephone will broadcast a short beep every 120 seconds. This beep serves as a reminder that calls have been forwarded. If desired, system programming allows this beep to be disabled.

(h) If the attendant uses the ALT key to forward calls to the alternate, the alternate can use Call Forwarding to forward calls to a third party. The following occurs:

(1) All Intercom calls to the attendant go to the alternate.
(2) All calls transferred to the attendant go to the alternate.
(3) All outside calls which normally would ring the attendant will ring the alternate.
(4) All Intercom and transferred calls to the alternate go the third party.
(5) All outside calls which would normally ring the alternate will ring the third party.

Required Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... to program multibutton telephones as KEY.
'S' --> SYSTEM FEATURES
'F' --> SYSTEM OPTIONS
OPTION ENABLED...19.. to turn off the Call Forwarding reminder.

Feature Reference:

Answering a Call
Call Forwarding Cancel
Transfer

CALL FORWARDING CANCEL

Description:

A multibutton station can cancel a Call Forwarding condition it has placed to another station, or a Call Forwarding condition another station has placed to it. The attendant can cancel all Call Forwarding conditions in the system.

Conditions: not applicable

Required Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS to assign system attendants.

Feature Reference:

Call Forwarding

CALL PICKUP, DIRECTED

Description:

Directed Call Pickup allows a station user to answer an outside call heard ringing at a nearby extension. The ringing call must be transferred from the attendant or from another station in the system.

Conditions:

This feature requires that the user know the number of the station that is ringing.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'M' -->  TIMERS
    TRANS RECALL.(SEC)..... to program the length of time a
      transferred call will ring before being recalled by the
      transferring station.
```

Feature Reference:

Call Pickup, Group
Transfer

CALL PICKUP, GROUP

Description:

Group Call Pickup allows a station user to answer a call ringing into his assigned pickup group. The TCX-128 has a maximum of 64 pickup groups.

Conditions:

(a) The multibutton or four button station user can enable or disable ringing for a call into the pickup group if:

(1) The call is a transferred call to another station in the pickup group.

OR

(2) The call is an intra-group call that does not normally ring at his station (i.e., CO AUDIBLE denied).

(b) A station can be assigned to only one pickup group; however, any number of stations can be assigned to one pickup group.

(c) Any station in the system can use Group Call Pickup for any call ringing into its pickup group. Pickup groups are assigned in 'E' --> STATIONS FEATURES programming.

Required Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN].. to assign audible for lines.
PICK UP GROUP IS..... to assign stations to pickup groups.

Feature Reference:

Answering a Call
Call Pickup, Directed
Transfer

CALL WAITING

Call Waiting allows signals to be sent to a station to indicate that a CO, attendant or Hotline partner call is waiting to be answered. A station must be busy on a call to receive Call Waiting signals.

Call Waiting, Attendant/Hotline Partner

Description:

When busy on another call, a station can receive a signal that an Intercom call from the attendant or Hotline partner (if assigned) is waiting to be answered. The attendant/Hotline partner Call Waiting signal is a double beep.

Conditions:

(a) If busy on an outside call, the call may be put on Hold before the Call Waiting is answered. If busy on an Intercom call, the Intercom call is terminated as the Call Waiting is answered.

(b) Each station in a Hotline pair can be individually programmed to send Hotline partner Call Waiting tones. Each attendant can be individually programmed to send Attendant Call Waiting tones. Any station in the system can be programmed to block Attendant/Hotline partner Call Waiting tones.

(c) Multibutton and four button telephones can use the Split feature to alternate between the attendant/Hotline partner and the initial call (if a CO call).

(d) Call Waiting is not received from Intercom callers.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'O' -->  OPERATORS & DSS to assign attendants.
'E' -->  STATIONS FEATURES
  HOT-LINE KEY..... to program Hotline partners or groups.
  CAMP-ON   ORIGINATE.... to allow stations to send Call Waiting
    signals.
  CAMP-ON   RECEIVE..... to allow stations to receive Call
    Waiting signals.
```

Feature Reference:

Answering a Call
Hotline
Split

Call Waiting, CO Call

Description:

When busy on a call, a station can receive a signal that an outside (CO) call is waiting to be answered. This call may be a call ringing into the station, or may be a call transferred from another station (or the attendant). The CO Call Waiting indication is a double beep.

Conditions:

(a) If busy on an outside call, the call may be put on Hold before the Call Waiting is answered. If busy on an Intercom call, the Intercom call is terminated as the Call Waiting is answered.

(b) Each station can be individually programmed to block CO Call Waiting tones for incoming calls, or send Call Waiting tones as calls are transferred.

(c) If busy on a CO call (when the Call Waiting tones are received), the Split feature can be used to alternate between the initial CO call and the incoming CO call.

(d) It may not be desirable to program Call Waiting for attendants, since the attendant (with a DSS console) receives off-hook signaling through the speaker in the console.

(e) The DIL OFF HOOK SIGNAL..... and CO AUDIBLE [NN..NN] IS .. fields must be programmed to receive CO Call Waiting for incoming calls.

Required Programming:

'E' --> STATIONS FEATURES
- CO AUDIBLE [NN..NN] IS.... to grant audible for incoming CO calls. Call Waiting signals for incoming calls can occur only if AUDIBLE is granted for that line, for that station.
- DIL OFF HOOK SIGNAL.... to program incoming calls to send Call Waiting signals to stations that are busy on a call.
- CAMP-ON ORIGINATE.... to allow stations to send Call Waiting signals for calls that they Transfer.
- CAMP-ON RECEIVE..... to allow stations to receive Call Waiting signals from transferred calls.

Feature Reference:

Answering a Call
Split
Transfer

CALLBACK

Description:

Callback enables a station user to leave a Callback request at a busy station. When the busy station becomes free, Callback automatically rings the station which placed the Callback request. Answering the Callback ring automatically calls the station where the Callback request was initially left. If the Callback is interrupted (i.e., the called station receives another call), the Callback procedure begins again.

Conditions:

(a) Callback cannot be initiated from single line (25ØØ type) and one button telephones.

(b) If the Callback ring is not answered within 3Ø seconds, the Callback is terminated.

(c) A Callback can not be left on a telephone in Do Not Disturb.

(d) An individual station can leave only one Callback request; however, many stations can leave a Callback at a single busy station. The callbacks will be queued and processed in the order in which they were placed.

(e) A multibutton telephone user can place a Callback to a busy station after a Callback from a third station has been placed to him (i.e., as the C.BACK LED is flashing).

(f) A station cannot leave a Callback to its Hotline partner.

Required Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE ..... to assign type KEY to multibutton and display telephones.

Feature Reference:

Direct Station Selection
Do Not Disturb
Intercom

CLASS OF SERVICE

Description:

The system uses Class of Service (COS) programming to help determine the dialing restrictions on outgoing calls. There are five restrictive Classes of Service (COSs 1-5), and a totally unrestricted Class of Service (COS Ø). Additional Toll Restriction programming (for each area code and exchange that can be dialed) allows dialing restrictions to be customized for the requirements of each installation.

The Classes of Service are as follows:

COS Ø

Unrestricted. Class of Service Ø is permitted to dial all System Speed Dial numbers and all area codes. This is the only COS permitted to dial (telco) operator ('Ø') calls. Intercom calls are permitted.

COS 1

Class of Service 1 is permitted to dial 7-digit (NNX + nnnn) and leading 1 7-digit (1 + NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 2

Class of Service 2 is permitted to dial 7-digit (NNX + nnnn) numbers, leading 1 7-digit (1 + NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 3

Class of Service 3 is permitted to dial 7-digit (NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 4

Class of Service 4 is permitted to dial 7-digit (NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 5

Class of Service 5 can dial Intercom calls and all System Speed Dial calls only.

Conditions:

Refer to Toll Restriction for additional dialing restriction information.

Required Programming:

'E' --> STATIONS FEATURES
CLASS OF SERVICE..... to assign Class of Service to each station.
'S' --> SYSTEM FEATURES
'P' --> CO TYPE to program lines as incoming only (INC) or toll free (TOLLF).
'K' --> COS ALOWED AREA CODES to assign Class of Service to area codes.

Feature Reference:

Placing a Call
Toll Restriction
Speed Dial

CONFERENCE

Conference allows up to three parties to be connected for a Conference call. There are two types of Conference: Add-On Conference and Line Conference.

Add-On Conference

Description:

Add-On Conference permits a second internal party to be added to an existing call.

Conditions:

Any telephone in the system can join an Add-On Conference; however, single line (2500 type) and one button telephones cannot initiate an Add-On Conference.

Required Programming:

Programming does not affect the ability of telephones to initiate or join an Add-On Conference.

Feature Reference:

Answering a Call
Placing a Call

Line Conference

Description:

Line Conference allows an internal party to add an additional outside party to an existing outside (CO) call. A Conference may be established between two incoming calls, two outgoing calls, or an incoming and outgoing call.

Conditions:

(a) Single line (2500 type) and one button telephones cannot initiate a Line Conference.

(b) If a Line Conference is to be established on two outgoing calls, CO ACCESS [NN..NN] IS .. must be enabled for the lines. If a Line Conference is to be established on two incoming calls, CO AUDIBLE [NN..NN] IS.. must be enabled for the lines.

(c) If the Conference is not established within the Hold Recall Interval, the initial call will revert to the attendant.

(d) A Conference may be established between two outside lines in the same line group, using the same outgoing line key. This is especially useful if toll free lines or LCR is installed.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'P' -->  SYSTEM OPTIONS
    OPTION ENABLED...Ø3.. to allow two calls to be joined in
      Conference using the same outgoing line key.
'E' -->  STATIONS FEATURES
  CO AUDIBLE [NN..NN] IS.. to allow a Line Conference to be
    established on incoming calls.
  CO ACCESS  [NN..NN] IS.. to allow a Line Conference to be
    established on outgoing calls.
```

Feature Reference:

Answering a Call
Hold Recall
Placing a Call

DATE AND TIME

Description:

Date and Time information is used for SMDR and display telephone presentations. The date and time can be entered from the programming terminal or from the attendant's station. Data entered includes the hour, minutes past the hour, month, date and year. The SMDR includes date and time in its output. The display telephones show the day of the week, month, date and time (12 hour clock).

Conditions:

Date and Time has to be reset if system power fails.

Required Programming:

'S' --> SYSTEM FEATURES
  'T' --> TIME OF DAY to program time.
  'D' --> DATE to program date and year.

Feature Reference:

Station Message Detail Recording

DIRECT INWARD LINES

Description:

Direct Inward Lines (DIL) allows the TCX-128 to be configured so that outside lines ring directly into designated stations (or groups of stations), without having to be transferred by the attendant. For multibutton telephones, DILs appear on the incoming line keys, in addition to ringing. A DIL call can be transferred to any station in the system.

Conditions:

(a) A line can ring directly into a station as a DIL if 'E' --> STATIONS FEATURES (CO AUDIBLE [NN..NN] IS..) assignments allow.

(b) DILs are not excluded from Universal Night Answer ringing.

(c) 'E' --> STATIONS FEATURES (CO ACCESS [NN..NN] IS..) programming allows calls to be placed on the lines programmed as DILs.

(d) Direct Inward Lines do not have the same characteristics as Private Lines. Refer to the Private Line feature in this section.

Required Programming:

'E' --> STATIONS FEATURES
- CO AUDIBLE [NN..NN] IS.. to assign lines as DILs.
- CO ACCESS [NN..NN] IS.. to allow lines designated as DILs to be used for outgoing calls.

Feature Reference:

Answering a Call
Placing a Call
Private Line
Night Service

DIRECT LINE ACCESS

Description:

Direct Line Access allows the attendant to select a specific line to place a call. Direct Line Access can be used to bypass LCR and/or outgoing line key assignments.

Conditions:

(a) Toll Restriction applies to all calls placed using Direct Line Access.

(b) Direct Line Access can be used to bypass outgoing restrictions imposed by 'E' --> STATIONS FEATURES (CO ACCESS [NN..NN] IS..) programming.

(c) Direct Line Access cannot be used to answer incoming calls.

(d) The attendant can use Direct Line Access to place a call for another station. After the call is connected, the attendant can transfer the call to the waiting station. Direct Line Acess cannot be used to bypass Toll Restriction by passing dial tone to another station in the system. If dial tone is passed, dialing is prevented.

Required Programming: not applicable

Feature Reference:

Placing a Call
Toll Restriction
Transfer

DIRECT STATION SELECTION

Description:

Direct Station Selection (DSS) allows users of multibutton telephones one button access to other stations in the system. DSS permits station users to press a DSS key to access a desired station, rather than by dialing a code. The DSS keys can also be used to provide a Busy Lamp Field (BLF) for the stations to which the keys are assigned.

Multibutton telephones have 14 DSS keys, assigned by the default program to stations 3Ø1-314. The telephone user can, however, change the DSS assignments to meet individual needs.

System attendants have full system DSS and BLF capability (except for stations 464 and 465) if they are installed with DSS consoles.

Conditions:

(a) The multibutton telephone user must press the INT key to put the telephone in the DSS mode.

(b) The attendant DSS console provides DSS keys and a BLF for all stations in the system (except for stations 464 and 465), and is not programmed by the user. When an attendant station has a DSS console assigned to it in programming, the DSS keys on the attendant's telephone do not function.

(c) If an attendant does not have a DSS console assigned to it in programming, the first 14 keys on the telephone will be DSS keys. The attendant must press the TRF/VOICE key to put the telephone in the DSS mode.

(d) The system allows up to six DSS consoles to be programmed and installed, each assigned to its respective attendant.

(e) Only the first 5Ø stations in the system have programmable DSS keys. The DSS keys for the remaining multibutton stations cannot be changed from the default assignments.

Required Programming:

'S' --> SYSTEM FEATURES
  'O' --> OPERATORS & DSS to assign attendants and DSS consoles.
'E' --> STATIONS FEATURES
  TYPE OF PHONE..... to assign DSS consoles with type DSS.

Feature Reference:

Intercom
Transfer

DISTINCTIVE RINGING

Description:

Distinctive Ringing provides different ringing patterns for Intercom and CO calls into a station. Distinctive Ringing is available on all telephones, but must be programmed for single line (25ØØ type) and one button telephones.

For single line (25ØØ type) and one button telephones, Distinctive Ringing provides an Intercom ring signal (tone burst) of 1.5 seconds followed by a 4.5 second pause. CO line ring consists of two short ring bursts followed by a 4.5 second pause. If Distinctive Ringing for single line (25ØØ type) and one button telephones is disabled, Intercom calls ring identically to CO calls (i.e., one ring burst followed by a pause).

Multibutton and four button telephones always have Distinctive Ringing enabled. The Intercom ring signal is a 1.5 second burst followed by a 2.5 second pause. The CO ring signal is two short bursts followed by a 2.5 second pause.

Conditions:

(a) Distinctive Ringing, if enabled, affects all single line (25ØØ type) and one button telephones in the system.

(b) Distinctive Ringing requires a B-8SLU-B PCB with software version 177-114-02 or 177-114-03.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...Ø4... to enable Distinctive Ringing for
      single line (25ØØ type) and one button telephones.
```

Feature Reference:

Answering a Call
Intercom

DO NOT DISTURB

Description:

Do Not Disturb allows multibutton telephone users to block all incoming Intercom calls and ringing for outside calls. If DND is enabled, callers attempting to reach a station in the Do Not Disturb mode will receive a reorder tone. While in the Do Not Disturb mode, a station can still be used to place Intercom calls, and place and answer outside calls.

Conditions:

(a) The attendant can override DND, but only if the telephone which has activated DND is not busy on another call.

(b) The attendant, single line (25ØØ type), one button and four button telephones do not have DND capability.

(c) The attendant can transfer calls to a station in Do Not Disturb; however, the transferred call will not ring (although the incoming line key will flash).

(d) The attendant's DSS console indicates which stations are in Do Not Disturb.

(e) An incoming Private Line call to a multibutton station in Do Not Disturb will cause the Private Line LED to flash, but the line will not ring.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'O' -->  OPERATORS & DSS to assign attendants.
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...Ø6... to enable Forced Intercom Ringing.
'E' -->  STATIONS FEATURES
  PRIVATE LINE.......IS.. to assign Private Lines.
```

Feature Reference:

Answering a Call
DND Override
Placing a Call
Private Line
Transfer

DO NOT DISTURB OVERRIDE

Description:

Do Not Disturb Override permits the attendant to override DND.

Conditions:

(a) Normally, DND Override will be a voice announcement; however, if Forced Intercom Ringing is enabled on a station or system wide basis, DND Override calls will ring.

(b) A station's Hotline partner cannot override DND.

Required Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS to assign attendants.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...Ø6... to enable Forced Intercom Ringing.

Feature Reference:

Do Not Disturb
Forced Intercom Ringing

EXTERNAL LOUD RINGING CAPABILITY

Description:

Customer-provided external alerting devices can be connected to the TCX-128 system to provide loud night ringing in areas where normal signaling is inadequate or unavailable. The alerting devices are connected to relay contacts in the KSU, which can be programmed to close whenever a call rings into the system on a Universal Night Answer line. Up to four relays can be assigned for external loud ringing.

Conditions:

(a) Two relays are available on the B-TGU-B PCB plugged into slot J15 in the KSU. Two additional relays are available if a B-AUX-A PCB is plugged into KSU slot J16.

(b) The devices connected to the relays must conform to the relay specifications listed in Section 6, INSTALLATION OF OPTIONAL EQUIPMENT.

(c) The relays in the KSU may be assigned for either loud night ringing or Page.

Required Programming:

'S' --> SYSTEM FEATURES
`R` --> RELAYS CONTROL to program relays for night ringing or Page.

Feature Reference:

External Paging Capability
Night Service
Page

EXTERNAL PAGING CAPABILITY

Description:

Vacant multibutton station ports can be used to output Page announcements to customer-provided paging equipment. Up to eight vacant ports can be designated as Alternate Audio Ports for external paging. In addition, each port can be individually programmed to broadcast any combination of Page, Background Music, and night audible (for Universal Night Answer lines).

Conditions:

(a) External Paging Capability requires a vacant port on a B-8SCU-C PCB for each page output.

(b) The customer-provided paging equipment can be switched on and off via the loud ring relays located in the KSU. Two relays are available on the B-TGU-B PCB plugged into slot J15 in the KSU. Two additional relays are available if a B-AUX-A PCB is plugged into KSU slot J16.

(c) The paging equipment must be compatible with the relay and audio specifications listed in Section 6, INSTALLATION OF OPTIONAL EQUIPMENT.

(d) One Zone Page can be broadcast from each Alternate Audio Port. The Zone Page assignments are as follows:

OUTPUT	ZONE PAGE
Ø1	Ø1 (DIAL 61)
Ø2	Ø2 (DIAL 62)
Ø3	Ø3 (DIAL 63)
Ø4	Ø4 (DIAL 64)
Ø5	Ø5 (DIAL 65)
Ø6	Ø6 (DIAL 66)
Ø7	Ø7 (DIAL 67)
Ø8	Ø8 (DIAL 68)

Required Programming:

'S' --> SYSTEM FEATURES
  'R' --> RELAYS CONTROL to program relays for paging or night ringing.
  'E' --> EXTERNAL OUTPUTS to assign vacant multibutton station ports as external paging outputs (Alternate Audio Ports).

Feature Reference:

External Loud Ringing Capability
Music On Hold/Background Music
Paging

FLASH

Description:

Flash allows a multibutton telephone user to receive a new dial tone without releasing the CO line. If the system is installed behind a PBX, Flash allows certain PBX features (such as Transfer) to be accessed.

Conditions:

(a) Flash parameters must be set for compatibility with the CO or PBX.

(b) Since Flash provides an interruption in loop current, it is compatible only with loop start lines.

(c) Flash cannot be used with single line (2500 type), one button and four button telephones.

Required Programming:

```
'S' --> SYSTEM FEATURES
  'M' --> TIMERS
    FLASH TIMER.(N*50MSEC)... to program the duration of Flash
       (i.e., the interruption of loop current).
```

Feature Reference:

Placing a Call

FLEXIBLE NUMBERING PLAN

Description:

Flexible Numbering Plan allows station-to-port assignments to be changed from the programming terminal. This permits stations to be relocated in a facility, without having to reprogram station options or alter the cabling which connects the stations to the KSU.

Conditions:

(a) Station features are assigned to station numbers, not ports. If a telephone is moved, reassigning the ports will enable all of the station features (including the station number) at the new location.

(b) A port is a fixed location in the KSU.

Required Programming:

'E' --> STATIONS FEATURES
PORT NUMBER..... to assign stations to ports.

Feature Reference:

Changing the port-to-station assignment could affect all features that are altered through system or user programming.

FORCED INTERCOM RINGING

Description:

Forced Intercom Ringing causes all Intercom calls to multibutton and four button telephones to ring. When Forced Intercom Ringing is enabled, Handsfree Answerback is disabled. Forced Intercom Ringing can be initiated on a system-wide basis from the programming terminal, or individually by the station user.

Conditions:

(a) If Forced Intercom Ringing is enabled on a system-wide basis, it can not be overridden on a station-by-station basis.

(b) A multibutton or four button station user can enable Forced Intercom Ringing for all incoming Intercom calls.

(c) Any station user can enable Forced Intercom Ringing as an Intercom call is placed.

(d) A multibutton station with a speakerphone can use Handsfree to answer a ringing Intercom call. All other stations must lift the handset to answer the ringing call.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...Ø6... to enable Forced Intercom Ringing on a
      system wide basis.
```

Feature Reference:

Handsfree
Handsfree Answerback
Intercom

HANDSFREE (SPEAKERPHONE)

Description:

Handsfree permits Intercom and CO calls to be placed and answered using the microphone and speaker in the multibutton telephone, instead of the handset. All multibutton telephones equipped with speakerphones have Handsfree capability.

Conditions:

(a) Multibutton telephones equipped with speakerphones have an HF key.

(b) Multibutton telephones without speakerphones have Monitor.

Required Programming: not applicable

Feature Reference:

Handsfree Answerback
Monitor

HANDSFREE ANSWERBACK

Description:

Handsfree Answerback allows Intercom calls to be answered using the speaker and microphone in the telephone, instead of the handset. Intercom calls to four button and multibutton telephones are normally received in the Handsfree Answerback mode.

Conditions:

(a) All multibutton and four button telephones have Handsfree Answerback capability.

(b) Handsfree Answerback cannot occur if Forced Intercom Ringing is enabled for the system, or if the call was placed using a leading 1.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...Ø6... to enable Forced Intercom Ringing on a
      system wide basis.
```

Feature Reference:

Forced Intercom Ringing
Handsfree
Intercom
Monitor

HOLD

Hold places a call in a temporary waiting condition. There are two types of Hold: Automatic Hold and Exclusive Hold.

Automatic Hold

Description:

Automatic Hold allows the attendant to answer an outside call, place it on Exclusive Hold and answer another outside call without using the HOLD key. When the attendant presses another incoming or outgoing line key, the initial call is put on Exclusive Hold automatically.

Conditions:

(a) Automatic Hold is available only to the attendant.

(b) A call placed on Automatic Hold re-rings the attendant after the Hold Recall interval.

(c) An attendant must have a DSS console programmed to enable Automatic Hold.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'O' -->  OPERATORS & DSS to assign attendants and DSS consoles.
  'M' -->  TIMERS
    HOLD RECALL  TIMER.(SEC).. to set the Hold Recall interval.
```

Feature Reference:

Answering a Call
Placing a Call

Exclusive Hold

Description:

A call put on Exclusive Hold can be picked up only at the station which placed the call on Hold. The Exclusive Hold indication is a flashing line key LED at the station which placed the call on Hold. If the call is left on Exclusive Hold longer than the Hold Recall interval, it will re-ring the station which placed it on Hold. If still unanswered, it will ring at the attendant's station.

Conditions:

Hold Recall will ring the station which placed the call on Hold for one minute. If the call is not answered within one minute, it will ring the attendant.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'M' -->  TIMERS
    HOLD RECALL  TIMER.(SEC).. to program the Hold Recall
      Interval.
```

Feature Reference:

Hold Recall

HOLD RECALL

Description:

Hold Recall prevents a call on Hold from being forgotten. The system automatically resignals the station where the call was placed on Hold after a programmed period of time (the Hold Recall interval). If the call remains unanswered at the initiating station, it will ring the attendant's station.

Conditions:

(a) The Hold Recall interval is programmable.

(b) Hold Recall will ring the station which placed the call on Hold for one minute. If the call is not answered within one minute, it will ring the attendant.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'M' -->  TIMERS
    HOLD RECALL  TIMER.(SEC).. to program the Hold Recall
      Interval.
```

Feature Reference:

Hold

HOTLINE

Description:

Hotline directly connects two multibutton telephones for one button communication and call Transfer. The HL key serves as a DSS key and busy lamp for the Hotline partner. It also can be used to Transfer calls to the Hotline partner.

Conditions:

(a) Single line (2500 type), one button and four button telephones should not have Hotline partners.

(b) The Hotline partner cannot override Do Not Disturb.

(c) The attendant can be programmed with a Hotline partner. The HL lamp indication at the attendant's telephone will be prevented if the attendant also has a DSS console programmed.

(d) The system can accommodate 64 Hotline pairs. For standard Hotline operation, each station can have only one Hotline partner.

(e) The higher number in the Hotline pair is assigned as the secretary in an executive/secretary arrangement. The secretary/receptionist will have a flashing line key for a call transferred to the executive. A call transferred to a busy executive station will automatically be transferred to the secretary.

(f) A call transferred to the secretary in a Hotline pair will indicate on the secretary's telephone as an Off Fluttering incoming line key. A call transferred to the executive in a Hotline pair will indicate on the secretary's telephone as an On Fluttering incoming line key.

(g) The system can be programmed so that stations are part of Hotline groups, rather than assigned to a single hotline partner. The station assigned as the secretary/receptionist in the group must always have the highest station number. Any calls transferred from any other station in the group can be transferred to the secretary/receptionist by using the HL key. The station reached when the secretary/receptionist presses the HL key is determined in programming.

Required Programming:

'E' --> STATIONS FEATURES
HOT-LINE KEY..... to assign Hotline partners.

Feature Reference:

Do Not Disturb
Intercom
Transfer

INTERCOM

Description:

Intercom enables any station in the system to call any other station in the system. Intercom calls to multibutton and four button telephones are normally answered using Handsfree Answerback. If Forced Intercom Ringing is enabled, all Intercom calls to telephones without speakerphones must be answered by lifting the handset.

Conditions:

(a) Intercom calls can be placed to other stations in the system by dialing the station number. Intercom calls can be placed to the primary attendant by dialing 0.

(b) Only the attendant can place Intercom calls to multibutton telephones in Do Not Disturb.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'O' -->  OPERATORS & DSS
    OPERATOR 1 IS..... to assign the primary attendant
      (i.e., the station reached by dialing 0).
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...06... to enable Forced Intercom Ringing on a
      system wide basis.
```

Feature Reference:

Direct Station Selection
Handsfree Answerback
Hotline
Microphone Cutoff/Mute

LAST NUMBER REDIAL

Description:

At each station, Last Number Redial stores the last number dialed (up to a maximum of 16 digits) so that it can be automatically redialed at a later time. The last number dialed is stored in memory regardless of whether the call was answered, unanswered or busy.

Conditions:

(a) Last Number Redial can redial manually dialed or Speed Dial calls.

(b) Last Number Redial calls can be identified on the SMDR by the code ERD. System Option 16 must be enabled for this code to appear.

(c) Calls placed using Last Number Redial are subject to the same Toll Restrictions as manually dialed calls.

Required Programming:

'S' --> SYSTEM FEATURES
'F' --> SYSTEM OPTIONS
OPTION ENABLED...16.. to allow the code ERD to print on the SMDR.

Feature Reference:

Placing a Call
Speed Dial
Station Message Detail Recording

LEAST COST ROUTING

Description:

Least Cost Routing (LCR) automatically places outgoing calls on the least expensive route. LCR uses rate structure software, customized for each installation, to evaluate up to 1Ø service types in determining the most economical service for the call being placed.

When LCR is installed, multibutton stations use outgoing line keys 12 and 13 to place calls. Outgoing calls from single line (25ØØ type), one button and four button stations, Speed Dial calls, Saved calls and Last Number Redial calls are automatically placed using Least Cost Routing.

Conditions:

(a) Least Cost Routing cannot be installed unless the Least Cost Routing Questionaire has been completed. This questionaire allows the customized software to be developed. The Least Cost Routing questionaire is available from a sales representative.

(b) Toll Restriction applies to all calls placed using LCR.

(c) LCR can be bypassed using Least Cost Routing Bypass.

(d) Least Cost Routing requires that a B-AUX-A PCB with a rate chip package be installed in the KSU.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'L' -->  LEAST COST ROUTING to program LCR parameters.
  'G' -->  CO GROUPS to assign lines to line groups.
  'K' -->  COS ALOWED AREA CODES to assign dialing restrictions
    to area codes.
'E' -->  STATIONS FEATURES
  CLASS OF SERVICE..... to program a station's Class of
    Service.
```

Feature Reference:

Class of Service
Least Cost Routing Bypass
Placing a Call
Toll Restriction

LEAST COST ROUTING BYPASS

Description:

Least Cost Routing Bypass allows Least Cost Routing to be bypassed if an area code or exchange is dialed that was not included in the rate structure software. The call is automatically placed on a Direct Distance Dialing line. Additionally, multibutton station users can bypass LCR by pressing outgoing line keys 8-11, or by dial-accessing a line group (if allowed). The system attendants may use keys 8-11, dial-accessing a line group, or Direct Line Access to bypass LCR.

Conditions:

(a) Least Cost Routing Bypass does not override Toll Restriction.

(b) If a call is placed using an area code or exchange not recognized by the rate structure software, SMDR and telephone displays will show the cost of the call at $9.99 per minute. An excessive amount of calls placed using LCR Bypass indicates that a Least Cost Routing software update is required.

(c) Single line (2500 type), one button and four button stations cannot select an outgoing line group to bypass LCR.

Required Programming:

'S' --> SYSTEM FEATURES
'L' --> LEAST COST ROUTING to program LCR.

Feature Reference:

Least Cost Routing
Placing a Call
Toll Restriction

LINE GROUPS, OUTGOING

Description:

Lines are arranged into line groups to allow outgoing calls to be placed. Similar lines, such as Direct Distance Dialing (DDD) lines, WATS lines or Other Common Carrier (OCC) lines are generally programmed into the same line group to provide for efficient management of the cost of placing calls.

Multibutton station users access a line group by pressing an outgoing line key or dialing an access code. Single line (2500 type), one button and four button station users access a line group by dialing an access code.

Conditions:

(a) Up to ten groups can be assigned. Any number of lines can be programmed into the same group.

(b) When a call is placed, the highest numbered available line in a line group is seized.

(c) When a station queues on a line, the recall will be from the first available line in the same group as the line initially queued on.

(d) Unless programmed otherwise, Speed Dial always dials on line group 1.

(e) If Least Cost Routing is installed, correct line group assignments are essential.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'L' -->  LEAST COST ROUTING to program LCR.
  'G' -->  CO GROUPS to assign lines to groups.
  'P' -->  CO TYPE to program line type.
'E' -->  STATIONS FEATURES
  DIAL C.O. GROUP..... to allow multibutton telephone users
    to dial access line groups not accessible using the outgoing
    line keys.
```

Feature Reference:

Least Cost Routing
Line Queuing
Placing a Call
Speed Dial

LINE QUEUING

Description:

Line Queuing permits a multibutton or four button station user to queue (wait in line) for an outside line if all lines in the outgoing line group are busy. The station will be recalled when the first line in the group becomes available. Any number of stations can queue on a line. The system will call the stations queued, in order, when a line in the group becomes free. If the queue recall is not answered within 15 seconds (approx.), it passes to the next station in the queue.

Conditions:

(a) A station can queue for a line only when all lines in a line group are busy.

(b) Single line (2500 type) and one button telephones cannot use the Line Queuing feature.

(c) Every time a line is queued on (Line Queuing), or a message is left (Message Waiting), a system memory element is consumed. The total number of elements consumed (i.e., the sum of lines queued and messages left) at any one time cannot exceed 128.

(d) If Least Cost Routing is installed and the least expensive route is busy, multibutton and four button station users can queue for a line.

(e) System attendants cannot queue for a line.

(f) A passed station is removed from the queue; it will not be recalled a second time.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'G' -->  CO GROUPS to assign lines to groups.
  'N' -->  OUT KEYS GROUPS to assign line groups to multibutton
    station outgoing line keys.
'E' -->  STATIONS FEATURES
  CO ACCESS  [NN..NN] IS.. to permit stations to place calls on
    lines.
```

Feature Reference:

Least Cost Routing
Message Waiting
Placing a Call

MESSAGE WAITING

Description:

Message Waiting enables a key station user to leave a Message Waiting indication at a called key station that is unattended or busy. The Message Waiting indication is a flashing M.WAIT key (HLD/TRF on four button) and a tone at the station where the message was left. The tone will be broadcast every two minutes to remind the user that a message has been left.

Conditions:

(a) Single line (2500 type) and one button telephones cannot use the Message Waiting facility.

(b) A station can leave or receive more than one Message Waiting.

(c) Messages are queued in the order in which they are left.

(d) Message Waiting indications can be canceled at the telephone where they were left (i.e., the telephone receiving the Message Waiting request), or by the station user which placed the message.

(e) Every time a line is queued on (Line Queuing), or a message is left (Message Waiting), a system memory element is consumed. The total number of elements consumed (i.e., the sum of lines queued and messages left) at any one time cannot exceed 128.

(f) The Message Waiting reminder can be disabled in programming.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'F' -->  SYSTEM OPTIONS
    OPTION ENABLED...19... to disable the Message Waiting
      reminder.
```

Feature Reference:

Callback
Direct Station Selection
Hotline
Intercom
Line Queuing

MICROPHONE CUTOFF/MUTE

Description:

Microphone Cutoff/Mute allows a multibutton telephone user to turn off the microphone in the telephone at any time. This prevents the calling party from hearing conversations in the user's office or work area. The microphone can be turned off before the call comes in (Microphone Cutoff), or while it is in progress (Microphone Mute).

Conditions:

(a) Single line (25ØØ type), one button and four button telephones do not have Microphone Cutoff/Mute.

(b) The attendant does not have access to Microphone Cutoff/Mute.

Required Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... to program the station as KEY.

Feature Reference:

Handsfree
Handsfree Answerback

MONITOR

Description:

Monitor permits multibutton and four button telephone users to dial and monitor the progress of an outside call without lifting the handset. The handset must be lifted to speak.

Conditions:

(a) Multibutton telephones without speakerphones (Handsfree) have Monitor capability. All display telephones have speakerphones; consequently, they do not have Monitor.

(b) Single line (25ØØ type) and one button telephones do not have Monitor capability.

Required Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... to assign KEY to multibutton and SLI to four button telephones.

Feature Reference:

Answering a Call
Handsfree
Placing a Call

MUSIC ON HOLD/BACKGROUND MUSIC

Description:

Music On Hold (MOH) and Background Music (BGM) can be connected to the system. If installed, BGM is broadcast through the speaker in the telephone and is controlled by the left volume control thumbwheel. The HOLD key is pressed to turn BGM on and off. BGM can also be broadcast over external paging equipment. On display telephones, the VOL UP and VOL DN keys are used to control the volume of BGM.

Music On Hold provides music to outside calls that have been placed on Hold.

Conditions:

(a) BGM and MOH require the installation of optional music sources. If desired, BGM and MOH can share the same music source.

(b) If BGM is to be broadcast over external paging equipment, optional paging equipment must be installed. BGM is turned off when paging announcements are made and when calls ring into the system.

(c) Single line (2500 type) and one button telephones cannot broadcast BGM.

Required Programming:

'S' --> SYSTEM FEATURES
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...02.. to enable MOH for the system.
  'E' --> EXTERNAL OUTPUTS to program Alternate Audio Ports to broadcast BGM.

Feature Reference:

Hold
Night Service
Paging

NIGHT SERVICE

Description:

Assigned Night Answer

Assigned Night Answer (ANA) automatically transfers incoming ringing to specific stations when the system is in the night mode. Stations which do not receive line ringing and incoming access during day hours can be programmed for Assigned Night Answer. Assigned Night Answer must be individually programmed for each station.

Universal Night Answer

When the system is in the night mode, Universal Night Answer (UNA) allows calls which ring over the external paging equipment or alerting device to be answered at designated stations. Stations which do not receive line ringing and incoming access during day hours can be programmed for Universal Night Answer. UNA must be individually programmed for each station.

Conditions:

(a) Only system attendants can place the system in the night mode, which activates Universal Night Answer and Assigned Night Answer.

(b) When more than one incoming CO line call is ringing while the system is in the night mode, single line (2500 type), one button and four button telephones will automatically access the first incoming call when the handset is lifted.

(c) If a station has CO AUDIBLE [NN..NN] IS... granted for a line, it can always answer an incoming call on that line. The night mode has no effect on CO AUDIBLE [NN..NN] IS... programming.

(d) Universal Night Answer and Assigned Night Answer do not allow stations to place outgoing night mode calls on lines not allowed by CO ACCESS [NN..NN] IS... assignments.

(e) Private Lines cannot be used for UNA and ANA.

Required Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to program lines for UNA.
'E' --> STATIONS FEATURES
NIGHT RING ENABLED... to assign ANA ringing for lines not programmed to ring in CO AUDIBLE [NN..NN] IS.. .
PRIVATE LINE.....IS... to assign a line as a Private Line.

Feature Reference:

Answering a Call
External Loud Ringing Capability
External Paging Capability

OFF PREMISES EXTENSION (OPX) COMPATIBILITY

Description:

Single line (2500 type) telephones can be installed as Off Premises Extensions (OPXs). Off Premise Extensions have access to all the features available to on-premise single line (2500 type) telephones.

Conditions:

(a) Additional OPX equipment must be installed before OPX telephones can be connected to the system. This equipment consists of a separate KSU with power supply, and a ring generator. Refer to publication P/N ØØ251 (Appendix F of this manual) for additional details.

(b) An OPX circuit must be ordered from the telco.

Required Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... to program OPX stations as type 500.

Feature Reference:

OPX telephones can access all the features of single line (2500 type) telephones.

PAGING

Description:

Paging allows the user to page selected areas (Zone Page), or throughout the entire system (All Call Page). Stations can be individually assigned to receive paging announcements from any combination of All Call Page and the eight internal Page zones.

Conditions:

(a) Single line (2500 type) and one button telephones cannot receive paging announcements. They can, however, initiate paging announcements.

(b) For systems with an expansion cabinet, a second B-TGU-B PCB or a B-AUX-A PCB must be installed if Paging should be broadcast to stations connected to expansion cabinet (ports 065-128).

Required Programming:

'E' --> STATIONS FEATURES
RECEIVE ALL-PAGE..... to program each station to receive All Call Page announcements.
PAGE ZONE RECEIVED..... to program which Page zones each station will receive.

Feature Reference:

External Paging Capability

PARK

Description:

Park allows a station user to place an outside call in a Park (waiting) condition, Page a third party and have that party pick up the Parked call from any station in the system. There are two types of Park: General Park and Personal Park.

General Park allows the user to place a call in a General Park Orbit. A call in a General Park Orbit can be picked up by any station in the system by dialing the General Park Orbit Code. The code must be announced when the call is placed in orbit.

Personal Park allows the user to Park a call at a specific idle station. Once parked at the station, any station in the system can pick up the call. The station at which the call is parked must be announced.

Conditions:

(a) The system has ten General Park Orbits.

(b) There is no limit to the number of Personal Park conditions that can be active in the system at any one time.

(c) If more than one call was parked at a station (Personal Park), the first call parked will be the first call picked up.

(d) Every station in the system can use the General Park and Personal Park facilities.

(e) A call placed in General Park Orbit that is not picked up will recall the station which placed it in orbit after the ORBIT RECALL TIMER.(SEC)..... interval. The call will ring at the station which placed it in orbit for 60 seconds, and then be automatically passed to the primary attendant.

(f) A call placed in Personal Park Orbit that is not picked up will recall the station which placed it in orbit after the TRANS RECALL.(SEC)..... interval. The call will ring at the station which placed it in orbit for 30 seconds, and then be automatically passed to the primary attendant.

Required Programming:

'S' --> SYSTEM FEATURES
'M' --> TIMERS
ORBIT RECALL TIMER.(SEC). to program the General Park Orbit recall time.
TRANS RECALL.(SEC)..... to program the Personal Park recall time.

Feature Reference:

Answering a Call
Page
Transfer

PLACING A CALL

Description:

Any station user has the capability to place any call on any line, unless restrictions have been imposed by system programming. Toll Restriction may impose dialing limitations, and outgoing access to specific lines may be denied.

Multibutton station users place outgoing calls by using the outgoing line keys (keys 8-13) or by dialing access codes. Single line (2500 type), one button and four button station users place outgoing calls by dialing access codes. If Least Cost Routing is installed, multibutton station users place LCR calls by using outgoing line keys 12 and 13. Outgoing calls from single line, one button and four button stations are routed via LCR automatically.

2

Conditions:

(a) Station users may be required to dial a PBX access code if the system is installed behind a PBX.

(b) Multibutton, four button, single line (2500 type) and one button station users place calls by accessing line groups, rather than specific lines. The attendant may also access line groups, or may use Direct Line Access to seize a particular line.

(c) If LCR is installed, the cost of outgoing calls will be displayed on the SMDR and on the telephone display.

(d) Lines may be designated as incoming only. These lines cannot be used to place outgoing calls.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'L' -->  LEAST COST ROUTING to program LCR.
  'P' -->  CO TYPE to program line type.
  'A' -->  OFFICE CODE TYPES to program office and area code type.
  'K' -->  COS ALOWED AREA CODES to assign Class of Service to
    all area codes.
'E' -->  STATIONS FEATURES
  CLASS OF SERVICE..... to assign Class of Service for each
    station.
  CO ACCESS  [NN..NN] IS.. to program outgoing access to lines on
    a station-by-station basis.
```

Feature Reference:

Class of Service
Least Cost Routing
Toll Restriction

POWER FAILURE RESTART

Description:

Power Failure Restart ensures that system memory will be retained in the event of a commercial AC power failure. When the AC source is restored, the system automatically restarts and returns all stations to service. This is accomplished by two methods:

(a) Non-volatile (permanent) Erasable Programmable Read Only Memory (EPROM) integrated circuits are used to store the system operating software. The software is permanently "burned" into each EPROM device and is retained even when no power is applied.

(b) The volatile (non-permanent) Random Access Memory (RAM) devices that are used to store the system programmable options and Speed Dial numbers are battery backed up. The battery is a rechargeable Nickel Cadmium (NICAD) cell which is continually trickle charged when the system is powered up. If commercial power should fail, the programmable options and Speed Dial numbers are retained for up to 10 days.

Conditions:

(a) Any active conditions in the system (such as Line Queuing, Callback, etc.) are cancelled if commercial AC power fails.

(b) Save and Last Number Redial numbers are erased when power fails.

(c) All calls are dropped when AC power fails.

(d) The B-CPU-B PCB must be correctly strapped for the NICAD battery to protect the RAM memory. Refer to Section 5, INSTALLATION for additional details.

(e) After commercial power is restored, single line (2500 type) and one button telephones must be cycled off hook, then on hook to return them to service.

(f) Power failure cut-through requires the installation of customer provided equipment. The TCX-128 does not accommodate automatic cut-through.

Required Programming: not applicable

Feature Reference:

Answering a Call
Last Number Redial
Placing a Call
Save
Speed Dial

PRIVACY

Description:

Privacy is assured on all Intercom and outside calls. The inherent system Privacy feature can only be overriden by the Barge In facility, and even then only in conjunction with warning tones.

Conditions:

(a) Only multibutton stations can be permitted to Barge In.

(b) Each station in the system can be programmed to block Barge In (thereby assuring complete Privacy).

Required Programming:

```
'E' -->  STATIONS FEATURES
  BARGE   IN     ENABLED.... to allow multibutton stations to
    Barge In.
  BLOCK BARGE    ENABLED... to allow any station to block
    (prevent) Barge In.
```

Feature Reference:

Answering a Call
Barge In
Intercom
Placing a Call

PRIVATE BRANCH EXCHANGE (PBX) COMPATIBILITY

Description:

The system may be installed behind a Private Branch Exchange (PBX). The line inputs into the KSU will be 500/2500 compatible PBX extensions, rather than CO lines. When a line is assigned in system programming as a PBX line, the first digit dialed (which is normally the PBX access code) is ignored in the outgoing Toll Restriction check.

Conditions:

CO and PBX lines can be arranged in any combination; however, additional customer-provided installation hardware (an "A" block) and the services of a certified installer are required.

Required Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to assign lines as PBX lines.

Feature Reference:

Placing a Call
Toll Restriction

PRIVATE LINE

Description:

Any multibutton station in the system can have a Private Line assigned to it, reserved exclusively for its use when placing outgoing calls. If desired, the Private Line can also be dedicated to the station for incoming calls. The Private Line is accessed and answered using incoming line key 5.

Conditions:

(a) The system can accommodate up to 32 Private Lines.

(b) A Private Line cannot be used by any other station in the system to place calls.

(c) A Private Line can be programmed to ring as a normal call at other stations in the system, or may be fully restricted for both incoming and outgoing access.

(d) Once answered, a Private Line can be transferred to any station in the system.

(e) When the system is put in the night mode, a Private Line cannot be accessed from a single line (2500 type), one button and four button telephone by dialing 69; cannot have ringing rerouted using Assigned Night Answer; and will not activate a night ring relay. Since Private Lines will not excite the loud ring relay, they should not be assigned as Universal Night Answer lines.

(f) A key station user cannot use Group Call Pickup to answer a call ringing in on another station's Private Line.

(g) A Private Line can be shared by more than one station.

(h) Toll Restriction always applies to calls made on a Private Line.

Required Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to exclude Private Lines for UNA.
'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] IS.. to restrict or allow other stations in the system to answer a Private Line.
PRIVATE LINE.....IS... to assign Private Lines.

Feature Reference:

Answering a Call
Placing a Call
Toll Restriction

RELEASE

Description:

Release allows the attendant to terminate a call, without replacing the handset, by pressing the RLS key. The Release feature is useful if the attendant is using a customer-provided headset or the Handsfree mode to answer and place calls.

Conditions:

(a) Release is a feature reserved for the system attendants.

(b) The attendant telephone must be a multibutton or display telephone.

(c) Release disconnects the line.

Required Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS to assign operators and alternate operators.

Feature Reference:

Placing a Call

SAVE

Description:

The Save feature permits multibutton telephone users to store a frequently called number for automatic dialing at a later time. A saved number remains stored until a new number is saved in its place.

Conditions:

(a) Save is applicable to multibutton telephones only.

(b) Save has no effect on Last Number Redial.

(c) System and Station Speed Dial numbers can be saved.

(d) Display telephones have a SAVE key on the dialpad which can be used in lieu of the SAVE feature key, if desired.

Required Programming: not applicable

Feature Reference:

Placing a Call
Last Number Redial
Speed Dial

SPEED DIAL

Speed Dial permits stations to dial stored telephone numbers. There are two types of Speed Dial: Station Speed Dial and System Speed Dial. Station Speed Dial allows 14 Speed Dial numbers to be stored at a multibutton station, and 1Ø Speed Dial numbers to be stored at a single line (25ØØ type), one button or four button telephone. These numbers are exclusively for the use of the station at which they are stored. System Speed Dial provides 1ØØ stored numbers that are available to every station in the system by dialing designated System Speed Dial codes.

Unlike Save and Last Number Redial, Speed Dial numbers are stored in battery backed-up system memory and will remain until they are erased or replaced.

Station Speed Dial

Description:

Station Speed Dial permits the first 5Ø stations in the system to store up to 14 telephone numbers for automatic dialing. Station Speed Dial numbers are stored in station bins, and each bin can accommodate up to 16 digits. Bins can be chained (linked together) to allow automatic dialing of numbers longer than 16 digits. Chaining is useful for services such as MCI or Sprint.

Conditions:

(a) Multibutton stations have access to 14 dedicated Station Speed Dial bins. Four button, single line (25ØØ type) and one button telephones have access to 1Ø dedicated Station Speed Dial bins.

(b) The system usually uses line group 1 to place Station Speed Dial calls; however, the line on which the call is to be placed can be pre-selected, and entered into the Station Speed Dial bin. If Least Cost Routing is installed, the route for the Speed Dial call is automatically selected.

(c) A pause may be entered into a Station Speed Dial bin by entering the character ♯. The length of the pause is programmed during system installation. Refer to Speed Dial Options.

(d) Multibutton telephone users can manually chain two Station Speed Dial bins. These users can also chain up to three Station Speed Dial numbers to a System Speed Dial number.

(e) All telephone users can manually dial after a Station Speed Dial bin has dialed out, if Class of Service restrictions permit.

(f) Station Message Detail Recording can be programmed to print the Speed Dial bin number as part of the call record. If bins are chained, the first and the last bin number will print.

Required Programming:

'E' --> STATIONS FEATURES
CLASS OF SERVICE..... to program outgoing dialing restrictions on a station by station basis.
CO ACCESS [NN..NN] IS.. to give stations outgoing access to lines in group 1.
'S' --> SYSTEM FEATURES
'M' --> TIMERS
PAUSE TIME-OUT.(SEC)..... to program the duration of the pause encountered when # is entered into the bin.
'L' --> LEAST COST ROUTING to enable LCR.
'G' --> CO GROUPS to assign lines to group 1 (line group normally used for Speed Dial calls.
'K' --> COS ALOWED AREA CODES to assign a Class of Service to each area code.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...16.. to allow bin numbers to print as part of the SMDR call record.

Feature Reference:

Placing a Call
Speed Dial Options

System Speed Dial

Description:

System Speed Dial permits every station in the system to access 1ØØ telephone numbers stored by the attendant in System Speed Dial bins. These numbers can be automatically dialed from any station in the system using a 3-digit code. Each bin can accommodate 16 digits; however, system bins may be automatically chained (linked together) to allow automatic dialing of numbers longer than 16 digits. Chaining is useful for services such as MCI or Sprint. In addition, special Speed Dial Options can be entered into the bins to provide for unique Speed Dial features.

Conditions:

(a) Station Class of Service programming can impose dialing restrictions on System Speed Dial numbers.

(b) The attendant can program System Speed Dial bins so that they will always dial out together. There is no limit to the number of bins that can be chained in this manner.

(c) All stations can manually dial after a System Speed Dial number has dialed out, if Class of Service restrictions or Speed Dial Options permit.

(d) Any user in the system can select up to four System Speed Dial bins to be chained. Multibutton station users can select up to three Station Speed Dial bins to be chained to a System Speed Dial bin.

(e) The attendant can program a System Speed Dial bin so that multibutton station users can chain it to a Station Speed Dial bin with just the touch of the station bin key. Refer to Speed Dial Options (Simplified Manual Chaining Option).

(e) If LCR is installed, System Speed Dial calls will automatically be placed on the least expensive route.

Required Programming:

'E' --> STATIONS FEATURES
  CLASS OF SERVICE..... to program outgoing dialing
    restrictions on a station by station basis.
  CO ACCESS [NN..NN] IS.. to give stations outgoing access to
    lines in group 1.
'S' --> SYSTEM FEATURES
  'L' --> LEAST COST ROUTING to program LCR.
  'G' --> CO GROUPS to assign lines to group 1 (line group
    normally used for Speed Dial calls.
  'K' --> COS ALOWED AREA CODES to assign a Class of Service to
    each area code.

Feature Reference:

Placing a Call
Speed Dial Options

SPEED DIAL OPTIONS

Speed Dial Options can be entered into Speed Dial bins to increase the flexibility of Speed Dialing. Each character in the option is counted as a digit.

Pause Option -

Description:

The # key allows a pause to be entered into a System or Station Speed Dial bin. The duration of the pause is programmed during system installation. More than one pause can be programmed into a bin and each # counts as a digit.

Pauses are typically entered into Speed Dial bins when the system is installed behind a PBX. For example, if the PBX access code for an outside line is 9, and the number to be Speed Dialed on the outside line is 12039262000, the bin would be programmed as 9#12039262000.

Conditions:

A # can be entered anywhere in a System or Station Speed Dial bin.

Required Programming:

'S' --> SYSTEM FEATURES
'M' --> TIMERS
PAUSE TIME-OUT.(SEC). to program the duration of the pause that occurs when # is entered into a bin.

Feature Reference:

Placing a Call
Speed Dial

Automatic Chaining Option - *1

Description:

The command *1 allows System Speed Dial bins to be automatically chained. A system bin ending in *1 will automatically be chained to the next consecutive system bin. This is useful if an OCC access or security code is longer than 16 digits. The *1 counts as two digits. More than one bin may be automatically chained using the *1 directive.

For example, if the OCC access and security code 213444858512129999 is to be programmed into System Speed Bins Ø1 and Ø2, enter 213444*1 into bin Ø1 and 858512129999 into bin Ø2. The bins will consecutively dial out when 8Ø1 is dialed.

Conditions:

There is no limit to the number of bins that can be chained using the *1 directive.

Required Programming: not applicable

Feature Reference:

Placing a Call
Speed Dial

Simplified Manual Chaining Option - *2*

Description:

The directive *2* simplifies the way a Station Speed Dial bin is chained to a System Speed Dial bin. If *2* is entered at the end of the system bin, the multibutton telephone user only has to press the Station Speed Dial bin key to chain the system bin to the station bin. The *2* command counts as three digits.

Conditions:

The *2* directive has no effect on the way single line (2500 type), one button and four button telephones use the System Speed Dial bin.

Required Programming: not applicable

Feature Reference:

Placing a Call
Speed Dial

Bypass Toll Restriction Option - *3

Description:

When entered at the beginning of a System Speed Dial bin, the *3 command prevents the number stored in the bin from displaying at display telephones and printing on the SMDR. This is used to prevent unauthorized use of OCC access and security codes. For example, if a System Speed Dial bin is programmed with *38882ØØØ, the SMDR and display will suppress 8882ØØØ, but the digits will still be dialed.

If *3 is entered at the beginning of a bin that uses *1 to automatically chain, none of the digits in the chained sequence will print. If *3 is entered in a *2* manually chained bin, the station bin will print; the system bin will not.

The command *3 also is used to bypass Toll Restriction. Any station can use a bin in which *3 was used to turn off the SMDR and display. For example, if a System Speed Dial bin containing 12Ø39262ØØØ should be accessible to every Class of Service, program a system bin with 1*32Ø39262ØØØ. The digits 2Ø39262ØØØ will also be suppressed on the displays and the SMDR. When used to bypass Toll Restriction, the directive *3 cannot be the first entry in the system bin.

Conditions:

The *3 directive can be used to bypass Toll Restriction for any station, including one button, four button and single line (25ØØ type) telephones.

Required Programming:

'S' --> SYSTEM FEATURES
  'K' --> COS ALOWED AREA CODES to assign allowed Class of Service to each area code.
'E' --> STATIONS FEATURES
  CLASS OF SERVICE..... to program Class of Service on a station by station basis.

Feature Reference:

Class of Service
Placing a Call
Speed Dial
Toll Restriction

Station Toll Restriction On Option - *4

Description:

The *4 command, entered at the beginning or end of a System Speed Dial bin, restricts the call according to the Class of Service (COS) of the station which is using the bin. For example, this prevents a station with COS 5 from using a system bin which contains a leading Ø. The *4 command counts as two digits.

Conditions:

Class of Service programming determines the restrictions imposed by the *4 directive.

Required Programming:

'S' --> SYSTEM FEATURES
'K' --> COS ALOWED AREA CODES to assign allowed Class of Service to each area code.
'E' --> STATIONS FEATURES
CLASS OF SERVICE..... to program Class of Service on a station-by-station basis.

Feature Reference:

Class of Service
Placing a Call
Speed Dial
Toll Restriction

Station Toll Restriction Off Option - *5

Description:

The *5 command, entered at the beginning or end of a System Speed Dial bin, assures that all stations in the system can use the bin. For example, the *5 directive allows a telephone with Class of Service 4 to dial a leading 1 10-digit call which would normally be prevented. The *5 directive counts as two digits.

The *5 command can also be used to enable Toll Restricted stations to manually dial after a System Speed Dial bin has dialed out. For example, assume that COS 1 is allowed to dial area code 203, and that System Speed Dial bin 50 is programmed with an OCC access number of 12039262000. When a station with COS 1 accesses bin 50 (dials 850), OCC dial tone is returned but the station cannot dial into the service. If the command *5 is entered at the beginning or the end of the bin (*512039262000), the station can manually dial into the service after the OCC dial tone is returned.

Conditions:

Class of Service programming determines the restrictions imposed by the *5 directive.

Required Programming:

'S' --> SYSTEM FEATURES
  'K' --> COS ALOWED AREA CODES to assign allowed Class of Service to each area code.
'E' --> STATIONS FEATURES
  CLASS OF SERVICE..... to program Class of Service on a station-by-station basis.

Feature Reference:

Class of Service
Placing a Call
Speed Dial
Toll Restriction

Supressing the Leading 1 Option - *6

Description:

When placed at the end of a System Speed Dial bin, the *6 command will automatically remove the leading 1 from any succeeding chained Speed Dial bin. This option is helpful if a system bin contains the access and security code for an OCC located in a non-leading 1 dialing area, and the bin to be chained to this system bin contains a leading 1. If the *6 option is implemented, the leading 1 from any chained bin is ignored. If the *6 option was not used in this situation, the chained bins could be incompatible with the non-leading 1 dialing service.

For example, If System Speed Dial bin 5Ø contains 12Ø3888200*6 and System Speed Dial bin 51 contains 15551212, bin 51 will dial out as 5551212 if it is chained to bin 5Ø.

Conditions:

(a) This option is used when the system is located in an area where both leading 1 (1 + NPX/NNX) and non-leading 1 (NPX/NNX) dialing services are provided. Speed Dial bins do not have to be reprogrammed if the service changes.

(b) Dialing services are determined by the telco.

Required Programming:

'S' --> SYSTEM FEATURES
  'A' --> OFFICE CODE TYPES to designate Conflict Codes.

Feature Reference:

Placing a Call
Speed Dial

SPLIT

Description:

Split allows a station user to alternate (Split) between two calls. Split will alternate between the current call and the call last placed on Hold.

Conditions:

(a) The attendant cannot use the Split feature.

(b) If a Split call is left on Hold longer than the Hold Recall interval, it will re-ring at the station which placed it on Hold.

(c) Multibutton telephone users can use the SPLIT key to answer Attendant/Hotline partner Call Waiting signals.

Required Programming: not applicable

Feature Reference:

Answering a Call
Hold

SPLIT RINGING

Description:

Split Ringing allows CO line ringing and incoming access assignments to be tailored to the requirements of each station. Any combination of lines can ring and be answered at a station. Split Ringing is applicable to the day mode (i.e. Assigned Night Answer and Universal Night Answer not activated).

Conditions:

(a) On a multibutton station, only those calls programmed to ring will appear on an incoming line key.

(b) Split Ringing is applicable to all telephones in the system.

(c) If CO AUDIBLE is granted for a line, it will ring in the day and night mode. Night Service may be configured to allow additional lines to ring when the system is in the night mode.

Required Programming:

'S' --> SYSTEM FEATURES
  'P' --> CO TYPE to program Universal Night Answer lines.
'E' --> STATIONS FEATURES
  CO AUDIBLE [NN..NN] IS.. to program Split Ringing assignments.

Feature Reference:

Answering a Call
Night Service

STATION MESSAGE DETAIL RECORDING (SMDR)

Description:

Station Message Detail Recording provides a hard copy record of outgoing calls. SMDR will record the date, station number, line used, number dialed, start time of call, duration of call, cost of call and account code (if entered). The Speed Dial bin number may also print, if enabled in system programming.

Conditions:

(a) If LCR is installed in the system, the cost of the call will also print.

(b) SMDR requires that an optional customer-provided printer or call accounting device (such as the TIE TELE-RECORD) be connected to the KSU.

(c) The minimum duration of calls that can be printed on the SMDR is determined in system programming.

(d) The SMDR can be selectively enabled to print any combination long distance calls, local (7-digit) calls, Speed Dial bin numbers and 'O' calls to an outside operator. Enabling the SMDR to record Speed Dial bin numbers also allows Last Number Redial and Save designations to print.

Required Programming:

'S' --> SYSTEM FEATURES
  'M' --> TIMERS
    SMDR TIMER..(SEC)..... to program the minimum duration of outgoing calls that will be printed.
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...13.. to enable SMDR for long distance calls.
    OPTION ENABLED...15.. to enable SMDR for 'O' calls to an outside operator.
    OPTION ENABLED...16.. to enable SMDR to print Speed Dial bin numbers and Save and Last Number Redial designations.
    OPTION ENABLED...17.. to enable SMDR to print local (7-digit) calls.

Feature Reference:

Account Code Capability
Least Cost Routing
Placing a Call
Toll Restriction

TENANT SERVICE

Description:

The TCX-128 can be configured to allow up to six tenants to share the same system. Each tenant (i.e., user group) can be programmed with incoming and outgoing lines dedicated exclusively for its own use. An attendant with a DSS console can be assigned to each tenant group.

Conditions:

When the system is divided between tenants, the following occurs:

(a) Each station is connected to the primary attendant when a 0 Intercom call is dialed. A tenant is connected to its own attendant by dialing the attendant's station number. Each DSS console in the system provides one button access and a Busy Lamp Field for all stations (regardless of tenant group).

(b) All attendant recalls (e.g., Hold, Transfer, etc.) for all tenant groups go to the primary attendant.

(c) All Call Page is broadcast to all tenant groups.

(d) Any station in a tenant group can place an Intercom call to any station in another tenant group.

(e) Any station (regardless of tenant group) can use any System Speed Dial number unless prevented by Class of Service and Toll Restriction.

(f) Least Cost Routing applies to all tenants. LCR routes an outgoing call from one tenant the same way as an outgoing call from another tenant, using the same line services.

(g) In the night mode, Universal Night Answer is in force globally (i.e., for the entire system). Universal Night Answer lines cannot be split between tenant groups.

Required Programming:

'S' --> SYSTEM FEATURES
- 'O' --> OPERATORS & DSS to assign the primary attendant (shared by all tenants), tenant attendants, tenant alternate attendants and DSS consoles.
- 'G' --> CO GROUPS to program lines into line groups (to be used in conjunction with OUT KEYS GROUPS and CO ACCESS programming.
- 'N' --> OUT KEYS GROUPS to assign line groups the outgoing line keys.

Required Programming (Cont'd):

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] IS.. to program which lines should ring in for each tenant group.
CO ACCESS [NN..NN] IS.. to program which lines are available for outgoing calls for each tenant.

Feature Reference:

Answering a Call
Least Cost Routing
Night Service
Page
Placing a Call
Speed Dial

TERMINATING A CALL

Description:

Any station user in the system can terminate an active call by hanging up the handset. Multibutton telephone users (other than the attendants with DSS consoles) can also terminate a call by pressing a line key. Multibutton telephone users can terminate a Handsfree call by pressing the HF key. Monitored calls can be terminated by pressing the MON key. The attendant can terminate a call by pressing the RLS key.

Conditions: not applicable

Required Programming: not applicable

Feature Reference:

Answering a Call
Placing a Call

TOLL RESTRICTION

Description:

Toll Restriction uses a station's programmable Class of Service to impose dialing restrictions on outgoing calls. In addition, each area code in the system is programmed to be available only to those telephones with the proper Class of Service. This allows a Toll Restriction scheme to be tailored to the specific site dialing requirements.

NOTE: Refer to the Class of Service feature for the Class of Service assignments.

Conditions:

(a) When the system is initialized, only Class of Service Ø can dial area codes (i.e., there are no allowed area codes).

(b) When the system is initialized, all stations are unrestricted (i.e., assigned with Class of Service Ø).

Required Programming:

'S' --> SYSTEM FEATURES
  'K' --> COS ALOWED AREA CODES to assign allowed Class of Service to each area code.
'E' --> STATIONS FEATURES
  CLASS OF SERVICE..... to assign a Class of Service on a station-by-station basis.

Feature Reference:

Class of Service
Placing a Call

TRANSFER

Description

Transfer allows a station user to transfer a call to another station user in the system. There are three types of Transfer: Screened Transfer, Unscreened Transfer and Handsfree Transfer. Screened Transfer allows the station user to announce a call before it is transferred. Unscreened Transfer transfers the calls unannounced. Handsfree Transfer, which can be initiated only by the attendant and Hotline partners, sends a call to the speakerphone of a multibutton telephone.

Unanswered transferred calls re-ring the station which initiated the Transfer. If the returned call is not answered within 30 seconds, it will ring the attendant.

Conditions:

(a) All stations in the system can initiate and receive Transfers.

(b) The Transfer Recall interval is programmable. This is the interval before an unanswered transferred call returns to the station from which it was initially transferred.

(c) Multibutton telephones can use the Direct Station Selection (DSS) keys or the Hotline key to Transfer calls.

(d) A station can answer a call and Transfer it to another station only if it has audible for the line. A station can, however, receive a transferred call to which it would normally be denied access.

Required Programming:

```
'S' -->  SYSTEM FEATURES
  'M' -->  TIMERS
    TRANS RECALL.(SEC)..... to set the Transfer Recall interval
```

Feature Reference:

Answering a Call
Direct Station Selection
Hotline

VOLUME CONTROLS

Description:

Two volume control thumbwheels are located on the front edge of the multibutton and four button telephones. The left thumbwheel is used to adjust the volume of the Page receive, splash tone, ring tone and BGM. The right thumbwheel controls the volume of incoming Handsfree, Handsfree Answerback and Monitor conversations. To increase volume, turn the thumbwheel counterclockwise.

On display telephones, volume is controlled by the VOL UP and VOL DN keys.

On the one button telephone, the single volume control regulates the volume of ringing. To increase volume, turn the thumbwheel counterclockwise.

Conditions: not applicable

Required Programming: not applicable

Feature Reference:

Answering a Call
Music on Hold/Background Music
Handsfree
Handsfree Answerback
Monitor
Paging

VOLUME CONTROLS

Description:

Two volume control thumbwheels are located on the front edge of the multibutton and four button telephones. The left thumbwheel is used to adjust the volume of the Page receive, splash tone, ring tone and BGM. The right thumbwheel controls the volume of incoming Handsfree, Handsfree Answerback and Monitor conversations. To increase volume, turn the thumbwheel counterclockwise.

On display telephones, volume is controlled by the VOL UP and VOL DN keys.

On the one button telephone, the single volume control regulates the volume of ringing. To increase volume, turn the thumbwheel counterclockwise.

Conditions: not applicable

Required programming: not applicable

Feature Reference:

Answering a Call
Music on Hold/Background Music
Handsfree
Handsfree Answerback
Monitor
Paging

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 3, HARDWARE CONFIGURATION

1. INTRODUCTION

1.01 The HARDWARE CONFIGURATION Section provides the information required to order the equipment necessary to meet the needs of the customer. This section gives the instructions necessary to complete Table 3-1, Order Sheet, located at the end of this section. The Order Sheet is used to develop a record of the equipment needed.

2. COMPLETING THE ORDER SHEET

KSU, EXPANSION CABINET AND POWER SUPPLY - ITEM 1

2.01 The TCX-128 Key Service Unit (KSU) is the equipment cabinet that houses the Printed Circuit Boards (PCBs) that control the system. One KSU is required. If more than 64 stations or 20 outside lines are to be connected, an expansion cabinet is required. Each equipment cabinet (KSU and expansion cabinet) requires a separate power supply to provide the DC voltages necessary to operate the PCBs.

On Table 3-1, indicate if an expansion cabinet is required. Indicate also the number of power supplies necessary (one or two).

TELEPHONES - ITEM 2

2.02 The system can accommodate up to 128 telephone instruments. The available telephones are:

- Multibutton Key Telephone with Speakerphone (Handsfree)
- Multibutton Key Telephone without Speakerphone (Monitor)
- Display Multibutton Key Telephone
- Four Button Key Telephone
- One Button Single Line Telephone
- Single Line (2500 type) Telephone

2.03 Display, multibutton and four button key telephones can be ordered in any combination, up to a maximum of 128. This total is limited by the number of DSS consoles (refer to paragraph 2.06), single line (2500 type) and one button telephones required (refer to paragraphs 2.04 and 2.05). If single line (2500 type) or one button telephones are to be used, the available number of key and four button telephones is decreased according to the following chart:

Single Line/One Button Telephones	Maximum Number of Key and Four Button Telephones
KSU	
1-8	120
9-16	112
17-24	104
25-32	96
33-40	88
41-48	80
49-56	72
57-64	64
EXPANSION CABINET	
65-72	56
73-80	48
81-88	40
89-96	32
97-104	24
105-112	16
113-120	8

2.04 Single Line (2500 type) telephones, available as desk or wall models, cannot use standard 90V ringers. A Special Loud Ringing Tone Board or a Tie Electronic Ringer must be purchased and installed for each single line (2500 type) telephone ordered. The Special Loud Ringing Tone board has provisions for connecting an external ringer in areas where normal ringing is not adequate. In addition, this board allows single line (2500 type) telephones to be ordered with special faceplates containing Hold buttons.

NOTE: Single line (2500 type) telephones can be installed as Off Premise Extensions (OPXs). Optional OPX equipment must be installed before OPX telephones can be connected to the system. This equipment consists of a separate KSU with power supply and a ring generator. Refer to Appendix F of this manual for additional details.

2.05 One button telephones provide all the features of single line (2500 type) telephones with Hold buttons, and do not require separately purchased ringers.

On Table 3-1, indicate the quantity and type of telephone instruments required. At least one multibutton station should be ordered (with a DSS console), to be used as the primary attendant. If single line (2500 type) telephones are to be ordered, indicate how many Special Loud Ringing Tone Boards, Tie Electronic Ringers, faceplates with Hold buttons and external ringers are required. If any of the key telephones are to be wall mounted, indicate on Table 3-1 the number of wall mounting kits required.

DSS CONSOLES - ITEM 3

2.06 In order to achieve full use of the attendant's station, it is recommended that one DSS console be ordered for each attendant. If the system has six attendants, six DSS consoles should be ordered.

Indicate on Table 3-1 the number of DSS consoles required.

LINES - ITEM 4

2.07 The system can accept up to 32 lines. These lines can include:

- Direct Distance Dialing (DDD) CO Lines
- Wide Area Telephone Service (WATS) CO Lines
- Foreign Exchange (FX) CO Lines
- Lines reserved for Other Common Carriers (e.g., MCI)
- Private Branch Exchange (PBX) Lines

Lines can be either Dual Tone Multifrequency (DTMF) or Dial Pulse (DP), in any combination. Keep a record of the lines ordered and the configuration of the RJ21X connectors provided by the telco or PBX personnel.

Indicate on Table 3-1 how many of each type of line is required.

NOTE: Combining CO lines and PBX lines in the same system requires additional customer-provided equipment (i.e., additional 66M1-50 connecting blocks) and the services of a certified installer.

WARNING: A DETAILED TRAFFIC STUDY SHOULD BE MADE IF MORE THAN 24 LINES ARE TO BE USED IN THE SYSTEM. THIS STUDY WILL DETERMINE IF THE NUMBER OF AVAILABLE SYSTEM TALKPATHS IS SUFFICIENT TO MANAGE THE INCREASED TRAFFIC.

PRINTED CIRCUIT BOARDS - ITEM 5

Central Processor Unit (B-CPU-B) PCB

2.Ø8 One Central Processor Unit (B-CPU-B) PCB is required in every system. The Central Processor Unit (B-CPU-B) PCB contains the Z8Ø executive microprocessor, the 65Ø2 traffic control microprocessor, system software and user accessible memory. The B-CPU-B PCB also contains a clock/calendar which is used for time and date display settings and Station Message Detail Recording (SMDR) purposes.

Station Card Unit (B-8SCU-C) PCB

2.Ø9 Each Station Unit (B-8SCU-C) PCB contains circuits for up to eight key telephones. Up to eight B-8SCU-C PCBs can be installed in the KSU, and up to eight additional B-8SCU-C PCBs can be installed in the expansion cabinet. Each PCB contains the required power and receive/transmit circuits for the stations; crosspoints for Intercom, CO and Conference calls; a microprocessor; a Read Only Memory (ROM) program; and overload protection circuits. The PCB position in the KSU determines the port number for the telephone instrument. Unused station positions can be used as Alternate Audio Outputs to allow customer-provided external paging equipment to be connected to the system.

2.1Ø To determine the total number of B-8SCU-C PCBs required:

(1) Add up the number of display, multibutton and four button telephones and Alternate Audio Outputs indicated in Table 3-1, Item 2.

(2) Combine this figure with the number of DSS consoles ordered in Table 3-1, Item 3.

(3) Consult the following chart to determine the number of B-8SCU-C PCBs required.

Number of Key Telephones and DSS Consoles Required	Number of B-8SCU-C PCBs PCBs Required
KSU	
1-8	1
9-16	2
17-24	3
25-32	4
33-4Ø	5
41-48	6
49-56	7
57-64	8

Number of Key Telephones and DSS Consoles Required	Number of B-8SCU-C PCBs PCBs Required
EXPANSION CABINET	
65-72	9
73-80	10
81-88	11
89-96	12
97-104	13
105-112	14
113-120	15
121-128	16

For example, assume the system requires 54 multibutton telephones, 10 four button telephones and two DSS consoles. The sum of these instruments is 66. The chart indicates that 66 instruments require 9 B-8SCU-C PCBs.

On Table 3-1, indicate the number of B-8SCU-C PCBs required.

Single Line Instrument (B-8SLU-B) PCB

2.11 The Single Line Instrument Unit (B-8SLU-B) PCB contains circuits for single line (2500 type) and one button telephones. The PCB is installed in place of a B-8SCU-C PCB when single line (2500 type) or one button telephones are used. Each B-8SLU-B PCB can accommodate up to eight single line telephones, but cannot be used with key telephones, DSS consoles or Alternate Audio Ports.

2.12 To determine the total number of B-8SLU-B PCBs required:

(1) Add up the number of single line (2500 type) and one button telephones indicated in Table 3-1, Item 2.

(2) Consult the following chart to determine the number of B-8SLU-B PCBs required.

Number of Single Line and One Button Telephones Required	Number of B-8SLU-B PCBs Required
KSU	
1-8	1
9-16	2
17-24	3
25-32	4
33-40	5
41-48	6
49-56	7
57-64	8

Number of Single Line and One Button Telephones Required	Number of B-8SLU-B PCBs Required
EXPANSION CABINET	
65-72	9
73-80	10
81-88	11
89-96	12
97-104	13
105-112	14
113-120	15

For example, assume the system requires 16 single line (2500 type) and 10 one button telephones. The sum of these instruments is 26. The chart indicates that 26 instruments require 4 B-8SLU-B PCBs.

CO Line Unit (B-4COU-A) PCB

2.13 Each CO Line Unit (B-4COU-A) PCB connects four CO lines to the system. Up to six B-4COU-A PCBs (24 lines) can be installed in the KSU cabinet, and an additional two B-4COU-A PCBs (8 lines) can be installed in the expansion cabinet. This PCB contains ring detectors, conference-enabling circuits, loop relays and MOH circuitry for each CO line.

2.14 To determine the number of B-4COU-A PCBs required, add up the total number of lines required (Table 3-1, Item 4) and consult the following chart.

Number of Lines Required	Number of B-4COU-A PCBs Required
KSU	
1-4	1
5-8	2
9-12	3
13-16	4
17-20	5
21-24	6
EXPANSION CABINET	
25-28	7
29-32	8

On Table 3-1, indicate how many B-4COU-A PCBs are required.

Tone Generator Unit (B-TGU-B) PCB

2.15 The Tone Generator Unit (B-TGU-B) PCB generates dial, reorder, Dual Tone Multifrequency (DTMF) and signaling tones for the TCX-128 system. It also contains two external output control relays that can be used with external paging equipment. The Tone Generator PCB contains DTMF receivers for tone-to-pulse conversion and can accept two additional DTMF receiver daughter boards. The B-TGU-B PCB also contains volume controls for paging, Background Music and Music-On-Hold (MOH).

2.16 The specific system configuration determines how many B-TGU-B PCBs are needed (either one or two). For a single KSU system, one Tone Generator PCB is always required. If the system has a KSU and an expansion cabinet, two tone generators are always required (unless a B-AUX-A is installed - refer to paragraph 2.18).

NOTE: A second B-TGU-B PCB will not provide external output control relays 3 and 4. These relays are only accessible when a B-AUX-A PCB is installed (refer to paragraph 2.18).

2.17 The number of DTMF receivers required determines how many DTMF receiver daughter boards are needed, and may also determine how many B-TGU-B PCBs are used. As shown in the chart below, the number of DTMF receivers needed depends on the intensity of system dialing. The chart explains when additional DTMF receiver daughter PCBs are required. It also shows when two B-TGU-B PCBs are needed in a single KSU system.

	Number of Stations	Number of Lines	B-TGU-B PCBs Required	Additional DTMF Daughter PCBs Req.
Low / Med. dialing	1-24	1-8	1	0
	25-40	9-12	1	1
	41-64	13-24	1	2
	65-80	13-24	2	1
	81-128	25-32	2	2
Heavy dialing	1-24	1-8	1	1
	25-40	9-12	1	2
	41-64	13-24	2	2
	81-128	25-32	2	4

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NOTE: Display telephones do not require DTMF receivers, and should not be counted when determining DTMF receiver requirements.

On Table 3-1, indicate the number of B-TGU-B PCBs required. Also indicate if any DTMF Receiver Daughter Boards are required.

Auxiliary (B-AUX-A) PCB

2.18 The Auxiliary (B-AUX-A) PCB replaces the second B-TGU-B PCB and is used if Least Cost Routing (LCR) is to be installed. The B-AUX-A must be ordered with "rate chips" (i.e., customized rate structure software) if LCR is required. A Rate Service Questionnaire, available from a sales representative, must be completed before Least Cost Routing can be delivered.

2.19 The B-AUX-A PCB is also ordered when two additional external output control relays are required. In this case, if LCR is not required the Rate Service Questionnaire should not be completed.

2.2Ø The B-AUX-A PCB does not contain any DTMF receivers. The maximum number of DTMF receivers available in a system with a B-AUX-A PCB is four (provided by the B-TGU-B PCB with two daughter boards).

On Table 3-1, indicate if a B-AUX-A PCB (with or without rate chips) is required.

BUFFER (B-BUF-A) PCB

2.21 The B-BUF-A PCB is always required when an expansion cabinet is installed. Indicate on Table 3-1 if this PCB is necessary.

INSTALLATION HARDWARE - ITEM 6

2.22 The number of station blocks required is determined by the total of B-8SLU-B PCBs and B-8SCU-C PCBs ordered, and the number of stations (ports) to be used on each board. In general, the breakdown is as follows:

KSU

PORTS Ø01-Ø04	- - 1 BLOCK
PORTS Ø05-Ø16	- - 2 BLOCKS
PORTS Ø17-Ø28	- - 3 BLOCKS
PORTS Ø29-Ø40	- - 4 BLOCKS
PORTS Ø41-Ø52	- - 5 BLOCKS
PORTS Ø53-Ø64	- - 6 BLOCKS

EXPANSION CABINET

PORTS Ø65-Ø76	- - 7 BLOCKS
PORTS Ø77-Ø88	- - 8 BLOCKS
PORTS Ø89-1ØØ	- - 9 BLOCKS
PORTS 1Ø1-112	- - 1Ø BLOCKS
PORTS 113-124	- - 11 BLOCKS
PORTS 125-128	- - 12 BLOCKS

Indicate on Table 3-1 the number of station blocks required.

2.23 One 25-pair cable, with a type 57 male connector on one end and a type 57 female connector on the other, must be ordered for each RJ21X provided by the telco. This cable is used to connect the telco lines to the KSU and the expansion cabinet. The cable cannot exceed 25 feet in length. Refer to the following chart when determining how many cables to order.

Number of Telco Lines	Number of RJ21X Connectors
1-12	1
13-24	2
25-32	3

Indicate of Table 3-1 how many male-to-female 25-pair cables are required.

2.24 Each station block requires a 25-pair cable to connect it to the KSU. This cable has a type 57 female connector on one end and is unterminated on the other. On Table 3-1, indicate how many of these cables are required.

2.25 Each telephone and DSS console ordered requires a 625A or 625F modular station jack. Indicate on Table 3-1 the number of modular station jacks required.

2.26 Quad telephone cable (or equivalent) is used to connect the modular jacks to the station connecting blocks. On Table 3-1, estimate how much cable is required.

2.27 The power supply(s) ordered in Item 1 must always be plugged into a surge protector. Indicate on Table 3-1 whether one or two surge protectors are required.

OPTIONAL EQUIPMENT - ITEM 7

2.28 A programming terminal with an RS-232-C serial output is required for system installation. This terminal must be plugged into the KSU every time programming is to be changed.

2.29 If a hard copy record of calls is desirable, an SMDR printer is required. In many instances the programming terminal doubles as an SMDR printer. Call accounting systems, such as the TIE TELE-RECORD, are also compatible with the system. The TELE-RECORD provides for comprehensive management of call records, rather than the chronological report generated by an SMDR printer.

On Table 3-1, indicate if an SMDR printer or TIE TELE-RECORD system is required.

2.30 Background Music (BGM) and Music On Hold (MOH) require an external music source. BGM and MOH can share the same music source, if desired. Indicate on Table 3-1 if one or two music sources are desired.

2.31 External paging and external Background Music speaker systems may be ordered to provide audible to areas where the levels from the telephone speakers are not adequate. Indicate on Table 3-1 if this type of equipment is desired.

Table 3-1 ORDER SHEET, TCX-128

ITEM 1: CABINET AND POWER SUPPLY (¶2.01)	
KSU (P/N 86003)	1 required
Expansion Cabinet (P/N 86016)	____ required
B-PSU-B Power Supply (P/N 86007)	____ required
Ribbon Cable Set (P/N 86019)	____ required
ITEM 2: TELEPHONES (¶2.02)	
MERITOR/DELPHI Display Multibutton Key Telephone (P/N 86073)	____ required
MERITOR/DELPHI Multibutton Key Telephone with speakerphone (Handsfree) (P/N 86070)	____ required
MERITOR/DELPHI Multibutton Key Telephone without speakerphone (Monitor) (P/N 86072)	____ required
MERITOR/DELPHI Four Button Key Telephone (P/N 86071)	____ required
MERITOR/DELPHI One Button Telephone (P/N 86057)	____ required
ULTRACOM Display Multibutton Key Telephone (P/N 86063)	____ required
ULTRACOM Multibutton Key Telephones with speakerphone (Handsfree) (P/N 86080)	____ required
ULTRACOM Multibutton Key Telephone without speakerphone (Monitor) (P/N 86062)	____ required
ULTRACOM Four Button Key Telephone (P/N 86061)	____ required
ULTRACOM One Button Telephone (P/N 86067)	____ required
Alternate Audio Outputs	____ required
Single line (2500) type telephone (desk model)[1]	____ required
Single line (2500) type telephone (wall mount)[1]	____ required
Special Loud Ringing Tone Board (P/N 86185)	____ required
Tie Electronic Ringer (P/N 86187)	____ required
Faceplate with Hold button[1]	____ required
External Ringer[1]	____ required
MERITOR/DELPHI Multibutton Wall Mounting Kit (P / N 86076)	____ required
MERITOR/DELPHI Four Button/One Button Wall Mounting Kit (P / N 86077)	____ required
ULTRACOM Multibutton Wall Mounting Kit (P / N 86066)	____ required
ULTRACOM Four Button/One Button Wall Mounting Kit (P / N 86062)	____ required
ITEM 3: DSS CONSOLES (¶2.06)	
MERITOR/DELPHI DSS Console (P/N 86075)	____ required
ULTRACOM DSS Console (P/N 86064)	____ required
ITEM 4: LINES (¶2.07)	
Direct Distance Dialing (DDD) CO lines[1]	____ required
Wide Area Telephone Service (WATS) CO lines[1]	____ required
Foreign Exchange (FX) CO lines[1]	____ required
Special Service (SPRINT, MCI, etc.) CO lines[1]	____ required
Private Branch Exchange (PBX) lines[1]	____ required
ITEM 5: PRINTED CIRCUIT BOARDS (¶2.08)	
B-CPU-B PCB (P/N 86037)	1 required
B-8SCU-C PCB (P/N 86023)	____ required
B-8SLU-B PCB (P/N 86027 / 86027A)	____ required
B-4COU-A PCB (P/N 86010)	____ required
B-TGU-B PCB (P/N 86033)	____ required
B-AUX-A PCB with rate chips (P/N 86047)	____ required
B-AUX-A PCB without rate chips (P/N 86048)	____ required
B-BUF-A PCB (P/N 86017)	____ required
DTMF Receiver Daughter PCB (P/N 86015)	____ required
ITEM 6: INSTALLATION HARDWARE (¶2.22)	
Station connecting block[1]	____ required
25-pair cable, RJ21X to KSU[1]	____ required
25-pair cable, connecting block to KSU[1]	____ required
625A, 625F or equivalent modular station jack[1]	____ required
Station cable (in feet)[1]	____ required
Surge Protector[1]	____ required
ITEM 7: OPTIONAL EQUIPMENT (¶2.28)	
Programming printer/terminal[1]	1 required
SMDR Printer[1]	____ required
External music source[1]	____ required
External paging/BGM equipment[1]	Yes/No

[1]Item not available from TIE/communications, Inc.

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TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 4, SOFTWARE CONFIGURATION

1. INTRODUCTION

1.01 The SOFTWARE CONFIGURATION Section presents an in-depth description of each of the programmable options in the TCX-128 Computerized Branch Exchange. Each option is represented by a programming field. As each field is examined, the requirements of the installation are determined and entries are made on the Program Record Forms. These forms are included at the end of this section. The data base compiled on the Program Record Forms is later entered into system memory during program entry (see Section 7, PROGRAM ENTRY).

1.02 Each option is explained by headings for Field, Access, Description, Instructions, Example, Default Value, Conditions, Related Programming and Feature Reference. The headings are defined as follows:

Field (Sub-Field) presents the prompt for the option exactly as it is shown on the printer or terminal.

Access defines the key strokes necessary to access the field.

Description explains how programming the field affects system operation.

Instructions defines how to determine the correct entry and how to enter it on the Program Record Form.

Example presents a complete sample entry for the field.

Default Value provides the initialized entry for the field.

Conditions establishes the limits of the field, as defined by the system software.

Related Programming lists other fields that interact with the field presented.

Feature Reference lists the features that are affected when the field is programmed.

1.03 Each field requires a decimal, hexadecimal or Y(yes)/N(no) entry. For certain fields, 1 and 0 are used to construct binary numbers. These binary numbers must be converted to hexadecimal numbers. Use Table 4-1 at the end of this section for this conversion.

1.04 The TCX-128 system uses menu-driven software (i.e., all the system programmable options appear on a menu at the programming terminal). The chart below lists all the system options that can be programmed.

ACCESS KEY		FIELD	DESCRIPTION
I	'I' -->	SYSTEM INITIALIZATION	Loads factory installed program
S	'S' -->	SYSTEM FEATURES	
T	'T' -->	TIME OF DAY	Program time of day
D	'D' -->	DATE	Program date
O	'O' -->	OPERATORS & DSS	Assign attendants and consoles
M	'M' -->	TIMERS	Set various system timers
L	'L' -->	LEAST COST ROUTING	Program Least Cost Routing
R	'R' -->	RELAYS CONTROL	Program night ring relays, etc.
G	'G' -->	CO GROUPS	Assign lines to line groups
P	'P' -->	CO TYPE	Program line type
A	'A' -->	OFFICE CODE TYPES	Assign area/office code type
K	'K' -->	COS ALLOWED AREA CODES	Assign COS to area codes
E	'E' -->	EXTERNAL OUTPUTS	Program alternate audio ports
N	'N' -->	OUT KEYS GROUPS	Assign line groups to outgoing line keys.
F	'F' -->	SYSTEM OPTIONS	Program miscellaneous options
?	'?' -->	COMMAND LIST	Display System Features menu
E	'E' -->	STATIONS FEATURES	Set individual station options
Q	'Q' -->	EXIT PROGRAMMING MODE	Press key to exit programming
D	'D' -->	DISPLAY SYSTEM STATUS	Maintenance diagnostic, refer to Section 9, MAINTENANCE

1.05 The menus and prompts in this section are shown exactly as they appear during programming; however, additional explanation may be shown in parentheses.

2. DEVELOPING THE PROGRAM RECORD FORMS

PROGRAM 'I' --> SYSTEM INITIALIZATION

Field: 'I' --> SYSTEM INITIALIZATION

Access:

Press the M key. When the main menu is displayed, press the I key to initialize the system.

Description:

The system must be initialized to set the default (factory installed) program. The system must be initialized prior to programming it for the first time.

Instructions:

Initialization is done at the time of initial programming and does not require an entry on a Program Record Form. Directions for initialization are provided in Section 7, PROGRAM ENTRY.

Example: not applicable

Default Value:

If the system has already been programmed, initialization returns all the fields to their default values. The default values for the system are listed on the Program Record Forms at the end of this section.

Conditions: not applicable

Related Programming:

Initialization returns all fields to the default values.

Feature Reference: not applicable

PROGRAM 'S' --> SYSTEM FEATURES

Field: 'T' --> TIME OF DAY

Access:

Press the M key to enter the programming mode. Press the S key to access the 'S' --> SYSTEM FEATURES field. Press the T key to program 'T' --> TIME OF DAY. 'T' --> TIME OF DAY has the following subfields:

ENTER HOURS HH.....
ENTER MINUTES...

After the ENTER HOURS HH..... subfield is programmed, the ENTER MINUTES... sub-field is accessed.

Description:

This field allows the correct time to be set. Time information is displayed on display telephones and printed by the SMDR.

Instructions:

The time is entered at the time of installation and does not require an entry on a Program Record Form.

To program ENTER HOURS HH....., enter Ø0-23 (where Ø1 is 1:Ø0 AM; 23 is 11:Ø0 PM).

To program ENTER MINUTES..., enter Ø0-59 for minutes past the hour.

Example:

Refer to Section 7, PROGRAM ENTRY.

Default Value: not applicable

Conditions: not applicable

Related Programming:

'S' --> SYSTEM FEATURES
'D' --> DATE to program the day of the week, month and year.

Feature Reference:

Date and Time
SMDR

Field: 'D' --> DATE

Access:

While in the 'S' --> SYSTEM FEATURES program, press the D key. The 'D' --> DATE field has the following sub-fields:

```
ENTER MONTH.....
ENTER DATE.....
ENTER YEAR.....
```

After the ENTER MONTH..... sub-field is programmed, the ENTER DATE..... sub-field is accessed. After the ENTER DATE..... sub-field is programmed, the ENTER YEAR..... sub-field is accessed.

Description:

The 'D' --> DATE field allows the correct date to be set. Date information is displayed on display telephones and printed by the SMDR.

Instructions:

Date information is entered at the time of installation and does not require an entry on a Program Record Form.

To program ENTER MONTH....., enter Ø1-12 (where Ø1 is January; 12 is December).

To program ENTER DATE....., enter Ø1-31 to designate the day of the month.

To program ENTER YEAR....., enter the last two digits of the year (85 for 1985).

Example:

Refer to Section 7, PROGRAM ENTRY.

Default Value: not applicable

Conditions: not applicable

Related Programming:

'S' --> SYSTEM FEATURES
'T' --> TIME to program the time of day.

Feature Reference:

Date and Time
SMDR

Field: 'O' --> OPERATORS & DSS

Access:

While in the 'S' --> SYSTEM FEATURES program, press the O key. The following sub-fields may be programmed:

FIELD	DEFAULT
OPERATOR 1 IS	301
DSS OPERATOR 1 IS	NONE
ALTERNATE OPERATOR 1 IS	NONE
OPERATOR 2 IS	NONE
DSS OPERATOR 2 IS	NONE
ALTERNATE OPERATOR 2 IS	NONE
OPERATOR 3 IS	NONE
DSS OPERATOR 3 IS	NONE
ALTERNATE OPERATOR 3 IS	NONE
OPERATOR 4 IS	NONE
DSS OPERATOR 4 IS	NONE
ALTERNATE OPERATOR 4 IS	NONE
OPERATOR 5 IS	NONE
DSS OPERATOR 5 IS	NONE
ALTERNATE OPERATOR 5 IS	NONE
OPERATOR 6 IS	NONE
DSS OPERATOR 6 IS	NONE
ALTERNATE OPERATOR 6 IS	NONE

After the first sub-field is programmed, the next sub-field is accessed. Refer to the specific sub-field for access instructions.

Description:

The system can accommodate six operators (attendants), six alternate operators and six DSS consoles. The entries in 'O' --> OPERATORS & DSS determine the station numbers for the operators, alternate operators and DSS consoles.

Instructions: Refer to the specific sub-field.

Example: Refer to the specific sub-field.

Default Value: Refer to the specific sub-field.

Conditions: Refer to the specific sub-field.

Related Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE to assign DSS consoles with type DSS.

Feature Reference:

All attendant features:
- Alternate Attendant Station
- Busy Out Lines
- Call Forwarding Cancel
- Call Waiting
- Date and Time
- Direct Line Access
- Do Not Disturb Override
- Night Service
- Speed Dial
- Speed Dial Options
- Transfer (Handsfree Transfer)

Sub-Field: OPERATOR 1 IS.....

Access:

While in the 'S' --> SYSTEM FEATURES program, press the 0 key. The OPERATOR 1 IS..... sub-field is accessed.

Description:

The OPERATOR 1 IS..... sub-field determines which station will be the primary operator (attendant). The primary operator is the station reached when a user dials 0.

Instructions:

On Table 4-2, enter the station number (301-363, 401-465) for the primary operator.

Example:

If station 306 is to be the primary operator, enter 306 for this sub-field on Table 4-2.

Default Value: 301

Conditions:

(a) The primary operator station must be a multibutton key telephone.

(b) If an operator is not assigned (i.e., entry is N), transferred calls, calls placed on Hold and calls placed into orbit will recall the initiating station only. These calls, if still unanswered, will continue to ring the initiating station and will never ring a third station.

(c) This sub-field must be programmed if a second operator is to be assigned in the OPERATOR 2 IS..... sub-field.

Related Programming:

'S' --> SYSTEM FEATURES
'0' --> OPERATORS & DSS
DSS OPERATOR 1 IS..... to enable the Automatic Hold, Do Not Disturb Override and Direct Station Selection (console) features for the primary operator.
ALTERNATE OPERATOR 1 IS.. to enable the Alternate Attendant Station feature for the primary operator.

Feature Reference:

All attendant features

Sub-Field: DSS OPERATOR 1 IS.....

Access:

The DSS OPERATOR 1 IS..... sub-field is accessed after the OPERATOR 1 IS..... sub-field is programmed.

Description:

This sub-field assigns the station number to the DSS console for operator 1.

Instructions:

On Table 4-2, enter the station number (301-363, 401-465) for the DSS console assigned to operator 1. Enter N (for NONE) if not assigned.

Example:

If station 307 is the DSS console for the primary operator, enter 307 for this sub-field on Table 4-2.

Default Value: NONE

Conditions:

A DSS console must be programmed to enable Automatic Hold for the primary attendant. A DSS console must be programmed and installed to enable Direct Station Selection (console) for the primary attendant.

Related Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS
OPERATOR 1 IS..... to be certain that a station is assigned as the primary operator.
'E' --> STATIONS FEATURES
TYPE OF PHONE..... to program DSS console with telephone type DSS.

Feature Reference:

Automatic Hold
Direct Station Selection

Sub-Field: ALTERNATE OPERATOR 1 IS..

Access:

The ALTERNATE OPERATOR 1 IS.. sub-field is accessed after the DSS OPERATOR 1 IS..... sub-field is programmed.

Description:

Operator 1 can have another station in the system assigned as its alternate operator. If the operator's station is unattended, all operator calls can be routed to the alternate.

Instructions:

On Table 4-2, enter the station number (301-363, 401-465) for the alternate operator assigned to operator 1. If an alternate operator is not required, enter N (for NONE).

Example:

If station 302 is to be the alternate operator for operator 1, enter 302 for this sub-field on Table 4-2.

Default Value: NONE

Conditions:

(a) The alternate operator should be a multibutton telephone.

(b) The alternate for the primary operator can be another operator (2-6).

Related Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS
OPERATOR 1 IS..... to be certain that a primary operator (operator 1) is programmed.

Feature Reference:

Alternate Attendant Station

Sub-Field: OPERATOR 2 IS.....

Access:

The OPERATOR 2 IS..... sub-field is accessed after the ALTERNATE OPERATOR 1 IS.. sub-field is programmed.

Description:

The OPERATOR 2 IS..... sub-field determines which station will be the second operator (attendant) in the system.

Instructions:

On Table 4-2, enter the station number (3Ø1-363, 4Ø1-465) for the second operator. Enter N (for NONE) if not assigned.

Example:

If station 324 is to be the second operator, enter 324 for this sub-field on Table 4-2.

Default Value: NONE

Conditions:

(a) The second operator station must be a multibutton key telephone.

(b) Transferred calls, calls placed on Hold and calls placed into orbit will recall the primary operator only. If the primary operator is busy on a call, the call will ring at the speaker in the primary operator's DSS console, not at another operator's telephone.

Related Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS
DSS OPERATOR 2 IS..... to enable the Automatic Hold and Direct Station Selection (console) features for the second operator.
ALTERNATE OPERATOR 2 IS.. to enable the Alternate Attendant Station feature for the second operator.

Feature Reference:

All attendant features

Sub-Field: DSS OPERATOR 2 IS.....

Access:

The DSS OPERATOR 2 IS..... sub-field is accessed after the OPERATOR 2 IS..... sub-field is programmed.

Description:

This sub-field assigns the station number to the DSS console for operator 2.

Instructions:

On Table 4-2, enter the station number (301-363, 401-465) for the DSS console assigned to operator 2. Enter N (for NONE) if not assigned.

Example:

If station 307 is the DSS console for operator 2, enter 307 for this sub-field on Table 4-2.

Default Value: NONE

Conditions:

A DSS console must be programmed to enable Automatic Hold for the second attendant. A DSS console must be programmed and installed to enable Direct Station Selection (console) for the second attendant.

Related Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS
OPERATOR 1 IS..... to be certain that a station is assigned as the primary operator.
'E' --> STATIONS FEATURES
TYPE OF PHONE..... to program DSS console with telephone type DSS.

Feature Reference:

Automatic Hold
Direct Station Selection

Sub-Field: ALTERNATE OPERATOR 2 IS..

Access:

The ALTERNATE OPERATOR 2 IS.. sub-field is accessed after the DSS OPERATOR 2 IS..... sub-field is programmed.

Description:

Operator 2 can have another station in the system assigned as its alternate operator. If the second operator's station is unattended, all calls to the second operator can be routed to its alternate.

Instructions:

On Table 4-2, enter the station number (3Ø1-363, 4Ø1-465) for the alternate operator assigned to operator 2. If an alternate operator is not required, enter N (for NONE).

Example:

If station 3Ø2 is to be the alternate operator for operator 2, enter 3Ø2 for this sub-field on Table 4-2.

Default Value: NONE

Conditions:

(a) The alternate operator should be a multibutton telephone.

(b) The alternate for operator 2 can be operator 1.

Related Programming:

'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS
OPERATOR 2 IS..... to be certain that a second operator (operator 2) is programmed.

Feature Reference:

Alternate Attendant Station

Sub-Field:

OPERATOR 3 IS.....
DSS OPERATOR 3 IS.....
ALTERNATE OPERATOR 3 IS..
OPERATOR 4 IS.....
DSS OPERATOR 4 IS.....
ALTERNATE OPERATOR 4 IS..
OPERATOR 5 IS.....
DSS OPERATOR 5 IS.....
ALTERNATE OPERATOR 5 IS..
OPERATOR 6 IS.....
DSS OPERATOR 6 IS.....
ALTERNATE OPERATOR 6 IS..

Access:

The OPERATOR 3 IS..... sub-field is accessed after the ALTERNATE OPERATOR 2 IS.. sub-field is programmed. Each remaining sub-field is accessed after the preceding sub-field is programmed.

Description: Refer to the sub-fields for operator 2.

Instructions: Refer to the sub-fields for operator 2.

Example: Refer to the sub-fields for operator 2.

Default Value: NONE

Conditions: Refer to the sub-fields for operator 2.

Related Programming: Refer to the sub-fields for operator 2.

Feature Reference: Refer to the sub-fields for operator 2.

Field: 'M' --> TIMERS

Access:

When in the 'S' --> SYSTEM FEATURES program, press the M key. The following sub-fields may be programmed:

FIELD	DEFAULT
HOLD RECALL TIMER.(SEC)..	060
ORBIT RECALL TIMER.(SEC).	060
PAUSE TIME-OUT.(SEC).....	006
FLASH TIMER.(N*50MSEC)...	020
DIAL TONE TIME-OUT.(SEC).	002
SMDR TIMER..(SEC).....	030
TRANS RECALL.(SEC).....	120

After the first sub-field is programmed, the next sub-field is accessed. Refer to the specific sub-field for access instructions.

Description:

Various timers are used in the system. Each of these timers is presented as a sub-field in the 'M' --> TIMERS field.

Instructions: Refer to the specific sub-field.

Example: Refer to the specific sub-field.

Default Value: Refer to the specific sub-field.

Conditions: Refer to the specific sub-field.

Related Programming: Refer to the specific sub-field.

Feature Reference: Refer to the specific sub-field.

Sub-Field: HOLD RECALL TIMER.(SEC)..

Access:

When in the 'S' --> SYSTEM FEATURES program, press the M key. The HOLD RECALL TIMER.(SEC).. sub-field is the first sub-field accessed.

Description:

HOLD RECALL TIMER.(SEC).. is the elapsed time before a call placed on Hold by a station re-rings that station. If the recall remains unanswered for longer than 60 seconds, the call will ring the attendant.

Instructions:

For this sub-field on Table 4-2, enter the required time in seconds.

Example:

If the HOLD RECALL TIMER.(SEC).. interval is to be 30 seconds, enter Ø30 for this sub-field on Table 4-2.

Default Value: Ø60

Conditions:

(a) HOLD RECALL TIMER.(SEC).. cannot be set for ØØØ seconds.

(b) To disable this timer for troubleshooting purposes (i.e., set it at its maximum duration), enter 999.

Related Programming: not applicable

Feature Reference:

Hold
Hold Recall

Sub-Field: ORBIT RECALL TIMER.(SEC).

Access:

The ORBIT RECALL TIMER.(SEC). sub-field is accessed after the HOLD RECALL TIMER.(SEC).. is programmed.

Description:

ORBIT RECALL TIMER.(SEC). is the elapsed time before a call placed in General Park Orbit by a station re-rings that station. If the recall remains unanswered for longer than 60 seconds, the call will ring the attendant.

Instructions:

For this sub-field on Table 4-2, enter the required time in seconds.

Example:

If a call placed in General Park Orbit should recall the station which placed it in orbit after 30 seconds, enter Ø30 for this sub-field on Table 4-2.

Default Value: Ø60

Conditions:

(a) The ORBIT RECALL TIMER.(SEC). cannot be set for ØØØ.

(b) To disable this timer for troubleshooting purposes (i.e., set it at its maximum duration), enter 999.

Related Programming: not applicable

Feature Reference:

Park

Sub-Field: PAUSE TIME-OUT.(SEC).....

Access:

The PAUSE TIME-OUT.(SEC)..... sub-field is accessed after the ORBIT RECALL TIMER.(SEC). sub-field is programmed.

Description:

The PAUSE TIME-OUT.(SEC)..... interval is the length of the pause inserted into a Speed Dial number when a # is entered into a bin. Pauses are frequently required by special dialing services or when the system is installed behind a PBX.

Instructions:

Enter the PAUSE TIME-OUT.(SEC)..... interval, in seconds, on Table 4-2.

Example:

If the length of the pause in a Speed Dial number should be three seconds, enter 003 for this sub-field on Table 4-2.

Default Value: 006

Conditions:

(a) This sub-field should be set for compatibility with the line or Other Common Carriers (e.g., MCI or Sprint) to be accessed.

(b) A pause may be inserted at the end of a System Speed Dial number. This prevents a display telephone from manually dialing (after the bin dials out) for the length of the pause. After the pause interval, manually dialed digits are sent out. The display telephone must be programmed in 'E' --> STATIONS FEATURES (CLASS OF SERVICE.....) with Class of Service 0. Non-display multibutton telephones with Class of Service 0 can dial during the pause, but conversation is prevented.

(c) The PAUSE TIME-OUT.(SEC)..... cannot be set for 000.

Related Programming:

'S' --> SYSTEM FEATURES
  'P' --> CO TYPE to assign line type.
'E' --> STATIONS FEATURES
  CLASS OF SERVICE ..... to program display telephones with Class of Service 0 if manual dialing after a System Speed Dial number is to be allowed.

Feature Reference:

PBX Compatibility
Placing a Call

Sub-Field: FLASH TIMER.(N*50MSEC)...

Access:

This sub-field is accessed after the PAUSE TIME-OUT.(SEC)..... sub-field is programmed.

Description:

The FLASH TIMER.(N*50MSEC)... sub-field is used to set the duration of loop current interruption that occurs when the Flash feature is used. If the line is a CO line, the loop current interruption allows a new dial tone to be obtained without the line being dropped. If the line is a PBX line, certain features (such as Transfer) can be initiated.

Instructions:

On Table 4-2, enter the time (in multiples of 50 milliseconds) that corresponds to the loop current interruption that occurs when the Flash feature is used.

Example:

If a PBX line requires an interruption of two seconds in order to initiate a call Transfer, enter 040 on Table 4-2.

Default Value: 020 (1 second)

Conditions:

(a) The FLASH TIMER.(N*50MSEC)... interval must be compatible with the PBX/Centrex or the Central Office.

(b) The FLASH TIMER.(N*50MSEC)... interval cannot be set for 000.

Related Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to program line types.

Feature Reference:

Flash

Sub-Field: DIAL TONE TIME-OUT.(SEC).

Access:

The DIAL TONE TIME-OUT.(SEC). sub-field is accessed after the FLASH TIMER.(N*5ØMSEC)... sub-field is programmed.

Description:

DIAL TONE TIME-OUT.(SEC). specifies the interval between line seizure and the receipt of dial tone for toll restricted telephones. After a line is seized, toll restricted telephones are prevented from manually dialing until the DIAL TONE TIME-OUT.(SEC). interval elapses. This timer is used to prohibit a user from bypassing system toll restriction before dial tone is received from the Central Office.

For a Dial Pulse (DP) line, this timer controls the delay from the time the line is accessed until the internal dial tone is heard. Since the telephone is isolated from the DP line until dialing is complete, there is no audio connection between the line and the telephone. Internal dial tone must be provided by the system after the line is initially seized.

When using Speed Dial, this timer controls the interval between the time of bin selection and the time when the digits are sent out. When using Last Number Redial and Save, this timer determines the interval between the time the feature key is pressed and the time the digits are sent out.

If a number is manually dialed using LCR, the system will wait for the DIAL TONE TIME-OUT.(SEC). interval before redialing the number.

Instructions:

On Table 4-2, enter the DIAL TONE TIME-OUT.(SEC). time in seconds.

Example:

If the DIAL TONE TIME-OUT.(SEC). interval should be one second, enter Ø01 for this sub-field on Table 4-2.

Default Value: Ø02

Conditions:

The DIAL TONE TIME-OUT.(SEC). interval should be set for compatibility with the PBX/Centrex or Central Office.

Related Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to indicate if the line is DP or DTMF.

Feature Reference:

PBX Compatibility
Toll Restriction

Sub-Field: SMDR TIMER..(SEC).....

Access:

The SMDR TIMER..(SEC)..... sub-field is accessed after the DIAL TONE TIME-OUT.(SEC). sub-field is programmed.

Description:

The SMDR TIMER.(SEC)..... sub-field determines the minimum duration of outgoing calls that are printed on the SMDR. Outgoing calls of a duration equal to or longer than the SMDR TIMER.(SEC)..... interval are recorded.

Instructions:

Enter the SMDR TIMER..(SEC)..... time in seconds on Table 4-2.

Example:

If outgoing calls lasting at least one minute should be recorded on the SMDR device, enter Ø6Ø for this sub-field on Table 4-2.

Default Value: Ø3Ø

Conditions:

(a) The SMDR TIMER.(SEC)..... cannot be set for ØØØ.

(b) Only outgoing calls are recorded on the SMDR device. In addition, these calls must be at least seven digits long (unless a 'Ø' call to an outside operator).

(c) If the system is installed behind a PBX, calls to PBX extensions will not be printed.

(d) To disable this timer for troubleshooting purposes, enter 999. This sets the timer at its maximum interval.

Related Programming:

'S' --> SYSTEM FEATURES
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...13.. to enable SMDR for long distance calls.
    OPTION ENABLES...15.. to enable 'Ø' calls to an outside operator to print.
    OPTION ENABLED...16.. to show Speed Dial bin numbers on SMDR.
    OPTION ENABLED...17.. to enable SMDR for local calls.

Feature Reference:

SMDR

Sub-Field: TRANS RECALL.(SEC).....

Access:

The TRANS RECALL.(SEC)..... sub-field is accessed after the SMDR TIMER..(SEC)..... sub-field is programmed.

Description:

TRANS RECALL.(SEC)..... is the interval before an unanswered transferred call returns to the station from which it was initially transferred. If the station which initially transferred the call does not retrieve the returned call within 3Ø seconds, it will ring the attendant.

Instructions:

On Table 4-2, enter the TRANS RECALL.(SEC)..... interval in seconds.

Example:

If unanswered transferred calls should ring the transferring station within one minute, enter Ø6Ø for this sub-field on Table 4-2.

Default Value: 12Ø

Conditions:

(a) The TRANS RECALL.(SEC)..... interval cannot be set for ØØØ.

(b) To disable this timer for troubleshooting purposes, enter 999. This sets the timer at its maximum interval.

Related Programming: not applicable

Feature Reference:

Transfer

Field: L --> LEAST COST ROUTING
LCR SERVICE #

Access:

When in the 'S' --> SYSTEM FEATURES program, press the L key. The following sub-fields may be programmed.

```
LCR ENABLED....
LCR SERVICE # Ø1
   LINE GROUP.....
   OCC DIALUP SYS BIN..
   FX SERVICE/OTHER..1/Ø..

       through

LCR SERVICE # 1Ø
   LINE GROUP.....
   OCC DIALUP SYS BIN..
   FX SERVICE/OTHER..1/Ø..
```

After the first sub-field is programmed, the next sub-field is accessed. Refer to the specific sub-field for access instructions.

Description:

Least Cost Routing (LCR) uses rate structure software, customized for each installation, to automatically place outgoing calls on the least expensive available route (line service type). There are a total of 18 line service types, any 1Ø of which can be incorporated into the LCR package. The LCR facility in the TCX-128 examines the 1Ø line service types selected and seizes the most economical line group for the call, based on the relative cost of each service. The line service types (and their respective identifying codes) are defined as follows:

LINE SERVICE TYPE	IDENTIFYING CODE
DDD	Ø1
FX 1	Ø2
FX 2	Ø3
FX 3	Ø4
RESELLER	Ø5
TIE LINE (not used)	Ø6
WATS BAND Ø or 9	Ø7
WATS BAND 1	Ø8
WATS BAND 2	Ø9
WATS BAND 3	ØA
WATS BAND 4	ØB

```
WATS BAND 5. . . . . .ØC
WATS BAND 6. . . . . .ØD
WATS BAND 7. . . . . .ØE
WATS BAND 8. . . . . .ØF
DIAL-UP OCC, ON NET. . . . . .1Ø
DIAL-UP OCC, OFF NET . . . . . .11
DEDICATED OCC, OFF NET . . . . .12
```

Instructions:

Before entries for Least Cost Routing can be made on the Program Record Form (Table 4-2), the number and types of services programmed into the LCR software (rate chip set) must be determined. This information is obtained from the Least Cost Routing Questionnaire (available from a sales representative). If it is difficult or inconvenient to obtain the questionnaire, the same information can be displayed by the LCR diagnostic. The LCR diagnostic is run from the programming terminal.

To run the LCR diagnostic:

(1) Verify that the system has been properly installed and initialized, using this manual as a guide.

WARNING: THERE ARE SEVERAL STEPS, INCLUDING RE-INITIALIZATION, THAT MUST BE FOLLOWED WHEN INSTALLING LCR IN AN EXISTING SYSTEM. REFER TO SECTION 7, PROGRAM ENTRY, FOR COMPLETE INSTRUCTIONS.

(2) Press the M key to enter the programming mode.

(3) Press the S key to display the System Commands menu.

(4) Press the H key; the following prompt will appear:

```
DISPLAY/CHECKSUM
Ø=DØ,1=D1,2=D_TC,3=D_AX,4=C_Ø,5=C_1,6=C_TC,7=C_AX..
```

(5) Enter 3 and press the RETURN key; the following prompt will appear:

```
ADDR..
```

(6) Enter 408F and press the RETURN key; the following prompt will appear:

```
UP-TO.
```

(7) Press RETURN; the following prompt will appear:

```
<408F> nn nn nn nn nn nn nn nn nn nn nn nn nn nn nn nn
```

where nn represents the identifying code (i.e., a hexadecimal number between Ø1 and 12, defined on page 4-24).

The bytes of the prompt are defined as follows:

```
          /--line service # Ø1
         /
<408F> nn nn nn nn nn nn nn nn nn nn nn nn nn nn nn nn
                                    /   \          /
           line service # 1Ø --/     \--not used-/
```

If LCR is installed, the first 1Ø 2-bit bytes identify the line services programmed into the rate chip, based on the codes shown on page 4-25. Byte 1 is for line service # Ø1, byte 1Ø is for line service # 1Ø. Byte 1 is programmed using the LCR SERVICE # Ø1 sub-field; byte 1Ø is programmed using the LCR SERVICE # 1Ø sub-field.

For example:

```
<408F>  Ø1  Ø7  Ø8  ØØ  ØØ  ØØ  ØØ  ØØ  ØØ ØØ
```

shows that line service # Ø1 is DDD, line service # Ø2 is WATS band Ø or 9 and line service # Ø3 is WATS band 1. The LCR software used for this example does not use line services # Ø4-1Ø, so they are designated as ØØ. If LCR software was not installed, all the 2-bit bytes would show FF.

On Table 4-2, next to the prompt LCR SERVICE #, identify each LCR service (1-1Ø) using either the Line Service Type or the Identifying Code on page 4-25.

Example:

If the LCR Diagnostic displays:

```
<408F>  Ø1  Ø5  ØC  ØØ  ØØ  ØØ  ØØ  ØØ  ØØ ØØ
```

on Table 4-2 indicate that LCR SERVICE # Ø1 is DDD (Ø1), LCR SERVICE # Ø2 is reseller (Ø5) and LCR SERVICE # Ø3 is WATS band 5 (ØC). Indicate also that LCR services 4 through 1Ø are not used.

Default Value: LCR not enabled

Conditions:

(a) Toll Restriction, determined by Class of Service programming, applies to all calls placed using Least Cost Routing. Without special programming, an outgoing LCR call cannot bypass a station's Toll Restriction.

(b) Class of Service programming also determines what takes place when LCR attempts to place a call if all lines in the least expensive route are busy. For stations with Class of Service Ø, the system will attempt to place the call on the next cheapest route. If that line group is also busy, the system will hunt through the remaining services for the most economical route. If all other services are busy, the call will be placed on a line in the Direct Distance Dialing (DDD) group. Multibutton telephone users can also press another outgoing line key (8-11) to bypass LCR.

(c) If the station is assigned Class of Service Ø1-Ø5, LCR will not search for the next cheapest route if the cheapest route is busy. In addition, LCR will not place the call on a DDD line unless DDD is the cheapest route for the call. Key telephone users can queue for the LCR line group. As with COS Ø, multibutton users may press another outgoing line key to bypass LCR. Single line (25ØØ type) and one button telephone users must retry the call.

(d) If LCR is enabled for the system, Speed Dial, Last Number Redial and Saved numbers will always be routed to the least expensive route.

(e) LCR always places emergency assistance calls (e.g., 911, 1911), WATS calls (i.e., 1 + 8ØØ + NNX + nnnn) and directory assistance calls (i.e., 1 + NPX + 555 + 1212) on Direct Distance Dialing (DDD) lines.

NOTE: The TCX-128 provides a maintenance diagnostic that allows service personnel to monitor how LCR is routing a call. Refer to Section 9, MAINTENANCE, Part 5.

Related Programming:

'S' --> SYSTEM FEATURES
  'K' --> COS ALOWED AREA CODES to assign Class of Service to area codes.
'E' --> STATIONS FEATURES
  CLASS OF SERVICE..... to assign Class of Service to a station.

Feature Reference:

Class of Service
Last Number Redial
Least Cost Routing
Least Cost Routing Bypass
Placing a Call
Save
Speed Dial
Toll Restriction

Sub-Field: LINE GROUP.....

Access:

When in the 'S' --> SYSTEM FEATURES program, press the L key. When the prompt LCR ENABLED.... appears, enter Y and RETURN. The LINE GROUP..... sub-field for LCR service # 1 is displayed. After all the fields for LCR service # 1 are programmed, LINE GROUP..... for LCR service # 2 is accessed. Continue this sequence to access LINE GROUP..... for LCR services 3 through 1Ø.

Description:

Each LCR service must be assigned to a line group. This allows the system to locate the specified lines after searching the rate tables for the least expensive route. When making entries for this sub-field, the physical location of each line in the RJ21X telco connector must be known.

Instructions:

On Table 4-2, enter the line group assigned to the LCR service.

4

WARNING: DIRECT DISTANCE DIALING (DDD) LINES MUST ALWAYS BE ASSIGNED TO GROUP 1.

Example:

For the example below (also see page 4-25):

<408F> Ø1 Ø5 ØC ØØ ØØ ØØ ØØ ØØ ØØ ØØ

assign line service # 1 to group 1, line service # 2 to group 2 and line service # 3 to group 3. All the DDD lines are in group 1 (which is a requirement), all the reseller lines are in group 2 and all the WATS band 5 lines are in group 3.

Default Value: 77 (not installed)

Conditions:

(a) LCR SERVICE # Ø1 must always be used for Direct Distance Dialing (DDD) lines.

(b) All lines in a service group must be the same type (DDD vs. WATS 5, etc.).

(c) The assignments made in LINE GROUP..... must consider the assignments made in 'G' --> CO GROUPS.

Related Programming:

'S' --> SYSTEM FEATURES
'G' --> CO GROUPS to assign lines to line groups.
'P' --> CO TYPE to program line type.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...01... to allow LCR to place calls for single line (2500 type), four button and one button telephones on lines normally denied because of 'E' --> STATIONS FEATURES (CO ACCESS [NN..NN] IS..) programming.

Feature Reference:

Least Cost Routing

Sub-Field: OCC DIALUP SYS BIN..

Access:

The OCC DIALUP SYS BIN.. subfield is accessed after the LINE GROUP..... sub-field is programmed.

Description:

The OCC DIALUP SYS BIN.. sub-field allows OCC access and security codes to be automatically dialed by the system if LCR selects the OCC as the least costly route for a call. The OCC must be LCR line service type Dial-Up OCC On Net (code 1Ø) or Dial-Up OCC Off Net (code 11).

Instructions:

On Table 4-2, enter the number of the System Speed Dial bin containing the access and security code for the designated OCC. Do not enter the contents of the bin, just the bin number.

Example:

If LCR SERVICE # Ø2 is a Dial-Up OCC On Net (code 1Ø), and the access and security codes for this OCC are stored in System Speed Dial bin 97, enter 97 for this prompt for LCR SERVICE # Ø2 on Table 4-2. If the system determines that service # Ø2 is the least expensive route for the call, it will automatically dial out the number stored in System Speed Dial bin 97. It will then dial the number entered by the user.

Default Value: ØØ (not assigned)

Conditions:

(a) Leave this field at the default value (ØØ) if the OCC is line service type Dedicated Off Net (code 12). This type of OCC does not require an access or security code.

(b) The flexibility of the System Speed Dial bin selected can be increased by the use of Speed Dial Options (refer to Section 2, FEATURES)

(c) The contents of a System Speed Dial bin designated in OCC DIALUP SYS BIN.. is suppressed on the multibutton telephone display and the SMDR if the bin is automatically accessed by LCR.

(d) Systems without LCR (rate chips) can be programmed to allow one button access to a selected OCC. To accomplish this:

(1) Enable LCR (i.e., LCR ENABLED....Y).

(2) For LCR SERVICE # Ø1, program LINE GROUP..... as Ø1. The lines in group 1 (also programmed in 'G' --> CO GROUPS) must be DDD lines. For LCR SERVICE # 2-1Ø, enter 77 for the sub-field LINE GROUP..... for each service.

(3) Identify the OCC DIALUP SYS BIN.. System Speed Dial bin number. This bin will contain the access and security codes for the OCC. The OCC must be Dial-up On Net (code 1Ø) or Dial-up Off Net (code 11).

(4) Have the attendant store the access and security code for the OCC (including Speed Dial Options if required) in the designated System Speed Dial bin.

(5) Refer to the Operational Specifications (appendixes A-E) for user instructions.

NOTE: Only one access and account code may be programmed in this manner.

Related Programming:

'S' --> SYSTEM FEATURES
'G' --> CO GROUPS to assign the OCC service to a line group.
'P' --> CO TYPE to program type, if required.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...16... to print the number of the bin (not the contents) on the SMDR.

Feature Reference:

Least Cost Routing
Placing a Call
Speed Dial
Speed Dial Options
Station Message Detail Recording

Sub-Field: FX SERVICE/OTHER..1/Ø..

Access:

The FX SERVICE/OTHER..1/Ø sub-field is accessed after the OCC DIALUP SYS BIN.. is programmed.

Description:

The line group containing the FX (Foreign Exchange) lines must be identified to the system. FX lines are line service types FX 1 (code Ø2), FX 2 (code Ø3) and FX 3 (code Ø4). Use the LCR diagnostic in conjunction with the RJ21X configuration data to determine which lines are FX lines.

Instructions:

If the LCR service contains FX lines, enter Ø1 for the LCR SERVICE # (FX SERVICE/OTHER..1/Ø..) sub-field on Table 4-2. If the service does not contain FX lines, enter Ø.

Example:

If LCR SERVICE # Ø3 contains FX 3 lines (code Ø4), enter Ø1 for this service number on Table 4-2.

Default Value: ØØ (no FX lines)

Conditions:

FX lines require dedicated circuits from the telco. The telco can identify the position of these in the RJ21X connector(s).

Related Programming:

'S' --> SYSTEM FEATURES
  'G' --> CO GROUPS to group FX lines in the same line group.
  'P' --> CO TYPE to program line type, if required.
  'L' --> LEAST COST ROUTING
    LINE GROUP..... to assign the FX lines to the same group.

Feature Reference:

Least Cost Routing
Placing a Call

Field: 'R' --> RELAYS CONTROL

Access:

While in the 'S' --> SYSTEM FEATURES program, press the R key. The following sub-fields are available for programming:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	NIGHT	ALL-P	ANY-P			NRNGR	ZPAGE	RINGR

RELAY #1 CONTROL.....00
RELAY #2 CONTROL.....00
RELAY #3 CONTROL.....00
RELAY #4 CONTROL.....00

The RELAY #1 CONTROL..... sub-field is the first sub-field displayed. After this sub-field is programmed, the remaining sub-fields can be displayed and programmed one at a time.

Description:

This field allows the four external relays to be programmed to close for night ringing, Pages and testing.

Instructions:

For each relay on the Relays Control bit graph below, place a 1 beneath a bit to enable its assigned function. Bits 0 through 7 in each sub-field control the relays as follows:

Bit 0 - Test

Enter 1 to cause the relay to toggle for test purposes. The relay will continuously toggle closed (500mS), open (500mS), closed (500mS) and open (2.5 Sec) until the bit is reset to 0.

Bit 1 - Zone Page Only

Enter 1 to cause the relay to close every time a Zone Page is initiated. The relay will stay closed until the Zone Page is terminated.

Bit 2 - Interrupted Night Ring

Enter 1 to cause the relay to close coincidently with CO audible on UNA lines when the system is in the night mode. The closure pattern is identical to the CO audible ring pattern.

Bit 3 - not used

Bit 4 - not used

Bit 5 - Any Page

Enter 1 to cause the relay to close every time a Zone or All Call Page is initiated. The relay will stay closed until the Page is terminated.

Bit 6 - All Page

Enter 1 to cause the relay to close every time an All Call Page is initiated. The relay will stay closed until the Page is terminated.

Bit 7 - Continuous Night Ring

Enter 1 to cause the relay to close whenever a CO call rings in on a UNA line when the system is in the night mode. The relay will stay closed until the call is answered or the caller hangs up.

RELAYS CONTROL

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	NIGHT	ALL-P	ANY-P			NRNGR	ZPAGE	RINGR	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
RELAY #1				0	0				
RELAY #2				0	0				
RELAY #3				0	0				
RELAY #4				0	0				

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Example:

If relay #1 should close any time an All Call Page is made, enter a 1 below bit 6 (for relay #1) on the Relays Control bit graph. The binary number Ø1ØØØØØØ is created. Use Table 4-1 to convert the binary number Ø1ØØØØØØ to hexadecimal 4Ø. Enter this value in the RELAY #1 CONTROL..... sub-field on Table 4-2.

Default Value: ØØ (all relays disabled)

Conditions:

(a) Relays 1 and 2 are located on the B-TGU-B PCB. Relays 3 and 4 are located on the B-AUX-A PCB. If a second B-TGU-B PCB is installed in place of a B-AUX-A PCB, relays 3 and 4 cannot be used.

(b) The devices connected to the relays must be compatible with the relay specifications stated in Table 1-1 and Section 6, INSTALLATION OF OPTIONAL EQUIPMENT.

Related Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to assign lines for Universal Night Answer

Feature Reference:

Night Service

Field: 'G' --> CO GROUPS

Access:

While in the 'S' --> SYSTEM FEATURES program, press the G key. The following sub-fields are available for programming.

```
LINE..01..GROUP IS......01
LINE..02..GROUP IS......01
LINE..03..GROUP IS......01
LINE..04..GROUP IS......01
LINE..05..GROUP IS......01
LINE..06..GROUP IS......01
LINE..07..GROUP IS......01
LINE..08..GROUP IS......01
LINE..09..GROUP IS......02
LINE..10..GROUP IS......02
LINE..11..GROUP IS......02
LINE..12..GROUP IS......02
LINE..13..GROUP IS......02
LINE..14..GROUP IS......02
LINE..15..GROUP IS......02
LINE..16..GROUP IS......02
LINE..17..GROUP IS......03
LINE..18..GROUP IS......03
LINE..19..GROUP IS......03
LINE..20..GROUP IS......03
LINE..21..GROUP IS......03
LINE..22..GROUP IS......03
LINE..23..GROUP IS......03
LINE..24..GROUP IS......03
LINE..25..GROUP IS......77
LINE..26..GROUP IS......77
LINE..27..GROUP IS......77
LINE..28..GROUP IS......77
LINE..29..GROUP IS......77
LINE..30..GROUP IS......77
LINE..31..GROUP IS......77
LINE..32..GROUP IS......77
```

The LINE..01..GROUP IS..... sub-field is the first sub-field displayed. After this sub-field is programmed, the remaining sub-fields can be displayed and programmed one at a time.

Description:

Lines can be arranged into a maximum of 10 line groups to provide for more efficient management of outgoing calls. A line can be assigned to only one of the 10 groups. Similar lines, such as Direct Distance Dialing (DDD) lines, WATS lines or Other Common Carrier (OCC) lines should be programmed into the same line group. This would assure, for example, that the rate structure (cost of a call) for all lines within a group would be the same.

If Least Cost Routing is installed, lines of a similar type (line service type) must be programmed into the same group. This is essential because LCR locates a line based only on line group assignments made in 'G' --> CO GROUPS and 'L' --> LEAST COST ROUTING (LINE GROUP.....).

Instructions:

For each LINE..XX..GROUP IS..... sub-field on Table 4-2, enter the line group number (Ø1-1Ø) for each line. Lines that are not installed should be assigned to group 77.

Example:

If line 1 should be assigned to group 1, enter Ø1 for the LINE..Ø1..TYPE IS..... sub-field on Tale 4-2.

Default Value: Lines 1 through 8 default into group 1 (Ø1).
Lines 9 through 16 default into group 2 (Ø2).
Lines 17 through 24 default into group 3 (Ø3).
Lines 25 through 32 default as not installed (77).

Conditions:

(a) Up to 1Ø groups can be programmed. Any number of lines can be programmed into the same group.

(b) All telephones use line groups to place all outside calls. The call will be placed on the highest numbered available line in the group.

(c) When a station queues for a line, the recall will be from the first available line in the group.

(d) Unless programmed otherwise or unless LCR is installed, Speed Dial always dials on line group 1.

Related Programming:

'S' --> SYSTEM FEATURES
'P' --> CO TYPE to program line type.
'L' --> LEAST COST ROUTING
LINE GROUP..... to correlate line service type to line group.

Feature Reference:

Line Groups, Outgoing
Line Queuing
Placing a Call

Field: 'P' --> CO TYPE

Access:

While in the 'S' --> SYSTEM FEATURES program, press the P key. The following sub-fields are available to be programmed:

BIT NUMBER	7	6	5	4	3	2	1	Ø
FUNCTION	IN	PBX	P/T				TOLLF	UNA

LINE..Ø1..TYPE IS.....Ø1
LINE..Ø2..TYPE IS.....Ø1
LINE..Ø3..TYPE IS.....Ø1
LINE..Ø4..TYPE IS.....Ø1
LINE..Ø5..TYPE IS.....Ø1
LINE..Ø6..TYPE IS.....Ø1
LINE..Ø7..TYPE IS.....Ø1
LINE..Ø8..TYPE IS.....Ø1
LINE..Ø9..TYPE IS.....Ø1
LINE..1Ø..TYPE IS.....Ø1
LINE..11..TYPE IS.....Ø1
LINE..12..TYPE IS.....Ø1
LINE..13..TYPE IS.....Ø1
LINE..14..TYPE IS.....Ø1
LINE..15..TYPE IS.....Ø1
LINE..16..TYPE IS.....Ø1
LINE..17..TYPE IS.....Ø1
LINE..18..TYPE IS.....Ø1
LINE..19..TYPE IS.....Ø1
LINE..2Ø..TYPE IS.....Ø1
LINE..21..TYPE IS.....Ø1
LINE..22..TYPE IS.....Ø1
LINE..23..TYPE IS.....Ø1
LINE..24..TYPE IS.....Ø1
LINE..25..TYPE IS.....Ø1
LINE..26..TYPE IS.....Ø1
LINE..27..TYPE IS.....Ø1
LINE..28..TYPE IS.....Ø1
LINE..29..TYPE IS.....Ø1
LINE..3Ø..TYPE IS.....Ø1
LINE..31..TYPE IS.....Ø1
LINE..32..TYPE IS.....Ø1

The LINE..Ø1..TYPE IS..... sub-field is the first sub-field displayed. After this sub-field is programmed, the remaining sub-fields can be displayed and programmed one at a time.

Description:

The LINE..##..TYPE IS..... field allows line type to be individually programmed for each line. A line may be programmed as incoming only, behind a PBX, Dial Pulse (DP) or Dual Tone Multifrequency (DTMF), toll free or Universal Night Answer.

Instructions:

For each line on the CO Type bit graph below, place a 1 beneath a bit to enable its assigned function. Bits Ø through 7 in each sub-field assign line type as follows:

Bit Ø - Universal Night Answer

Enter 1 to enable the line for Universal Night Answer. These lines can be answered when the system is in the night mode from any station in the system, regardless of 'E' --> STATIONS FEATURES assignments.

Bit 1 - Toll Free

Enter 1 to assign the line as a toll free line. A toll free line can be used to place any call, regardless of the station or area code Class of Service. Lines programmed as toll free are not recognized by Least Cost Routing. LCR will continue to place calls on the least expensive route as dictated by the LCR rate tables.

Bit 2 - not used
Bit 3 - not used
Bit 4 - not used

Bit 5 - Dial Pulse Line

Enter 1 to assign the line as a Dial Pulse line. The default value of Ø assigns the line as a DTMF line.

Bit 6 - PBX Line

Enter 1 to assign the line as a Private Branch Exchange (PBX) line. Toll Restriction ignores the first digit dialed on PBX lines. The Toll Restriction check begins with the second dialed digit, for manually dialed and Speed Dial calls.

Bit 7 - Incoming Only

Enter 1 to assign the line as incoming only. Outgoing calls cannot be placed on an incoming only line, regardless of a station's Class of Service and 'E' --> STATIONS FEATURES (CO ACCESS) programming. Programming lines as incoming only assures that a specified number of lines will always be reserved for incoming calls. Least Cost Routing cannot place calls on incoming only lines.

CO TYPE

BIT NUMBER	7	6	5	4	3	2	1	0	
TYPE	IN	PBX	P/T				TOLLF	UNA	HEX
DEFAULT	0	0	0	0	0	0	0	1	01
LINE 01				0	0	0			
LINE 02				0	0	0			
LINE 03				0	0	0			
LINE 04				0	0	0			
LINE 05				0	0	0			
LINE 06				0	0	0			
LINE 07				0	0	0			
LINE 08				0	0	0			
LINE 09				0	0	0			
LINE 10				0	0	0			
LINE 11				0	0	0			
LINE 12				0	0	0			
LINE 13				0	0	0			
LINE 14				0	0	0			
LINE 15				0	0	0			
LINE 16				0	0	0			
LINE 17				0	0	0			
LINE 18				0	0	0			
LINE 19				0	0	0			
LINE 20				0	0	0			
LINE 21				0	0	0			
LINE 22				0	0	0			
LINE 23				0	0	0			
LINE 24				0	0	0			
LINE 25				0	0	0			
LINE 26				0	0	0			
LINE 27				0	0	0			
LINE 28				0	0	0			
LINE 29				0	0	0			
LINE 30				0	0	0			
LINE 31				0	0	0			
LINE 32				0	0	0			

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Example:

If line 1 is to be reserved for incoming calls only, enter 1 below bit seven and Ø below all other bits. The binary number 10000000 is created. Use Table 4-1 to convert this binary number to hexadecimal 80. Enter 80 for the LINE..Ø1..TYPE IS..... sub-field on Table 4-2.

Default Value: Ø1 (all lines are UNA, DTMF lines)

Conditions:

A line may be programmed for any number of variables.

Related Programming:

'S' --> SYSTEM FEATURES
'G' --> CO GROUPS to make sure that lines of the same type are in the same group.
'E' --> STATIONS FEATURES
NIGHT RING ENABLED... to allow a station to receive ringing for a UNA line.

Feature Reference:

Line Groups, Outgoing
Toll Restriction
Night Service

Field: 'A' --> OFFICE CODE TYPES

Access:

While in the 'S' --> SYSTEM FEATURES program, press the A key. The following sub-field is displayed:

```
 OFFICE CODE TYPE.
Ø : 1Ø-11 DIGITS TOLL
1 : TOLL IF 1-NNN..., OTHERWISE LOCAL
2 : LOCAL 3-4 DIGITS
3 : LOCAL 7-8 DIGITS
4 : SPECIAL 1NN PREFIX (not used)

ENTER EXCHANGE...(NNN).
```

Press carriage return repeatedly to scroll through the entire field.

Description:

This field is used to assign type to all office codes (NNX), area codes (NPX) and Emergency Assistance (N11) numbers. Office codes in the United States are numbers from 2Ø0-999. Area codes are numbers from 2Ø0-219 through 9Ø0-919. Emergency Assistance numbers are numbers such as 411, 911 and 811.

Instructions:

For each entry on Table 4-3, assign office code type (defined as follows):

Type ØØ - Office and Area Codes

Office and area codes in the United States are numbers between 2Ø0 and 999. If the code is not an Emergency Assistance number (N11), a conflict code or an office code only, it should be assigned as ØØ. Codes designated as type ØØ may be dialed with or without a leading 1 (1 + NPX + NNX + nnnn or NPX + NNX + nnnn), depending on the type of service where the system is installed.

Type Ø1 - Conflict Codes

In certain areas, a code may be an office code and an area code. These "conflict codes" should always be identified as type Ø1. If a leading 1 is dialed, the code is treated as an area code (i.e., a 1 + NPX + NNX + nnnn long distance call was dialed). If a leading 1 is not dialed, the code is treated as an office code (i.e., a NNX + nnnn non-toll local call was dialed). In this instance, there is no limit imposed on the number of digits that can be dialed from a toll restricted telephone, unless 'F' --> SYSTEM OPTIONS (OPTION ENABLED...14...) is enabled to restrict the maximum digits that can be dialed to 16.

In addition, all codes between 1ØØ-199 must be assigned as type Ø1.

Type Ø2 - Emergency Assistance (N11) Numbers

All Emergency Assistance numbers (911, 411, 811, etc.) must be identified as type Ø2. This allows these numbers to be dialed with or without a leading 1 (1 + N11 or N11) from any station in the system with Class of Service Ø-4. Stations with Class of Service 5 cannot directly dial these numbers.

Type Ø3 - Office Code Only

If a code is to be used as an office code only (NNX), assign it type Ø3. For classes of service Ø1 and Ø2, the system assumes that these are non-toll calls, and allows 1 + NNX + nnnn and NNX + nnnn dialing without restriction. Whatever restrictions may have been made in the "K Table" (i.e., in 'K' --> COS ALOWED AREA CODES programming) are ignored. There is no limit imposed on the number of digits that can be dialed, unless 'F' --> SYSTEM OPTIONS (OPTION ENABLED...14...) is enabled to restrict the maximum digits dialed to 16.

For classes of service Ø3 and Ø4, 1 + NNX + nnnn dialing is not permitted; NNX + nnnn dialing (without restriction) is. "K Table" restrictions (i.e., in 'K' --> COS ALOWED AREA CODES programming) are ignored. For NXX + nnnn dialing, there is no limit imposed on the number of digits that can be dialed unless 'F' --> SYSTEM OPTIONS (OPTION ENABLED...14...) is enabled. This option restricts the maximum digits dialed to 16.

Stations with Class of Service Ø5 cannot directly dial outside calls.

Type Ø4 - not used

It may be helpful to develop Table 4-3 in a non-consecutive order. For example:

(1) Identify all Office Codes (exchanges) as type Ø3.
(2) Identify all Area Codes as type ØØ.
(3) Identify all Conflict Codes as type Ø1.
(4) Identify all Emergency Assistance Numbers as type Ø2.

Programming is done for each individual code, in ranges, or globally for all codes.

(a) Programming Individual Codes

When the system prompts:

ENTER EXCHANGE...(NNN).

enter code to be programmed and press return. When the system prompts:

UP TO AND INCLUDE.....

enter the same exchange again and press return. When the system returns:

EXCHANGE TYPE IS....

enter code type from Table 4-3 and press return.

(b) Programming in Ranges

When the system prompts:

ENTER EXCHANGE...(NNN).

enter the lowest numbered code in the range to be programmed and press return.

When the system prompts:

UP TO AND INCLUDE .....

enter the highest numbered code in the range to be programmed and press return.

When the system prompts:

EXCHANGE TYPE IS....

enter code type from Table 4-3 and press return. The entire range is now assigned that code type.

(c) Global Programming

When the system prompts:

ENTER EXCHANGE..(NNN)

enter 1ØØ and press return. When the system prompts:

UP TO AND INCLUDE .....

enter 999 and press return. When the system returns:

EXCHANGE TYPE IS....

enter code from Table 4-3 and press return. The entire table is now assigned that code.

To check the assignment for a code, when the system prompts:

ENTER EXCHANGE...(NNN)_

enter code to be checked and press return. When the system prompts:

UP TO AND INCLUDE.....

press return.

The EXCHANGE TYPE IS.... prompt will display the assignment for the code checked.

Example:

If code 212 can be an office code and an area code, enter Ø1 for this code on Table 4-3.

Default Value: Ø1 (for all codes)

Conditions:

(a) Conflict codes are determined by the local telephone company.

(b) International calls can only be dialed from stations with Class of Service Ø.

(c) Emergency Assistance numbers are determined by the local telephone company.

(d) If Least Cost Routing is installed, type Ø1 (Conflict Code) should only be used for codes 1ØØ-199. LCR automatically accommodates Conflict Codes, without the need for special programming.

Related Programming:

'S' --> SYSTEM FEATURES
'K' --> COS ALOWED AREA CODES to program which Classes of Service can use each area code.

Feature Reference:

Class of Service
Placing a Call
Toll Restriction

Field: 'K' --> COS ALOWED AREA CODES

Access:

While in the 'S' --> SYSTEM FEATURES program, press the K key. The following prompt is displayed:

ALLOWED COS FOR OFFICE CODE.

BIT	7	6	5	4	3	2	1	Ø
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON

ENTER EXCHANGE...(NNN).

Press carriage return repeatedly to scroll through the entire field.

Description:

Area codes (2ØØ-219 through 9ØØ-919) can be assigned a specific Class of Service. This allows a station with that Class of Service to dial the code. Stations with a Class of Service not specifically permitted in 'K' --> COS ALOWED AREA CODES cannot dial the area code.

The system has six Classes of Service (COS), as follows:

COS Ø

Unrestricted. Class of Service Ø is permitted to dial all System Speed Dial numbers and all area codes. This is the only COS permitted to dial (telco) operator ('Ø') calls. Intercom calls are permitted.

COS 1

Class of Service 1 is permitted to dial 7-digit (NNX + nnnn) and leading 1 7-digit (1 + NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 2

Class of Service 2 is permitted to dial 7-digit (NNX + nnnn) numbers, leading 1 7-digit (1 + NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 3

Class of Service 3 is permitted to dial 7-digit (NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 4

Class of Service 4 is permitted to dial 7-digit (NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 5

Class of Service 5 can dial Intercom calls and all System Speed Dial calls only.

Instructions:

For each area code on Table 4-4, place a 1 beneath each Class of Service that will be able to dial the code. Place a Ø beneath each Class of Service that will be prevented from dialing the area code. The bits are assigned as follows:

Bit Ø - On (always leave at 1)
Bit 1 - C-1 (COS 1)
Bit 2 - C-2 (COS 2)
Bit 3 - C-3 (COS 3)
Bit 4 - C-4 (COS 4)
Bit 5 - C-5 (COS 5, always leave at Ø)
Bits 6 and 7 - not used (always leave at Ø)

Use Table 4-1 to convert the resultant eight bit binary number to hexadecimal and enter the number in the 'HEX' column on Table 4-4.

Programming is done for each individual area code, in ranges, or globally for all codes.

(a) Programming Individual Area Codes

When the system prompts:

ENTER EXCHANGE...(nnn).

enter code to be programmed and press return. When the system prompts:

UP TO AND INCLUDE.....

enter the same code and press return. When the system returns:

COS RECORDED/NEW...._Ø1

enter data from Table 4-4 and press return. Prompts continue until the Q key is pressed.

(b) Programming in Ranges

When the system prompts:

ENTER EXCHANGE...(NNN).

enter the lowest numbered code in the range to be programmed and press return. When the system prompts:

UP TO AND INCLUDE .....

enter the highest numbered code in the range to be programmed and press return. When the system returns:

ENTER NEW COS....._

enter data from Table 4-4 and press return. The entire range is now assigned that code type. The * prompt will display, indicating that the entire range has been programmed.

(c) Global Programming

When the system prompts:

ENTER EXCHANGE...(NNN)

enter 200 and press return. When the system prompts:

UP TO AND INCLUDE .....

enter 999 and press return. When the system returns:

ENTER NEW COS....._

enter data from Table 4-4 and press return. The entire table is now assigned that code. The * prompt will display, indicating that the entire table has been programmed.

To check the Class of Service for an area code, when the system prompts:

ENTER EXCHANGE...(NNN)_

enter area code to be checked and press return. When the system prompts:

UP TO AND INCLUDE.....

press return.

The COS RECORDED/NEW.... prompt will display the Class of Service data for the area code.

Example:

If area code 212 will be accessible only to stations with Class of Service 1, enter 1 beneath bit 1 on Table 4-4. The resultant binary number ØØØØØØ11 is converted to hexadecimal Ø3 and entered in the "HEX" column.

Default Value: Ø1 (fully restricted for COS 1 through 5)

Conditions:

(a) Emergency Assistance numbers should always be accessible to every station in the system that can dial outside calls (entry 1F).

(b) 'K' --> COS ALOWED AREA CODES programming may be used to allow stations with Classes of Service 3 and 4 to dial 1 + 7-digit numbers to which they normally would be denied access. To accomplish this:

(1) Designate the exchange to be allowed as type Ø1 (in 'A' --> OFFICE CODE TYPES). Indicate on Table 4-3 that this exchange has special programming.

(2) In 'K' --> COS ALOWED AREA CODES, enter Ø8 (hex) for the exchange if CØS 3 should be able to dial it; enter 18 (hex) for CØS 3 and 4. Record this programming in the margin of Table 4-4. Since the least significant bit will always be added by the system, these entries will display differently when checked. Entry Ø8 (hex) will display as Ø9 (hex); 18 (hex) will display as 19 (hex).

(c) If the call is placed without a leading 1, the system assumes that the code is a local exchange (office code) and allows any 7-digit dialing. If the call is placed with a leading 1, the office code is Toll Restricted as if it were an area code. 1 + NNX +nnnn and 1 + NPX + NNX + nnnn dialing is allowed.

(d) Use this type of programming only for those codes which require special treatment.

Related Programming:

'S' --> SYSTEM FEATURES
'A' --> OFFICE CODE TYPES to assign a type to each area code.

Feature Reference:

Class of Service
Placing a Call
Toll Restriction

Field: 'E' --> EXTERNAL OUTPUTS

Access:

While in the 'S' --> SYSTEM FEATURES program, press the E key. The following sub-fields are available to be programmed:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	NIGHT	BGM	PAGE			PG-DZ	ON	C-OFF

```
OUTPUT..01..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..02..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..03..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..04..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..05..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..06..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..07..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
OUTPUT..08..CONTROL  IS...20
ALTERNATE AUDIO PORT IS..NONE
```

The OUTPUT..01..CONTROL IS.../ALTERNATE AUDIO PORT IS... sub-field is the first sub-field that is accessed. Each successive sub-field is accessed after the previous sub-field is programmed.

Description:

External Page, Background Music and night mode ringing is output from the system at Alternate Audio Ports. Unused station positions on a B-8SCU-C PCB may be used as Alternate Audio Ports. The 'E' --> EXTERNAL OUTPUTS field assigns which unused station ports will receive External Page, Background Music and night ringing.

Instructions:

The 'E' --> EXTERNAL OUTPUTS field uses eight control bits, shown on the External Outputs bit graph, defined as follows:

Bits 0 through 4 - not used

Bit 5 - Page (PAGE)

On the External Outputs bit graph, a 1 below bit 5 indicates that Page audio will be output from the designated Alternate Audio Port. A 0 indicates that page will not be broadcast.

All Call Page and one Zone Page is broadcast from each Alternate Audio Port. The Zone Page assignments are as follows:

OUTPUT	ZONE PAGE
Ø1	Ø1 (dial 61)
Ø2	Ø2 (dial 62)
Ø3	Ø3 (dial 63)
Ø4	Ø4 (dial 64)
Ø5	Ø5 (dial 65)
Ø6	Ø6 (dial 66)
Ø7	Ø7 (dial 67)
Ø8	Ø8 (dial 68)

Bit 6 - Background Music (BGM)

On the External Outputs bit graph, a 1 below bit 6 indicates that BGM will be output from the designated Alternate Audio Port. A Ø indicates that BGM will not be broadcast.

Bit 7 - Night Ringing (NIGHT)

On the External Outputs bit graph, a 1 below bit 7 indicates that night ringing will be output from the designated Alternate Audio Port. A Ø indicates that night ringing will not be broadcast.

Enter 1s and Øs on the External Outputs bit graph to determine the parameters of each Alternate Audio Port to be used. Eight bit binary numbers will be created. Use Table 4-1 to convert each of these numbers to hexadecimal, and record the hex equivalent for each sub-field on Table 4-2.

EXTERNAL OUTPUTS

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	NIGHT	BGM	PAGE			PG-OZ	ON	C-OFF	HEX
DEFAULT	0	0	1	0	0	0	0	0	20
OUTPUT 01				0	0	0	0	0	
OUTPUT 02				0	0	0	0	0	
OUTPUT 03				0	0	0	0	0	
OUTPUT 04				0	0	0	0	0	
OUTPUT 05				0	0	0	0	0	
OUTPUT 06				0	0	0	0	0	
OUTPUT 07				0	0	0	0	0	
OUTPUT 08				0	0	0	0	0	

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Example:

Unused station position 32 (port Ø32) is to be used as an Alternate Audio Port to broadcast Background Music. On the External Outputs bit graph, enter 1 below bit 6 (for output Ø1) and a Ø for all other bits. The binary number Ø1ØØØØØ is created. Using Table 4-1, convert this binary number to hexadecimal 4Ø. Enter 4Ø for the Output Ø1 sub-field on Table 4-2.

To assign Output Ø1 to station position (port) 32, enter Ø32 as the Alternate Audio Port for output Ø1.

Default Value:

All OUTPUT..NN..CONTROL IS... sub-fields default to 2Ø (Page bit set to 1).

All ALTERNATE AUDIO PORT IS.. sub-fields default to NONE

Conditions:

(a) To avoid Page volume fluctuations in the system, leave the OUTPUT..NN..CONTROL IS... sub-fields defaulted to 2Ø if the alternate outputs are not going to be used.

(b) Alternate Audio Ports require a B-8SCU-C PCB.

(c) CO audible from Private Lines and non-UNA lines will not be sent to the Alternate Audio Ports.

(d) The system ignores any 'E' --> STATIONS FEATURES programming made for an Alternate Audio Port.

Related Programming:

'E' --> STATIONS FEATURES
  PAGE ZONE RECEIVED..... so that stations which will hear the Alternate Audio Port Zone Page are in the same Page zone as the Alternate Audio Port.
  PRIVATE LINE.....IS... to assign lines as Private Lines. Private lines will not output to the Alternate Audio Ports.
'S' --> SYSTEM FEATURES
  'P' --> CO TYPE to assign lines as UNA lines. Lines not assigned as UNA lines will not activate the Alternate Audio Ports.

Feature Reference:

Music on Hold/Background Music
Paging
Night Service

Field: 'N' --> OUT KEYS GROUPS

Access:

While in the 'S' --> SYSTEM FEATURES program, press the N key. The following fields may be programmed:

OUTGOING KEYS FORMAT

```
OUT_KEY # Ø1 SELECT GROUP # _Ø1_
OUT_KEY # Ø2 SELECT GROUP # _Ø1_
OUT_KEY # Ø3 SELECT GROUP # _Ø2_
OUT_KEY # Ø4 SELECT GROUP # _Ø2_
OUT_KEY # Ø5 SELECT GROUP # _Ø3_
OUT_KEY # Ø6 SELECT GROUP # _Ø3_
```

Description:

The 'N' --> OUT KEYS GROUPS field selects the line groups accessed by each of the outgoing line keys (keys 8-13) on multibutton telephones. When an outgoing line key is pressed, the highest numbered available line in the assigned line group is seized. More than one key may be assigned to the same line group.

Instructions:

On Table 4-2, enter the line group number that should be accessed by each of the six outgoing line keys (keys 8-13). Refer to 'G' --> CO GROUPS programming for line group assignments.

Example:

If outgoing line key 1 (key 8) should access line group 3, enter Ø3 for the OUT_KEY # Ø1 SELECT GROUP # _ sub-field on Table 4-2.

Default Value:

The default key assignments are as follows:

KEY	GROUP
OUTGOING KEY 1 (KEY 8)	Ø1
OUTGOING KEY 2 (KEY 9)	Ø1
OUTGOING KEY 3 (KEY 1Ø)	Ø2
OUTGOING KEY 4 (KEY 11)	Ø2
OUTGOING KEY 5 (KEY 12)	Ø3
OUTGOING KEY 6 (KEY 13)	Ø3

Conditions:

(a) If LCR is installed, outgoing keys 12 and 13 will access LCR, not the line groups assigned in 'N' --> OUT KEYS GROUPS programming.

(b) Outgoing line keys cannot access Private Lines designated in 'E' --> STATIONS FEATURES (PRIVATE LINE.....IS...) programming.

(c) A multibutton station user cannot use an outgoing line key to seize a line if access is not also granted in 'E' --> STATIONS FEATURES (CO ACCESS [NN..NN] IS..) programming.

(d) When all of the lines assigned to an outgoing line key or group of keys are unavailable (i.e., either busy or ringing in), the line key LEDs will illuminate on all the multibutton telephones. If this happens frequently, it can be used as an indication that more lines need to be added to the line group.

Related Programming:

'S' --> SYSTEM FEATURES
  'G' --> CO GROUPS to assign lines to line groups.
  'P' --> CO TYPE to designate line type.
'E' --> STATIONS FEATURES
  CO ACCESS [NN..NN] IS.. to grant outgoing access for lines on a station by station basis.
  PRIVATE LINE.....IS... to assign a Private Line to a station.

Feature Reference:

Least Cost Routing
Placing a Call

Field: 'F' --> SYSTEM OPTIONS

The options available are shown below, with the default values in parentheses.

Option Ø1 (YES) - Enable LCR to Override CO Access
Option Ø2 (YES) - Enable Music on Hold
Option Ø3 (YES) - Enable Conference for Outgoing Line Key
Option Ø4 (NO) - Enable Single Line Telephone Distinctive Ringing
Option Ø5 (YES) - Line Supervision
Option Ø6 (NO) - Enable Forced Intercom Ringing
Option Ø7 (YES) - DTMF Speed (Half/Full)
Option Ø8 (NO) - Drop Pulse Supervision
Option Ø9 (YES) - Reserve Link for CO Ringing
Option 1Ø (YES) - not used
Option 11 (YES) - not used
Option 12 (NO) - not used
Option 13 (YES) - Enable SMDR for Long Distance Calls
Option 14 (NO) - Enable 16-digit Limit for Manual Dialing
Option 15 (YES) - Enable SMDR for Calls to Outside Operator
Option 16 (NO) - Enable SMDR to Print Speed Dial Bin Numbers
Option 17 (YES) - Enable SMDR for Local (7-digit) Calls
Option 18 (YES) - not used
Option 19 (YES) - Enable Call Forwarding Beep

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. The following prompt is displayed:

SYS OPTION EDIT

ENTER OPTION#..
OPTION ENABLED...NN..

The prompt for Option Ø1 is displayed first. Press the carriage return repeatedly to scroll down through the prompts for options 2 through 19.

Description:

The 'F' --> SYSTEM OPTIONS field allows miscellaneous system options to be programmed.

Instructions:

Refer to the specific sub-fields that follow.

Example:

Refer to the specific sub-fields that follow.

Default Value:

Refer to the specific sub-fields that follow.

Conditions:

Refer to the specific sub-fields that follow.

Related Programming:

Refer to the specific sub-fields that follow.

Feature Reference:

Refer to the specific sub-fields that follow.

Sub-Field: OPTION ENABLED...Ø1.. (Enable LCR to Override CO Access)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., press carriage return.

Description:

This option allows LCR to override 'E' --> STATIONS FEATURES (CO ACCESS [NN..NN] IS..) programming when routing a call for a toll restricted telephone. When option Ø1 is enabled, the least expensive route (line) for the call is selected; CO ACCESS programming is ignored. If option Ø1 is disabled and LCR selects a line for which access is denied, the call will not go through.

Instructions:

On Table 4-2, enter Y if LCR should be able to override CO access assignments; N if not.

Example: not applicable

Default Value: YES

Conditions:

Option Ø1 has no affect on how calls are placed using outgoing line keys 8-11.

Related Programming:

'S' --> SYSTEM FEATURES
  'L' --> LEAST COST ROUTING to program LCR.
  'G' --> CO GROUPS to assign lines to groups.
  'N' --> OUT KEYS GROUPS to assign line groups to the outgoing line keys.
'E' --> STATIONS FEATURES
  CO ACCESS [NN..NN] IS.. to configure CO access on a station-by-station basis.

Feature Reference:

Least Cost Routing
Placing a Call

Sub-Field: OPTION ENABLED...Ø2.. (Enable Music on Hold)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø2 and press carriage return.

Description:

If the system is equipped with an optional music source, this option allows callers on Hold to receive Music on Hold.

Instructions:

On Table 4-2, enter Y if callers on Hold should receive Music on Hold; N if they should not.

Example: not applicable

Default Value: YES

Conditions:

An external music source must be installed.

Related Programming: not applicable

Feature Reference:

Music on Hold/Background Music

Sub-Field: OPTION ENABLED...Ø3..(Enable Conference for Outgoing Line Key)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø3 and press carriage return.

Description:

Enabling option Ø3 allows a multibutton telephone user to place and join in Conference two outside calls using the same outgoing line key. If option Ø3 is disabled, this feature is not allowed. This option is used when each outgoing line key is assigned to a line group, and the user wishes to place and join in Conference two calls using the same line group. It is also useful for placing and Conferencing two calls using the same LCR key.

Instructions:

On Table 4-2, enter Y if a multi-line Conference should be allowed using the same outgoing line key; N if not.

Example: not applicable

Default Value: YES

Conditions:

(a) For option Ø3 to function, the line group accessed by pressing the outgoing line key must contain at least two lines. If only one line is available, the facility will be denied.

(b) If placing the initial call uses the last available line in the line group, the facility will be denied.

Related Programming:

'S' --> SYSTEM FEATURES
'L' --> LEAST COST ROUTING to enable LCR.
'G' --> CO GROUPS to assign at least two lines to each line group.
'N' --> OUT KEYS GROUPS to assign line groups to outgoing line keys.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...Ø1.. to allow LCR to bypass CO access programming.
'E' --> STATIONS FEATURES
CO ACCESS [NN..NN] IS.. to configure CO access for the lines in each line group, on a station-by-station basis.

Feature Reference:

Conference
Least Cost Routing
Line Groups, Outgoing
Placing a Call

Sub-Field: OPTION ENABLED...Ø4.. (Enable Single Line Telephone Distinctive Ringing)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø4 and press carriage return.

Description:

Distinctive ringing allows users of single line (25ØØ type) and one button telephones to differentiate between Intercom and outside calls. If this option is enabled, outside calls will ring with two short ring bursts followed by a 4.5 second pause; Intercom calls will ring with a 1.5 second burst followed by a 4.5 second pause. If this option is disabled, all calls ring with a 1.5 second burst followed by a 4.5 second pause.

Instructions:

On Table 4-2, enter Y for Option Ø4 if distinctive ringing for single line and one button telephones is desired; N if not.

Example: not applicable

Default Value: NO

Conditions:

This option pertains only to single line (25ØØ type) and one button telephones.

Related Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... assigned as 5ØØ for all single line (25ØØ type) and one button telephones.

Feature Reference

Answering a Call
Distinctive Ringing
Intercom

Sub-Field: OPTION ENABLED...Ø5.. (Line Supervision)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: OPTION ENABLED #.., enter Ø5 and press carriage return.

Description:

When a line is seized, the system will supervise that line for loop current provided option Ø5 is enabled. If the system does not detect loop current within two seconds, it will assume that the line is defective and automatically route the call to the next lowest numbered line in the same line group as the initial call. If If the next lowest numbered line is also defective, the call will be routed through the remaining lines in the group (from highest to lowest) until a good line is found.

If option Ø5 is disabled, the line is not supervised for loop current and the system will not automatically disconnect from a bad CO circuit.

Instructions:

On Table 4-2, enter Y if the system should supervise lines for loop current; N if not.

Example: not applicable

Default Value: YES

Conditions:

Line supervision does not apply for systems with Least Cost Routing.

Related Programming:

'S' --> SYSTEM FEATURES
'G' --> CO GROUPS to program lines into groups.

Feature Reference:

Placing a Call

Sub-Field: OPTION ENABLED...Ø6.. (Enable Forced Intercom Ringing)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø6 and press carriage return.

Description:

If enabled, Option Ø6 forces all Intercom calls to ring, rather than be voice announced.

Instructions:

On Table 4-2, enter Y if all Intercom calls should ring; N if voice announced calls are permitted.

Example: not applicable

Default Value: NO

Conditions:

If this option is disabled, each key telephone user can select the mode (ring vs. voice announce) of each Intercom call placed.

Related Programming: not applicable

Feature Reference:

Forced Intercom Ringing
Intercom
Handsfree (Speakerphone)

Sub-Field: OPTION ENABLED...Ø7.. (DTMF Speed [Half/Full])

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø7 and press carriage return.

Description:

Option Ø7 determines the speed at which the system dials DTMF digits when using Speed Dial, Last Number Redial and Save. When Option Ø7 is enabled, the dialed digits are 6ØmS on, 6ØmS off (i.e., full speed). When Option Ø7 is disabled, the dialed digits are 12ØmS on, 12ØmS off (i.e., half speed).

Instructions:

For Option Ø7 on Table 4-2, indicate if DTMF dialing of stored numbers should be full speed (Y) or half speed (N).

Example: not applicable

Default Value: YES

Conditions:

The speed at which stored numbers will dial is set for compatibility with the telco or PBX.

Related Programming: not applicable

Feature Reference:

Last Number Redial
Placing a Call
Save
Speed Dial

Sub-Field: OPTION ENABLED...Ø8... (Drop Pulse Supervision)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter Ø8 and press carriage return.

Description:

The system has the ability to drop a call that has been placed on Hold and abandoned by the outside party. If Option Ø8 is enabled, the system will not drop an abandoned call on Hold. If Option Ø8 is disabled, the system will disconnect from an abandoned call on Hold.

Instructions:

If the system should be able to drop abandoned calls on Hold, enter N on Table 4-2; Y if not.

Example: not applicable

Default Value: NO

Conditions:

This sub-field is meaningful for both DTMF and Dial Pulse lines, and only for calls on Hold.

Related Programming: not applicable

Feature Reference:

Hold

Sub-Field: OPTION ENABLED...Ø9.. (Reserve Link for CO Ringing)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the P key. When the system prompts: ENTER OPTION #.., enter Ø9 and press carriage return.

Description:

If Option Ø9 is enabled, an Intercom link is exclusively reserved for incoming CO line ringing (incoming CO Audible). This assures that an incoming call will ring as soon as the LED for that line starts to flash (i.e., as soon as ring detect occurs). If this option is disabled, ringing for incoming calls will use one of the links shared for Intercom functions.

Instructions:

For this option on Table 4-2, enter Y if a dedicated CO audible link is required; N if not.

Example: not applicable

Default Value: YES

Conditions:

If a high volume of Intercom traffic is not anticipated (blockage is unlikely), enabling this option is not required.

Related Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] IS.. to assign ringing and incoming access to lines.

Feature Reference:

Answering a Call

Sub-Field: OPTION ENABLED...13.. (Enable SMDR for Long Distance Calls)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 13 and press carriage return.

Description:

Enabling Option 13 allows the SMDR to print the following types of calls:

1 + NNX + nnnn
Ø + NNX + nnnn
1 + NPX + NNX + nnnn
Ø + NPX + NNX + nnnn

where NNX is an office code (exchange), NPX is an area code and nnnn represents any local address dialed.

Instructions:

For Option 13 on Table 4-2, enter Y to turn on the SMDR for 1 + NNX + nnnn, Ø + NNX + nnnn, 1 + NPX + NNX + nnnn and Ø + NPX + NNX + nnnn calls; N to turn it off.

Example: not applicable

Default Value: YES

Conditions:

7-digit (NNX + nnnn) calls will only be printed if Option 17 is enabled.

Related Programming:

'S' --> SYSTEM FEATURES
'M' --> TIMERS
SMDR TIMER..(SEC)..... to set the minimum duration of outgoing calls that print on the SMDR.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...17.. to enable the SMDR for 7-digit calls.

Feature Reference:

Placing a Call
SMDR

Sub-Field: OPTION ENABLED...14... (Enable 16-digit Limit for Manual Dialing)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 14 and press carriage return.

Description:

Manually dialed outgoing calls from Toll Restricted telephones can be restricted to 16 digits, if desired. This would prevent a user from manually dialing an OCC access or security code, and then dialing a 10 or 11 digit long distance call. The dial pad would be cut off after the 16th digit. Enabling Option 14 will cause the dial pad to be cut off after 16 manually dialed digits. If Option 14 is disabled, the dial pad will never be cut off.

Instructions:

For Option 14 on Table 4-2, enter Y if the dial pad is to be cut off after 16 digits; N if it should not be cut off.

Example: not applicable

Default Value: NO

Conditions:

The first digit dialed is not counted for Option 14 restrictions. The total number of digits that can be dialed if Option 14 is enabled is 17.

Related Programming: not applicable

Feature Reference:

Placing a Call

Sub-Field: OPTION ENABLED...15.. (Enable SMDR for Calls to Outside Operator)

Access:

When in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 15 and press carriage return.

Description:

All calls to an outside operator will be printed on the SMDR if option 19 is enabled. Only stations with Class of Service Ø are permitted to dial an outside operator. If option 15 is disabled, calls to an outside operator will not print.

Instructions:

On Table 4-2, enter Y for option 15 if calls to an outside operator should print; N if not.

Example: not applicable

Default Value: YES

Conditions:

Ø + NPX + NNX + nnnn and Ø + NNX + nnnn calls are enabled for the SMDR by option 13.

Related Programming:

'S' --> SYSTEM FEATURES
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...13..to enable SMDR to print Ø + NPX + NNX + nnnn and Ø + NNX + nnnn calls.
    OPTION ENABLED...17.. to enable SMDR to print NNX + nnnn calls.

Feature Reference:

Class of Service
Placing a Call
SMDR

Sub-Field: OPTION ENABLED...16... (Enable SMDR to Print Speed Dial Bin Numbers)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 16 and press carriage return.

Description:

The SMDR will print the bin number of every Speed Dial number dialed when Option 16 is enabled. Station Speed Dial bins are printed on the SMDR as EØ1 through E14. System Speed Dial bins are printed as SØØ through S99. If two Speed Dial bins are chained, both bin designations will be printed. If more than two Speed Dial bins are chained, the first and the last bin numbers will be printed.

Option 16 will also indicate if a call has been placed using Save and Last Number Redial. Saved numbers are designated by ESV; Last Number Redialed numbers are designated by ERD.

Instructions:

For Option 16 on Table 4-2, enter Y if Speed Dial bin, Save and Last Number Redial designations should be printed on the SMDR; N if not.

Example: not applicable

Default Value: NO

Conditions:

Options 13, 15 and 17 determine which numbers will print on the SMDR.

Related Programming:

'S' --> SYSTEM FEATURES
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...13.. to enable 1 + NNX + nnnn, 1 + NPX + NNX + nnnn, Ø + NNX + nnnn and Ø + NPX + NNX + nnnn calls to print.
    OPTION ENABLED...15.. to enable SMDR to print 'Ø' calls to an outside operator.
    OPTION ENABLED...17.. to enable NNX + nnnn calls to print.

Feature Reference:

Placing a Call
SMDR
Speed Dial

Sub-Field: OPTION ENABLED...17.. (Enable SMDR for Local [7-digit] Calls)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 17 and press carriage return.

Description:

If Option 17 is enabled, all local (7-digit) calls will be printed on the SMDR. If Option 17 is disabled, local calls (NNX + nnnn) will not print.

Instructions:

For Option 17 on Table 4-2, enter Y if 7-digit calls should print on the SMDR; N if not.

Example: not applicable

Default Value: YES

Conditions:

(a) The duration of the local call must exceed the SMDR TIMER..(SEC)..... interval.

(b) If Option 13 is disabled, only local calls will print on the SMDR.

Related Programming:

'S' --> SYSTEM FEATURES
  'M' --> TIMERS
    SMDR TIMER..(SEC)..... to set the minimum duration of outgoing calls that print on the SMDR.
  'F' --> SYSTEM OPTIONS
    OPTION ENABLED...13.. to allow 1 + NNX + nnnn, 1 + NPX + NNX + nnnn, Ø + NNX + nnnn and Ø + NPX + NNX + nnnn calls to print.
    OPTION ENABLED...15.. to enable SMDR to print 'Ø' calls to an outside operator.

Feature Reference:

Placing a Call
SMDR

Sub-Field: OPTION ENABLED...19.. (Enable Call Forwarding Beep)

Access:

While in the 'S' --> SYSTEM FEATURES program, press the F key. When the system prompts: ENTER OPTION #.., enter 19 and press carriage return.

Description:

When a station is in the Call Forwarding mode (i.e., all calls have been forwarded to another station), the speaker will broadcast a short beep every 12Ø seconds. This beep serves as a reminder that calls have been forwarded. If this option is disabled, the Call Forwarding beep will not occur. Disabling Option 19 will also cancel the Message Waiting beep.

Instructions:

For Option 19 on Table 4-2, enter Y if the Call Forwarding reminder beep is desired; N if not.

Example: not applicable

Default Value: YES

Conditions:

Call Forwarding can only be initiated from multibutton telephones. The attendant cannot initiate Call Forwarding.

Related Programming: none

Feature Reference:

Call Forwarding

PROGRAM 'E' --> STATIONS FEATURES

Field: 'E' --> STATIONS FEATURES
ENTER STATION NUMBER..

Access:

Press the M key to enter the programming mode. Once the main menu is displayed, press the E key. The system prompts:

ENTER STATION NUMBER..

Enter the number of the station to be programmed and press the carriage return. The following prompt is displayed:

PROGRAMMING STATION.....

Each of the fields shown below can be accessed, one at a time, as the previous field is programmed.

```
PORT NUMBER.............*
TYPE OF PHONE..........KEY
HOT-LINE KEY...........*
CLASS OF SERVICE........00
CO AUDIBLE [01..08] IS..*
CO AUDIBLE [09..16] IS..*
CO AUDIBLE [17..24] IS..*
CO AUDIBLE [25..32] IS..*
CO ACCESS  [01..08] IS..*
CO ACCESS  [09..16] IS..*
CO ACCESS  [17..24] IS..*
CO ACCESS  [25..32] IS..*
RECEIVE ALL-PAGE.......YES
BARGE   IN   ENABLED....NO
BLOCK BARGE  ENABLED....NO
NIGHT RING   ENABLED...YES
DIL OFF HOOK SIGNAL.....NO
DIAL C.O. GROUP.........NO
CAMP-ON   ORIGINATE....YES
CAMP-ON   RECEIVE......YES
PAGE ZONE RECEIVED..... *
PICK UP GROUP IS........00
PRIVATE LINE.......IS...NONE
```

* Default assignment depends on station number. Refer to the individual sub-fields for default value.

Description:

Each station in the system is individually programmed for various options. These options are assigned in the 'E' --> STATIONS FEATURES program.

Instructions: Refer to the fields that follow.

Example: Refer to the fields that follow.

Default Value: Refer to the fields that follow.

Conditions: Refer to the fields that follow.

Related Programming: Refer to the fields that follow.

Feature Reference: Refer to the fields that follow.

Field: PORT NUMBER.....

Access:

The PORT NUMBER..... field is displayed after the ENTER STATION NUMBER.. field is programmed.

Description:

Each station in the system is assigned to a port. A port is a fixed location (position) in the KSU, although the station number assigned to each port can be changed. This facility allows for a Flexible Numbering Plan, eliminating the need to reconfigure the installation if stations are moved. Station programming follows the station numbers, not the port numbers.

Instructions:

On Table 4-5, enter the number of the port (001 through 128) to which each station is to be assigned, if different from the default value.

Example:

In general, this field is programmed on an individual basis as the installation changes. To swap the port assignments for stations 301 and 332, on Table 4-5 enter PORT NUMBER.....032 for station 301 and PORT NUMBER.....001 for station 332. Station 301 is now assigned to port 032; station 332 is assigned to port 001.

Default Value:

KSU

STATION	PORT	STATION	PORT
301	001	317	017
302	002	318	018
303	003	319	019
304	004	320	020
305	005	321	021
306	006	322	022
307	007	323	023
308	008	324	024
309	009	325	025
310	010	326	026
311	011	327	027
312	012	328	028
313	013	329	029
314	014	330	030
315	015	331	031
316	016	332	032

KSU (Cont'd)

STATION	PORT	STATION	PORT
333	Ø33	349	Ø49
334	Ø34	350	Ø50
335	Ø35	351	Ø51
336	Ø36	352	Ø52
337	Ø37	353	Ø53
338	Ø38	354	Ø54
339	Ø39	355	Ø55
340	Ø40	356	Ø56
341	Ø41	357	Ø57
342	Ø42	358	Ø58
343	Ø43	359	Ø59
344	Ø44	360	Ø60
345	Ø45	361	Ø61
346	Ø46	362	Ø62
347	Ø47	363	Ø63
348	Ø48	401	Ø64

Expansion Cabinet

402	Ø65	434	Ø97
403	Ø66	435	Ø98
404	Ø67	436	Ø99
405	Ø68	437	100
406	Ø69	438	101
407	Ø70	439	102
408	Ø71	440	103
409	Ø72	441	104
410	Ø73	442	105
411	Ø74	443	106
412	Ø75	444	107
413	Ø76	445	108
414	Ø77	446	109
415	Ø78	447	110
416	Ø79	448	111
417	Ø80	449	112
418	Ø81	450	113
419	Ø82	451	114
420	Ø83	452	115
421	Ø84	453	116
422	Ø85	454	117
423	Ø86	455	118
424	Ø87	456	119
425	Ø88	457	120
426	Ø89	458	121
427	Ø90	459	122
428	Ø91	460	123
429	Ø92	461	124
430	Ø93	462	125
431	Ø94	463	126
432	Ø95	464	127
433	Ø96	465	128

Conditions

Do not assign two stations to the same port.

'E' --> STATIONS FEATURES programming correlates to the station number, not the port number. If the port/station designation is changed, all of the programmed options are retained with the station.

Related Programming: not applicable

Feature Reference:

Flexible Numbering Plan

Field: TYPE OF PHONE.....

Access:

The TYPE OF PHONE..... field is displayed after the PORT NUMBER..... field is programmed.

Description:

The TYPE OF PHONE field is used to designate the type of telephone instrument installed at the station. The available types are:

KEY for a Multibutton Key Telephone
DSS for a Direct Station Selection (DSS) console
SLI for a Four Button Key Telephone
5ØØ for a single line (25ØØ type) or one button Telephone.

NOTE: Single line (25ØØ type) and one button telephones require B-8SLU-B PCBs to be installed. Refer to Section 5, INSTALLATION.

Instructions:

On Table 4-5, enter the type of station instrument required.

Example:

If the station being programmed is a Four Button Key Telephone, enter SLI.

Default Value: KEY

Conditions:

(a) The TYPE OF PHONE..... entry must match the telephone instrument installed.

(b) Alternate Audio Ports require TYPE OF PHONE..... to be KEY or SLI.

Related Programming:

'E' --> STATIONS FEATURES
PORT NUMBER..... to determine the port assignment for the instrument installed.
'S' --> SYSTEM FEATURES
'O' --> OPERATORS & DSS to assign operators and DSS consoles.

Feature Reference: not applicable

Field: HOT-LINE KEY.....

Access:

The HOT-LINE KEY..... field is displayed after the TYPE OF PHONE..... field is programmed.

Description:

Station pairs can be configured as Hotline partners. This provides for one button communication, a Busy Lamp Field and call Transfer between the partners.

Instructions:

On Table 4-5, enter the number of the station that is to be the Hotline partner for the station being programmed. The Hotline partner must be programmed in a similar manner.

Example:

If stations 314 and 315 are to be Hotline partners, enter 315 as the Hotline partner for station 314. Enter 314 as the Hotline partner for station 315.

Default Value:

not assigned (i.e., each station assigned to itself)

Conditions:

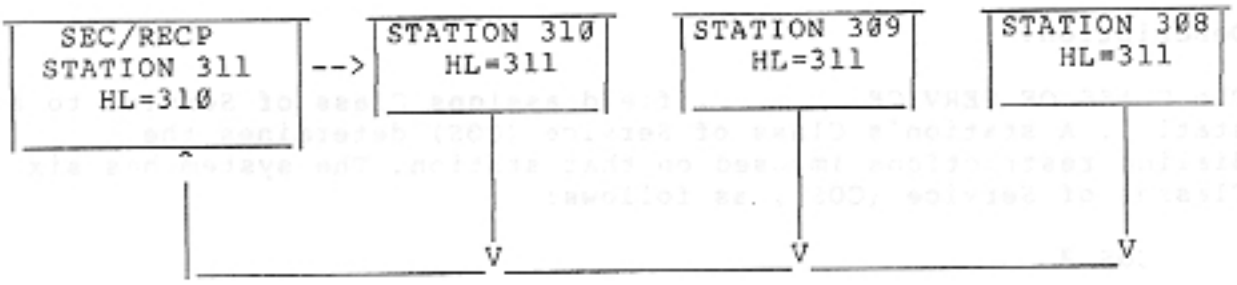
(a) For standard Hotline operation, each station can have only one Hotline partner.

(b) The total number of Hotline combinations in the system cannot exceed 64.

(c) Only multibutton telephones should be assigned as Hotline partners.

(d) The higher number in the Hotline pair is generally assigned as the secretary/receptionist in an executive/secretary arrangement. A call transferred to a busy executive station will automatically be transferred to the secretary/receptionist. If a call is transferred to an executive who is not busy, the Transfer will ring at both the secretary/receptionist and the executive.

(e) As shown below, special applications may require Hotline groups, rather than Hotline pairs. The station assigned as the secretary/receptionist is the highest numbered station in the Hotline group. All other stations in the Hotline group have the secretary/receptionist assigned as their Hotline partner.



(f) All the partners in a Hotline group receive a LED indication when the secretary/receptionist goes off hook. The secretary/receptionist station receives a LED indication only when the Hotline station to which it is assigned goes off hook.
In the above example, 311 receives HL LED only from 310. Stations 308, 309 and 310 receive HL LED from 311.

(g) When transferring calls, calls from 308, 309 and 310 are Transferred to 311 when the HL key is pressed. A call transferred from 311, using just the HL key, will go to station 310.

Related Programming:

'E' --> STATIONS FEATURES
TYPE OF PHONE..... to assure that only multibutton telephones are assigned as Hotline partners.

Feature Reference:

Hotline
Transfer

Field: CLASS OF SERVICE.....

Access:

This field is accessed after the HOT-LINE KEY..... field is programmed.

Description:

The CLASS OF SERVICE ..... field assigns Class of Service to a station. A station's Class of Service (COS) determines the dialing restrictions imposed on that station. The system has six Classes of Service (COS), as follows:

COS Ø

Unrestricted. Class of Service Ø is permitted to dial all System Speed Dial numbers and all area codes. This is the only COS permitted to dial (telco) operator ('Ø') calls. Intercom calls are permitted.

COS 1

Class of Service 1 is permitted to dial 7-digit (NNX + nnnn) and leading 1 7-digit (1 + NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 2

Class of Service 2 is permitted to dial 7-digit (NNX + nnnn) numbers, leading 1 7-digit (1 + NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 3

Class of Service 3 is permitted to dial 7-digit (NNX + nnnn) numbers, all System Speed Dial numbers and allowed area codes (1 + NPX + NNX + nnnn). Intercom calls are permitted.

COS 4

Class of Service 4 is permitted to dial 7-digit (NNX + nnnn) numbers, allowed area codes (1 + NPX + NNX + nnnn) and System Speed Dial numbers that do not contain a leading 1 or Ø. Intercom calls are permitted.

COS 5

Class of Service 5 can dial Intercom calls and all System Speed Dial calls only.

Instructions:

On Table 4-5, indicate the Class of Service for the station being programmed.

Example:

If the station is to be restricted to dialing 7-digit numbers, allowed area codes, System Speed Dial numbers (that do not contain a leading 1 or Ø) and Intercom calls, enter Ø4 for the station being programmed on Table 4-5.

Default Value: ØØ (unrestricted)

Conditions:

Class of Service Ø is the only COS permitted to dial leading Ø calls.

Related Programming:

'S' --> SYSTEM FEATURES
'K' --> COS ALOWED AREA CODES to assign the Class of Service that can dial each area code.

Feature Reference:

Class of Service
Placing a Call
Toll Restriction

Field: CO AUDIBLE [Ø1..Ø8] IS..
CO AUDIBLE [Ø9..16] IS..
CO AUDIBLE [17..24] IS..
CO AUDIBLE [25..32] IS..

Access:

The CO AUDIBLE [Ø1..Ø8] IS.. field is accessed after the CLASS OF SERVICE..... field is programmed. After the first CO AUDIBLE sub-field is programmed, the next CO AUDIBLE sub-field is accessed.

Description:

Stations can be programmed to answer calls and receive ringing on specified lines. The CO AUDIBLE fields determine which lines will ring at each station when the system is not in the night mode. Any line that rings can be answered.

Instructions:

On the CO Audible bit graph, place a 1 below each line that should ring at the station during the day. Place a Ø below all other lines. The assignment of 1s and Øs creates an eight bit binary number. Use Table 4-1 to convert the eight bit binary number to a two bit hexadecimal number. Enter the hex number on Table 4-5.

Example:

If station 3Ø1 should receive day ringing for all 32 lines, enter a 1 beneath each line on the CO Audible bit graphs. The binary numbers 11111111 are converted to hex FF and entered on Table 4-5.

Default Value:

Stations 3Ø1 and 3Ø2:	CO AUDIBLE [Ø1..Ø8] IS..FF
	CO AUDIBLE [Ø9..16] IS..FF
	CO AUDIBLE [17..24] IS..FF
	CO AUDIBLE [25..32] IS..FF
Station 3Ø3:	CO AUDIBLE [Ø1..Ø8] IS..FF
	CO AUDIBLE [Ø9..16] IS..FF
	CO AUDIBLE [17..24] IS..ØØ
	CO AUDIBLE [25..32] IS..ØØ
Stations 3Ø4-363 & 4Ø1-465:	CO AUDIBLE [Ø1..Ø8] IS..ØØ
	CO AUDIBLE [Ø9..16] IS..ØØ
	CO AUDIBLE [17..24] IS..ØØ
	CO AUDIBLE [25..32] IS..ØØ

Conditions:

Outgoing calls cannot be placed unless CO ACCESS has been granted. The outgoing call may be restricted by a station's Class of Service.

Related Programming:

'S' --> SYSTEM FEATURES
'G' --> CO GROUPS to program lines into groups.
'P' --> CO TYPE to assign type to lines.
'E' --> STATIONS FEATURES
CO ACCESS [NN..NN] IS.. to allow outgoing calls to be placed on specified lines.

Feature Reference:

Answering a Call
Split Ringing
Universal Night Answer

CO AUDIBLE - LINES 01-08, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
DEFAULT	0	0	0	0	0	0	0	0	00
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
STA 319									
STA 320									
STA 321									
STA 322									
STA 323									
STA 324									
STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
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STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

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CO AUDIBLE - LINES 01-08, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
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STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

CO AUDIBLE - LINES 09-16, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
DEFAULT	0	0	0	0	0	0	0	0	00
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
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STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
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STA 361									
STA 362									
STA 363									
STA 401									

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CO AUDIBLE - LINES 09-16, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 433									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
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STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

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CO AUDIBLE - LINES 17-24, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
DEFAULT	0	0	0	0	0	0	0	0	00
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
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STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
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STA 362									
STA 363									
STA 401									

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CO AUDIBLE - LINES 17-24, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 431									
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STA 433									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
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STA 463									
STA 464									
STA 465									

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CO AUDIBLE - LINES 25-32, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
DEFAULT	0	0	0	0	0	0	0	0	00
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
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STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
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STA 361									
STA 362									
STA 363									
STA 401									

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CO AUDIBLE - LINES 25-32, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	0	0	0	0	0	0	0	0	00
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
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STA 463									
STA 464									
STA 465									

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Field: CO ACCESS [Ø1..Ø8] IS..
CO ACCESS [Ø9..16] IS..
CO ACCESS [17..24] IS..
CO ACCESS [25..32] IS..

Access:

The CO ACCESS [Ø1..Ø8] IS.. field is accessed after the CO AUDIBLE [25..32] IS.. field is programmed. After the first CO ACCESS sub-field is programmed, the next sub-field is accessed.

Description:

Stations can be programmed to allow outgoing calls to be placed on specified lines.

Instructions:

On the CO Access bit graph, place a 1 below each line that the station can dial out on. Place a Ø below all other lines. The 1s and Øs entered create an eight bit binary number. Using Table 4-1, convert this binary number to its two-digit hexadecimal equivalent. Enter the hex number on Table 4-5.

Example:

If station 314 should be able to place a call on every outside line in the system, place a 1 beneath each line on the bit graphs. The resultant binary numbers (11111111) are converted to hex (FF) and entered on Table 4-5.

Default Value: FF

Conditions:

(a) A station's Class of Service may impose dialing restrictions on outgoing calls.

(b) A station will receive a flashing line key LED and CO audible for a line only if granted in CO AUDIBLE programming.

Related Programming:

'S' --> SYSTEM FEATURES
'L' --> LEAST COST ROUTING to enable LCR, if available.
'G' --> CO GROUPS to program lines into line groups.
'N' --> OUT KEYS GROUPS to assign line groups to outgoing line keys.
'F' --> SYSTEM OPTIONS
OPTION ENABLED...Ø1.. to allow LCR to override CO ACCESS assignments, if desired.
'E' --> STATIONS FEATURES
CLASS OF SERVICE..... to program a station's Class of Service.
CO AUDIBLE [NN..NN] IS.. to program lines to ring.

Feature Reference:

Answering a Call
Class of Service
Placing a Call
Toll Restriction

CO ACCESS - LINES 01-08, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
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STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
STA 344									
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STA 354									
STA 355									
STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

CO ACCESS - LINES 01-08, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	08	07	06	05	04	03	02	01	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
STA 443									
STA 444									
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STA 458									
STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

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CO ACCESS - LINES 09-16, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
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STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
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STA 350									
STA 351									
STA 352									
STA 353									
STA 354									
STA 355									
STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

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CO ACCESS - LINES 09-16, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
STA 413									
STA 414									
STA 415									
STA 416									
STA 417									
STA 418									
STA 419									
STA 420									
STA 421									
STA 422									
STA 423									
STA 424									
STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	16	15	14	13	12	11	10	09	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
STA 443									
STA 444									
STA 445									
STA 446									
STA 447									
STA 448									
STA 449									
STA 450									
STA 451									
STA 452									
STA 453									
STA 454									
STA 455									
STA 456									
STA 457									
STA 458									
STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

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CO ACCESS - LINES 17-24, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
STA 319									
STA 320									
STA 321									
STA 322									
STA 323									
STA 324									
STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
STA 344									
STA 345									
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STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

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CO ACCESS - LINES 17-24, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
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STA 422									
STA 423									
STA 424									
STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	24	23	22	21	20	19	18	17	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
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STA 452									
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STA 456									
STA 457									
STA 458									
STA 459									
STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

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CO ACCESS - LINES 25-32, TCX-128 (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 301									
STA 302									
STA 303									
STA 304									
STA 305									
STA 306									
STA 307									
STA 308									
STA 309									
STA 310									
STA 311									
STA 312									
STA 313									
STA 314									
STA 315									
STA 316									
STA 317									
STA 318									
STA 319									
STA 320									
STA 321									
STA 322									
STA 323									
STA 324									
STA 325									
STA 326									
STA 327									
STA 328									
STA 329									
STA 330									
STA 331									
STA 332									

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BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 333									
STA 334									
STA 335									
STA 336									
STA 337									
STA 338									
STA 339									
STA 340									
STA 341									
STA 342									
STA 343									
STA 344									
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STA 352									
STA 353									
STA 354									
STA 355									
STA 356									
STA 357									
STA 358									
STA 359									
STA 360									
STA 361									
STA 362									
STA 363									
STA 401									

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CO ACCESS - LINES 25-32, TCX-128 (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 402									
STA 403									
STA 404									
STA 405									
STA 406									
STA 407									
STA 408									
STA 409									
STA 410									
STA 411									
STA 412									
STA 413									
STA 414									
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STA 418									
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STA 420									
STA 421									
STA 422									
STA 423									
STA 424									
STA 425									
STA 426									
STA 427									
STA 428									
STA 429									
STA 430									
STA 431									
STA 432									
STA 433									

BIT NUMBER	7	6	5	4	3	2	1	0	
CO LINES	32	31	30	29	28	27	26	25	HEX
DEFAULT	1	1	1	1	1	1	1	1	FF
STA 434									
STA 435									
STA 436									
STA 437									
STA 438									
STA 439									
STA 440									
STA 441									
STA 442									
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STA 460									
STA 461									
STA 462									
STA 463									
STA 464									
STA 465									

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Field: RECEIVE ALL PAGE.......

Access:

The RECEIVE ALL PAGE....... field is accessed after the CO ACCESS [25..32] IS.. field is programmed.

Description:

Each key station can be individually programmed to receive All Page announcements through the speaker.

Instructions:

To allow the station to receive All Page announcements, enter Y for this field on Table 4-5.

Example: not applicable

Default Value: YES

Conditions:

The telephone instrument must have a speaker to be able to receive paging announcements. Single line (2500 type) and one button telephones cannot receive Paging announcements.

Related Programming:

'S' --> SYSTEM FEATURES
'E' --> EXTERNAL OUTPUTS to activate external outputs, if external paging equipment is installed.

Feature Reference:

Paging

Field: BARGE IN ENABLED....

Access:

The BARGE IN ENABLED.... field is accessed after the RECEIVE ALL-PAGE..... field is programmed.

Description:

Stations may be programmed to Barge In on (intrude into) conversations in progress.

Instructions:

On Table 4-5, enter Y if the station should be able to Barge In to conversations in progress; N if not.

Example: not applicable

Default Value: NO

Conditions:

(a) Barge In may be blocked at a station in BLOCK BARGE ENABLED.... programming.

(b) The attendant and Hotline partner cannot override a BLOCK BARGE ENABLED.... condition at a station.

(c) Single line (25ØØ type), one button and four button telephones cannot initiate Barge In.

Related Programming:

'E' --> STATIONS FEATURES
BLOCK BARGE ENABLED.... to block Barge In.

Feature Reference:

Barge In

Field: BLOCK BARGE ENABLED....

Access:

The BLOCK BARGE ENABLED.... field is accessed after the BARGE IN ENABLED.... field is programmed.

Description:

The BLOCK BARGE ENABLED... field allows Barge In attempts to be blocked.

Instructions:

On Table 4-5, enter Y if station should be able to block Barge In attempts; N if not.

Example: not applicable

Default Value: NO

Conditions:

(a) The attendant and Hotline partner cannot override a BLOCK BARGE ENABLED.... condition at a station.

(b) All stations in the system can be programmed block Barge In.

Related Programming:

'E' --> STATIONS FEATURES
BARGE IN ENABLED.... to allow stations to Barge In.

Feature Reference:

Barge In

Field: NIGHT RING ENABLED...

Access:

The NIGHT RING ENABLED... field is accessed after the BLOCK BARGE ENABLED field is programmed.

Description:

This field enables the audible and incoming access for inbound night mode calls (on UNA lines) if CO AUDIBLE has denied ringing for that line. NIGHT RING ENABLED... allows any UNA line to be answered from any telephone (using Assigned Night Answer), regardless of CO AUDIBLE programming. Multibutton telephone users can answer the call by pressing the flashing line key. Single line (2500 type), one button and four button telephone users can answer the call by lifting the handset.

Instructions:

On Table 4-5, enter Y if station is to receive UNA audible; N if not.

Example: not applicable

Default Value: YES

Conditions:

(a) If this field, CO AUDIBLE and CO ACCESS are disabled, a night mode UNA line can be answered from a single line (2500 type), one button or four button telephone only by dialing an access code (69). Multibutton users can answer the night mode UNA call by pressing the flashing line key, even if the call doesn't ring.

(b) CO audible and CO access must be denied for the line if the NIGHT RING ENABLED... field is to control night mode audible on UNA lines.

(c) Day mode access and audible assignments are also in force at night.

Related Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] and CO ACCESS [NN..NN] to grant or deny access to calls.
'S' --> SYSTEM FEATURES
'P' --> CO TYPE to program specified lines as UNA lines.

Feature Reference:

Answering a Call
Night Service (Assigned Night Answer)

Field: DIL OFF HOOK SIGNAL..... (Call Waiting for Incoming CO Calls)

Access:

The DIL OFF HOOK SIGNAL..... field is accessed after the NIGHT RING ENABLED... field is programmed.

Description:

The DIL OFF HOOK SIGNAL..... field allows stations, busy on a call, to receive two Call Waiting beeps when a call rings into the system. The call must be on a line to which the station is normally granted CO AUDIBLE.

Instructions:

On Table 4-5, enter Y if the station is to receive CO Call Waiting beeps from an incoming call; N if not.

Example: not applicable

Default Value: NO

Conditions:

The station must have CO AUDIBLE granted for the line before CO Call Waiting beeps can be received.

Related Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] to grant audible for incoming calls.

Feature Reference:

Answering a Call
Call Waiting

Field: DIAL C.O. GROUP.....

Access:

The DIAL C.O. GROUP..... field is accessed after the DIL OFF HOOK SIGNAL..... field is programmed.

Description:

The DIAL C.O. GROUP..... field allows users of multibutton telephones to dial line groups that do not appear on their outgoing line keys. Access to these line groups is permitted only if CO ACCESS is granted for the lines in the groups being dialed.

Instructions:

On Table 4-5, enter Y if the station being programmed should be able to dial access line groups that do not appear on the outgoing line keys.

Example:

If the outgoing line keys are programmed for line groups 1 through 6, and station 306 should be able to dial access other line groups, enter Y for station 306 on Table 4-5.

Default Value: NO

Conditions:

This field does not pertain to single line (2500 type), one button and four button telephones.

Related Programming:

'E' --> STATION FEATURES
  CO ACCESS [NN..NN] IS.. to provide outgoing access to lines in the dial up line groups.
'S' --> SYSTEM FEATURES
  'G' --> CO GROUPS to assign lines to line groups.
  'N' --> OUT KEYS GROUPS to assign line groups to the multibutton telephone outgoing line keys (8-13).

Feature Reference:

Line Groups, Outgoing
Placing a Call

Field: CAMP-ON ORIGINATE.... (Send Call Waiting for Transferred Calls)

Access:

After the DIL OFF HOOK SIGNAL field is programmed, press the carriage return to access the CAMP-ON ORIGINATE.... field.

Description:

A station can be individually programmed to send CO Call Waiting tones when it transfers a call. The station receiving the Transfer must be programmed to receive CO Call Waiting for transferred calls or the tones will not be heard.

Instructions:

On Table 4-5, enter Y if the station should send CO Call Waiting tones when it transfers a call; N if not.

Example: not applicable

Default Value: YES

Conditions:

(a) The station receiving the Transfer must be programmed to receive CO Call Waiting for transferred calls or the tones will not be heard.

(b) A station can receive a transferred call on a line which it normally would be prevented from answering.

(c) This field also enables Attendant/Hotline Partner Call Waiting.

(d) An attendant with a DSS console will hear Call Waiting tones as off-hook signaling in the DSS console speaker.

Related Programming:

'E' --> STATIONS FEATURES
CALL WAIT RECEIVE..... to allow station to receive CO Call Waiting tones for transferred calls.

Feature Reference:

Call Waiting
Transfer

Field: CAMP-ON RECEIVE..... (Receive Call Waiting for Transferred Calls)

Access:

The CAMP-ON RECEIVE..... field is accessed after the CAMP-ON ORIGINATE.... field is programmed.

Description:

A station can be individually programmed to receive Call Waiting tones from calls transferred to it. If this field is not enabled, the station receiving the Transfer will not hear Call Waiting tones, even if the station which transferred the call was programmed to send them.

Instructions:

On Table 4-5, enter Y if the station should receive Call Waiting tones from Transferred calls; N if not.

Example: not applicable

Default Value: YES

Conditions:

(a) The station transferring the call must have CALL WAIT ORIGINATE.... enabled in order to send the Call Waiting tones.

(b) A station can answer a transferred call on a line to which it normally would be denied access.

(c) This field also applies to Attendant/Hotline Partner Call Waiting.

Related Programming:

'E' --> STATIONS FEATURES
CALL WAIT ORIGINATE.... to allow station which transferred the call to send CO Call Waiting tones.

Feature Reference:

Call Waiting
Transfer

Field: PAGE ZONE RECEIVED.....

Access:

The PAGE ZONE RECEIVED..... field is accessed after the CALL WAIT RECEIVE..... field is programmed.

Description:

The system has eight Page zones (61-68) and All Call Paging. Each station can be individually assigned to receive paging for any combination of Page zones.

Instructions:

On the Page Zone Received bit graph, place a 1 below each Page zone that the station can receive. Place a Ø below all other zones. The 1s and Øs create an eight bit binary number. This binary number is converted to its two digit hexadecimal equivalent using Table 4-1. The hex resultant is entered on Table 4-5.

Example:

If station 318 should receive paging for zones 5 through 8, place a 1 beneath zone 5 through 8 on the bit graph. The binary number 11110000 is converted to hexadecimal FØ and entered on Table 4-5.

Default Value:

Stations 301 through 316 are in Page zone 1 (Default = Ø1).
Stations 317 through 332 are in Page zone 2 (Default = Ø2).
Stations 333 through 348 are in Page zone 3 (Default = Ø4).
Stations 349 through 401 are in Page zone 4 (Default = Ø8)
Stations 402 through 417 are in Page zone 5 (Default = 10).
Stations 418 through 433 are in Page zone 6 (Default = 20).
Stations 434 through 449 are in Page zone 7 (Default = 40).
Stations 450 through 465 are in Page zone 8 (Default = 80).

Conditions:

A station can be in any combination of Page zones.

Related Programming:

'E' --> STATIONS FEATURES
RECEIVE ALL-PAGE..... to program station to receive All Call Paging.

Feature Reference:

Paging

PAGE ZONE RECEIVE (Page 1 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	ZONE 8	ZONE 7	ZONE 6	ZONE 5	ZONE 4	ZONE 3	ZONE 2	ZONE 1	HEX
DEFAULT	0	0	0	0	0	0	0	1	01
301									
302									
303									
304									
305									
306									
307									
308									
309									
310									
311									
312									
313									
314									
315									
316									
DEFAULT	0	0	0	0	0	0	1	0	02
317									
318									
319									
320									
321									
322									
323									
324									
325									
326									
327									
328									
329									
330									
331									
332									

BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	ZONE 8	ZONE 7	ZONE 6	ZONE 5	ZONE 4	ZONE 3	ZONE 2	ZONE 1	HEX
DEFAULT	0	0	0	0	0	1	0	0	04
333									
334									
335									
336									
337									
338									
339									
340									
341									
342									
343									
344									
345									
346									
347									
348									
DEFAULT	0	0	0	0	1	0	0	0	08
349									
350									
351									
352									
353									
354									
355									
356									
357									
358									
359									
360									
361									
362									
363									
401									

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PAGE ZONE RECEIVE (Page 2 of 2)

BIT NUMBER	7	6	5	4	3	2	1	0		BIT NUMBER	7	6	5	4	3	2	1	0	
FUNCTION	ZONE 8	ZONE 7	ZONE 6	ZONE 5	ZONE 4	ZONE 3	ZONE 2	ZONE 1	HEX	FUNCTION	ZONE 8	ZONE 7	ZONE 6	ZONE 5	ZONE 4	ZONE 3	ZONE 2	ZONE 1	HEX
DEFAULT	0	0	0	1	0	0	0	0	10	DEFAULT	0	1	0	0	0	1	0	0	40
402										434									
403										435									
404										436									
405										437									
406										438									
407										439									
408										440									
409										441									
410										442									
411										443									
412										444									
413										445									
414										446									
415										447									
416										448									
417										449									
DEFAULT	0	0	1	0	0	0	0	0	20	DEFAULT	1	0	0	0	0	0	0	0	80
418										450									
419										451									
420										452									
421										453									
422										454									
423										455									
424										456									
425										457									
426										458									
427										459									
428										460									
429										461									
430										462									
431										463									
432										464									
433										465									

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Field: PICK UP GROUP IS.....

Access:

The PICK UP GROUP IS..... field is accessed after the PAGE ZONE RECEIVED..... field is programmed.

Description:

Stations may be grouped into pickup groups. A call ringing into a pickup group can be answered from any station in the group, regardless of CO AUDIBLE assignments. The system has a maximum of 64 pickup groups.

Multibutton and four button telephone users can turn ringing on and off for calls coming into the pickup group. These users can turn incoming CO audible on and off if:

(a) A call is transferred to another station in the pickup group.

OR

(b) The call is an intra-group call that does not normally ring at the user's station (i.e., CO AUDIBLE denied).

Instructions:

On Table 4-5, indicate the number (Ø1-64) of the pickup group to which the station is assigned.

Example: not applicable

Default Value: ØØ

Conditions:

(a) A station can be assigned to only one pickup group. Any number of stations can be assigned to one pickup group.

(b) Incoming CO audible cannot be turned on and off for calls that normally ring at a station (i.e., allowed by CO AUDIBLE [NN..NN] IS..). In addition, ringing for a call transferred to a station cannot be turned on and off by that station.

(c) Single line (2500 type) and one button telephone users cannot turn ringing on and off for calls transferred to other stations in the pickup group. Ringing also cannot be turned on and off for intra-group calls that normally do not ring at these stations.

Related Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] IS.. to assign audible and incoming access for lines.

Feature Reference:

Answering a Call
Call Pickup, Group
Transfer

Field: PRIVATE LINE.....IS...

Access:

The PRIVATE LINE.....IS... field is accessed after the PICK UP GROUP IS..... field is programmed.

Description:

A multibutton station can have a line designated in PRIVATE LINE.....IS... programming as a Private Line. The TCX-128 can accommodate up to 32 Private Lines. A line designated in the PRIVATE LINE.....IS... field has the the following characteristics:

(a) Multibutton users place and answer calls on the Private Line using incoming line key 5.

(b) The line cannot be used by any other station in the system to place calls. The CO ACCESS [NN..NN] IS.. field is automatically changed for every other station in the system as soon as the restricted access line is assigned.

(c) The line will ring and can be answered by any other station in the system if CO AUDIBLE [NN..NN] IS.. programming permits it. It can also be transferred after it has been answered. If the line should ring only as a Private Line, CO AUDIBLE [NN.NN] IS.. should be denied for that line at all other stations in the system.

Instructions:

If the station is to have a Private Line, enter the number of the line (Ø1-32) on Table 4-5.

Example:

If station 316 is to have line 6 as a restricted access line, enter Ø6 for the PRIVATE LINE.....IS... field on Table 4-5.

Default Value: NONE

Conditions:

(a) A line assigned in the PRIVATE LINE.....IS... field will ring and can be answered by any other station in the system if CO AUDIBLE [NN..NN] IS .. programming permits it.

(b) If a station with a Private Line is part of a pickup group, the other stations in the group will not be able to use the PKUP key to answer the call.

(c) When the system is put in the night mode, a Private Line cannot be accessed from a single line (2500 type), one button and four button telephone by dialing 69; cannot have ringing rerouted using Assigned Night Answer; will not send audio to Alternate Audio Ports; and will not activate a night ring relay. Since Private Lines will not excite the loud ring relay, they should not be assigned as Universal Night Answer lines in 'P' --> CO TYPE.

(d) A Private Line can be shared by more than one station.

(e) Toll Restriction always applies to calls made on a Private Line.

Related Programming:

'E' --> STATIONS FEATURES
CO AUDIBLE [NN..NN] IS.. to prevent other stations in the system from answering incoming calls on the Private Line.
CO ACCESS [NN..NN] IS.. is automatically denied for the Private Line for all other stations in the system.

Feature Reference:

Answering a Call
Night Service
Placing a Call
Private Line

Table 4-1 BINARY TO HEXADECIMAL CONVERSION CHART

TO CONVERT	ENTER	TO CONVERT	ENTER	TO CONVERT	ENTER	TO CONVERT	ENTER
0000 0000	00	0100 0000	40	1000 0000	80	1100 0000	C0
0000 0001	01	0100 0001	41	1000 0001	81	1100 0001	C1
0000 0010	02	0100 0010	42	1000 0010	82	1100 0010	C2
0000 0011	03	0100 0011	43	1000 0011	83	1100 0011	C3
0000 0100	04	0100 0100	44	1000 0100	84	1100 0100	C4
0000 0101	05	0100 0101	45	1000 0101	85	1100 0101	C5
0000 0110	06	0100 0110	46	1000 0110	86	1100 0110	C6
0000 0111	07	0100 0111	47	1000 0111	87	1100 0111	C7
0000 1000	08	0100 1000	48	1000 1000	88	1100 1000	C8
0000 1001	09	0100 1001	49	1000 1001	89	1100 1001	C9
0000 1010	0A	0100 1010	4A	1000 1010	8A	1100 1010	CA
0000 1011	0B	0100 1011	4B	1000 1011	8B	1100 1011	CB
0000 1100	0C	0100 1100	4C	1000 1100	8C	1100 1100	CC
0000 1101	0D	0100 1101	4D	1000 1101	8D	1100 1101	CD
0000 1110	0E	0100 1110	4E	1000 1110	8E	1100 1110	CE
0000 1111	0F	0100 1111	4F	1000 1111	8F	1100 1111	CF
0001 0000	10	0101 0000	50	1001 0000	90	1101 0000	D0
0001 0001	11	0101 0001	51	1001 0001	91	1101 0001	D1
0001 0010	12	0101 0010	52	1001 0010	92	1101 0010	D2
0001 0011	13	0101 0011	53	1001 0011	93	1101 0011	D3
0001 0100	14	0101 0100	54	1001 0100	94	1101 0100	D4
0001 0101	15	0101 0101	55	1001 0101	95	1101 0101	D5
0001 0110	16	0101 0110	56	1001 0110	96	1101 0110	D6
0001 0111	17	0101 0111	57	1001 0111	97	1101 0111	D7
0001 1000	18	0101 1000	58	1001 1000	98	1101 1000	D8
0001 1001	19	0101 1001	59	1001 1001	99	1101 1001	D9
0001 1010	1A	0101 1010	5A	1001 1010	9A	1101 1010	DA
0001 1011	1B	0101 1011	5B	1001 1011	9B	1101 1011	DB
0001 1100	1C	0101 1100	5C	1001 1100	9C	1101 1100	DC
0001 1101	1D	0101 1101	5D	1001 1101	9D	1101 1101	DD
0001 1110	1E	0101 1110	5E	1001 1110	9E	1101 1110	DE
0001 1111	1F	0101 1111	5F	1001 1111	9F	1101 1111	DF
0010 0000	20	0110 0000	60	1010 0000	A0	1110 0000	EO
0010 0001	21	0110 0001	61	1010 0001	A1	1110 0001	E1
0010 0010	22	0110 0010	62	1010 0010	A2	1110 0010	E2
0010 0011	23	0110 0011	63	1010 0011	A3	1110 0011	E3
0010 0100	24	0110 0100	64	1010 0100	A4	1110 0100	E4
0010 0101	25	0110 0101	65	1010 0101	A5	1110 0101	E5
0010 0110	26	0110 0110	66	1010 0110	A6	1110 0110	E6
0010 0111	27	0110 0111	67	1010 0111	A7	1110 0111	E7
0010 1000	28	0110 1000	68	1010 1000	A8	1110 1000	E8
0010 1001	29	0110 1001	69	1010 1001	A9	1110 1001	E9
0010 1010	2A	0110 1010	6A	1010 1010	AA	1110 1010	EA
0010 1011	2B	0110 1011	6B	1010 1011	AB	1110 1011	EB
0010 1100	2C	0110 1100	6C	1010 1100	AC	1110 1100	EC
0010 1101	2D	0110 1101	6D	1010 1101	AD	1110 1101	ED
0010 1110	2E	0110 1110	6E	1010 1110	AE	1110 1110	EE
0010 1111	2F	0110 1111	6F	1010 1111	AF	1110 1111	EF
0011 0000	30	0111 0000	70	1011 0000	B0	1111 0000	FO
0011 0001	31	0111 0001	71	1011 0001	B1	1111 0001	F1
0011 0010	32	0111 0010	72	1011 0010	B2	1111 0010	F2
0011 0011	33	0111 0011	73	1011 0011	B3	1111 0011	F3
0011 0100	34	0111 0100	74	1011 0100	B4	1111 0100	F4
0011 0101	35	0111 0101	75	1011 0101	B5	1111 0101	F5
0011 0110	36	0111 0110	76	1011 0110	B6	1111 0110	F6
0011 0111	37	0111 0111	77	1011 0111	B7	1111 0111	F7
0011 1000	38	0111 1000	78	1011 1000	B8	1111 1000	F8
0011 1001	39	0111 1001	79	1011 1001	B9	1111 1001	F9
0011 1010	3A	0111 1010	7A	1011 1010	BA	1111 1010	FA
0011 1011	3B	0111 1011	7B	1011 1011	BB	1111 1011	FB
0011 1100	3C	0111 1100	7C	1011 1100	BC	1111 1100	FC
0011 1101	3D	0111 1101	7D	1011 1101	BD	1111 1101	FD
0011 1110	3E	0111 1110	7E	1011 1110	BE	1111 1110	FE
0011 1111	3F	0111 1111	7F	1011 1111	BF	1111 1111	FF

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Table 4-2 PROGRAM RECORD FORM, SYSTEM, TCX-128 (Page 1 of 2)

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
Operators & DSS		
OPERATOR 1 IS	301	___ ___ ___
DSS OPERATOR 1 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 1 IS	NONE	___ ___ ___
OPERATOR 2 IS	NONE	___ ___ ___
DSS OPERATOR 2 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 2 IS	NONE	___ ___ ___
OPERATOR 3 IS	NONE	___ ___ ___
DSS OPERATOR 3 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 3 IS	NONE	___ ___ ___
OPERATOR 4 IS	NONE	___ ___ ___
DSS OPERATOR 4 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 4 IS	NONE	___ ___ ___
OPERATOR 5 IS	NONE	___ ___ ___
DSS OPERATOR 5 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 5 IS	NONE	___ ___ ___
OPERATOR 6 IS	NONE	___ ___ ___
DSS OPERATOR 6 IS	NONE	___ ___ ___
ALTERNATE OPERATOR 6 IS	NONE	___ ___ ___
Timers		
HOLD RECALL TIMER (SEC)	060	___ ___ ___
ORBIT RECALL TIMER (SEC)	060	___ ___ ___
PAUSE TIME-OUT (SEC)	006	___ ___ ___
FLASH TIMER (N*50MSEC)	020	___ ___ ___
DIAL TONE TIME-OUT (SEC)	002	___ ___ ___
SMDR TIMER (SEC)	030	___ ___ ___
TRANS RECALL (SEC)	120	___ ___ ___
Least Cost Routing		
LCR ENABLED	NO	___
LCR SERVICE #01		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #02		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #03		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #04		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #05		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #06		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #07		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #08		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #09		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
LCR SERVICE #10		
LINE GROUP	77	___ ___
OCC DIALUP SYS BIN	00	___ ___
FX SERVICE/OTHER 1/0	00	___ ___
Relays Control		
RELAY #1 CONTROL	00	___ ___
RELAY #2 CONTROL	00	___ ___
RELAY #3 CONTROL	00	___ ___
RECALL #4 CONTROL	00	___ ___
CO Groups		
LINE 01 GROUP IS	01	___ ___
LINE 02 GROUP IS	01	___ ___
LINE 03 GROUP IS	01	___ ___
LINE 04 GROUP IS	01	___ ___
LINE 05 GROUP IS	01	___ ___
LINE 06 GROUP IS	01	___ ___
LINE 07 GROUP IS	01	___ ___
LINE 08 GROUP IS	01	___ ___
LINE 09 GROUP IS	02	___ ___
LINE 10 GROUP IS	02	___ ___
LINE 11 GROUP IS	02	___ ___
LINE 12 GROUP IS	02	___ ___
LINE 13 GROUP IS	02	___ ___
LINE 14 GROUP IS	02	___ ___
LINE 15 GROUP IS	02	___ ___
LINE 16 GROUP IS	02	___ ___
LINE 17 GROUP IS	03	___ ___
LINE 18 GROUP IS	03	___ ___
LINE 19 GROUP IS	03	___ ___
LINE 20 GROUP IS	03	___ ___
LINE 21 GROUP IS	03	___ ___
LINE 22 GROUP IS	03	___ ___
LINE 23 GROUP IS	03	___ ___
LINE 24 GROUP IS	03	___ ___
LINE 25 GROUP IS	77	___ ___
LINE 26 GROUP IS	77	___ ___
LINE 27 GROUP IS	77	___ ___
LINE 28 GROUP IS	77	___ ___
LINE 29 GROUP IS	77	___ ___
LINE 30 GROUP IS	77	___ ___
LINE 31 GROUP IS	77	___ ___
LINE 32 GROUP IS	77	___ ___

Table 4-2 PROGRAM RECORD FORM, SYSTEM, TCX-128 (Page 2 of 2)

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
CO Type		
LINE 01 TYPE IS	01	
LINE 02 TYPE IS	01	
LINE 03 TYPE IS	01	
LINE 04 TYPE IS	01	
LINE 05 TYPE IS	01	
LINE 06 TYPE IS	01	
LINE 07 TYPE IS	01	
LINE 08 TYPE IS	01	
LINE 09 TYPE IS	01	
LINE 10 TYPE IS	01	
LINE 11 TYPE IS	01	
LINE 12 TYPE IS	01	
LINE 13 TYPE IS	01	
LINE 14 TYPE IS	01	
LINE 15 TYPE IS	01	
LINE 16 TYPE IS	01	
LINE 17 TYPE IS	01	
LINE 18 TYPE IS	01	
LINE 19 TYPE IS	01	
LINE 20 TYPE IS	01	
LINE 21 TYPE IS	01	
LINE 22 TYPE IS	01	
LINE 23 TYPE IS	01	
LINE 24 TYPE IS	01	
LINE 25 TYPE IS	01	
LINE 26 TYPE IS	01	
LINE 27 TYPE IS	01	
LINE 28 TYPE IS	01	
LINE 29 TYPE IS	01	
LINE 30 TYPE IS	01	
LINE 31 TYPE IS	01	
LINE 32 TYPE IS	01	
LINE 31 TYPE IS	01	
LINE 32 TYPE IS	01	
External Outputs		
OUTPUT 01 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 02 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 03 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 04 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 05 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 06 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 07 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	
OUTPUT 08 CONTROL IS	20	
ALTERNATE AUDIO PORT IS	NONE	

FIELD DESCRIPTION	DEFAULT ENTRY	PROGRAM ENTRY
Out Key Groups		
OUT KEY #1 SELECT GROUP #	01	
OUT KEY #2 SELECT GROUP #	01	
OUT KEY #3 SELECT GROUP #	02	
OUT KEY #4 SELECT GROUP #	02	
OUT KEY #5 SELECT GROUP #	03	
OUT KEY #6 SELECT GROUP #	04	
System Options		
ENTER OPTION #		
OPTION ENABLED 01 Enable LCR to Override CO Access	YES	
OPTION ENABLED 02 Enable Music On Hold	YES	
OPTION ENABLED 03 Enable Conference for Outgoing Line Key	YES	
OPTION ENABLED 04 Enable Single Line Telephone Distinctive Ringing	NO	
OPTION ENABLED 05 Line Supervision	YES	
OPTION ENABLED 06 Enable Forced Intercom Ringing	NO	
OPTION ENABLED 07 DTMF Speed (Half / Full)	YES	
OPTION ENABLED 08 Drop Pulse Supervision	NO	
OPTION ENABLED 09 Reserve Link for CO Ringing	YES	
OPTION ENABLED 13 Enable SMDR for Long Distance Calls	YES	
OPTION ENABLED 14 Enable 16-Digit Limit for Manual Dialing	NO	
OPTION ENABLED 15 Enable SMDR for Calls to Outside Operator	YES	
OPTION ENABLED 16 Enable SMDR to Print Speed Dial Bin Numbers	NO	
OPTION ENABLED 17 Enable SMDR for Local (7-digit) Calls	YES	
OPTION ENABLED 19 Enable Call Forwarding Beep	YES	

Table 4-3 OFFICE CODE TYPES (Page 1 of 6)

3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04
100		X				150		X				200					
101		X				151		X				201					
102		X				152		X				202					
103		X				153		X				203					
104		X				154		X				204					
105		X				155		X				205					
106		X				156		X				206					
107		X				157		X				207					
108		X				158		X				208					
109		X				159		X				209					
110		X				160		X				210					
111		X				161		X				211					
112		X				162		X				212					
113		X				163		X				213					
114		X				164		X				214					
115		X				165		X				215					
116		X				166		X				216					
117		X				167		X				217					
118		X				168		X				218					
119		X				169		X				219					
120		X				170		X				220					
121		X				171		X				221					
122		X				172		X				222					
123		X				173		X				223					
124		X				174		X				224					
125		X				175		X				225					
126		X				176		X				226					
127		X				177		X				227					
128		X				178		X				228					
129		X				179		X				229					
130		X				180		X				230					
131		X				181		X				231					
132		X				182		X				232					
133		X				183		X				233					
134		X				184		X				234					
135		X				185		X				235					
136		X				186		X				236					
137		X				187		X				237					
138		X				188		X				238					
139		X				189		X				239					
140		X				190		X				240					
141		X				191		X				241					
142		X				192		X				242					
143		X				193		X				243					
144		X				194		X				244					
145		X				195		X				245					
146		X				196		X				246					
147		X				197		X				247					
148		X				198		X				248					
149		X				199		X				249					

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Table 4-3 OFFICE CODE TYPES (Page 2 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
250						300						350					
251						301						351					
252						302						352					
253						303						353					
254						304						354					
255						305						355					
256						306						356					
257						307						357					
258						308						358					
259						309						359					
260						310						360					
261						311						361					
262						312						362					
263						313						363					
264						314						364					
265						315						365					
266						316						366					
267						317						367					
268						318						368					
269						319						369					
270						320						370					
271						321						371					
272						322						372					
273						323						373					
274						324						374					
275						325						375					
276						326						376					
277						327						377					
278						328						378					
279						329						379					
280						330						380					
281						331						381					
282						332						382					
283						333						383					
284						334						384					
285						335						385					
286						336						386					
287						337						387					
288						338						388					
289						339						389					
290						340						390					
291						341						391					
292						342						392					
293						343						393					
294						344						394					
295						345						395					
296						346						396					
297						347						397					
298						348						398					
299						349						399					

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Table 4-3 OFFICE CODE TYPES (Page 3 of 6)

3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04
400						450						500					
401						451						501					
402						452						502					
403						453						503					
404						454						504					
405						455						505					
406						456						506					
407						457						507					
408						458						508					
409						459						509					
410						460						510					
411						461						241					
412						462						512					
413						463						513					
414						464						514					
415						465						515					
416						466						516					
417						467						517					
418						468						518					
419						469						519					
420						470						520					
421						471						521					
422						472						552					
423						473						523					
424						474						524					
425						475						525					
426						476						526					
427						477						527					
428						478						528					
429						479						529					
430						480						530					
431						481						531					
432						482						532					
433						483						533					
434						484						534					
435						485						535					
436						486						536					
437						487						537					
438						488						538					
439						489						539					
440						490						540					
441						491						541					
442						492						542					
443						493						543					
444						494						544					
445						495						545					
446						496						546					
447						497						547					
448						498						548					
449						499						549					

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Table 4-3 OFFICE CODE TYPES (Page 4 of 6)

3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE					3-DIGIT	OFFICE CODE TYPE				
EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04	EXCHANGE	00	01	02	03	04
550						600						650					
551						601						651					
552						602						652					
553						603						653					
554						604						654					
555						605						655					
556						606						656					
557						607						657					
558						608						658					
559						609						659					
560						610						660					
561						611						661					
562						612						662					
563						613						663					
564						614						664					
565						615						665					
566						616						666					
567						617						667					
568						618						668					
569						619						669					
570						620						670					
571						621						671					
572						622						672					
573						623						673					
574						624						674					
575						625						675					
576						626						676					
577						627						677					
578						628						678					
579						629						679					
580						630						680					
581						631						681					
582						632						682					
583						633						683					
584						634						684					
585						635						685					
586						636						686					
587						637						687					
588						638						688					
589						639						689					
590						640						690					
591						641						691					
592						642						692					
593						643						693					
594						644						694					
595						645						695					
596						646						696					
597						647						697					
598						648						698					
599						649						699					

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3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04
700						750						800					
701						751						801					
702						752						802					
703						753						803					
704						754						804					
705						755						805					
706						756						806					
707						757						807					
708						758						808					
709						759						809					
710						760						810					
711						761						811					
712						762						812					
713						763						813					
714						764						814					
715						765						815					
716						766						816					
717						767						817					
718						768						818					
719						769						819					
720						770						820					
721						771						821					
722						772						822					
723						773						823					
724						774						824					
725						775						825					
726						776						826					
727						777						827					
728						778						828					
729						779						829					
730						780						830					
731						781						831					
732						782						832					
733						783						833					
734						784						834					
735						785						835					
736						786						836					
737						787						837					
738						788						838					
739						789						839					
740						790						840					
741						791						841					
742						792						842					
743						793						843					
744						794						844					
745						795						845					
746						796						846					
747						797						847					
748						798						848					
749						799						849					

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3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04	3-DIGIT EXCHANGE	OFFICE CODE TYPE 00	01	02	03	04
850						900						950					
851						901						951					
852						902						952					
853						903						953					
854						904						954					
855						905						955					
856						906						956					
857						907						957					
858						908						958					
859						909						959					
860						910						960					
861						911						961					
862						912						962					
863						913						963					
864						914						964					
865						915						965					
866						916						966					
867						917						967					
868						918						968					
869						919						969					
870						920						970					
871						921						971					
872						922						972					
873						923						973					
874						924						974					
875						925						975					
876						926						976					
877						927						977					
878						928						978					
879						929						979					
880						930						980					
881						931						981					
882						932						982					
883						933						983					
884						934						984					
885						935						985					
886						936						986					
887						937						987					
888						938						988					
889						939						989					
890						940						990					
891						941						991					
892						942						992					
893						943						993					
894						944						994					
895						945						995					
896						946						996					
897						947						997					
898						948						998					
899						949						999					

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Table 4-4 ALLOWED COS FOR AREA CODE (Page 1 of 2)

BIT	7	6	5	4	3	2	1	0		BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX	COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
200	0	0	0					1		400	0	0	0					1	
201	0	0	0					1		401	0	0	0					1	
202	0	0	0					1		402	0	0	0					1	
203	0	0	0					1		403	0	0	0					1	
204	0	0	0					1		404	0	0	0					1	
205	0	0	0					1		405	0	0	0					1	
206	0	0	0					1		406	0	0	0					1	
207	0	0	0					1		407	0	0	0					1	
208	0	0	0					1		408	0	0	0					1	
209	0	0	0					1		409	0	0	0					1	
210	0	0	0					1		410	0	0	0					1	
211	0	0	0					1		411	0	0	0					1	
212	0	0	0					1		412	0	0	0					1	
213	0	0	0					1		413	0	0	0					1	
214	0	0	0					1		414	0	0	0					1	
215	0	0	0					1		415	0	0	0					1	
216	0	0	0					1		416	0	0	0					1	
217	0	0	0					1		417	0	0	0					1	
218	0	0	0					1		418	0	0	0					1	
219	0	0	0					1		419	0	0	0					1	
300	0	0	0					1		500	0	0	0					1	
301	0	0	0					1		501	0	0	0					1	
302	0	0	0					1		502	0	0	0					1	
303	0	0	0					1		503	0	0	0					1	
304	0	0	0					1		504	0	0	0					1	
305	0	0	0					1		505	0	0	0					1	
306	0	0	0					1		506	0	0	0					1	
307	0	0	0					1		507	0	0	0					1	
308	0	0	0					1		508	0	0	0					1	
309	0	0	0					1		509	0	0	0					1	
310	0	0	0					1		510	0	0	0					1	
311	0	0	0					1		511	0	0	0					1	
312	0	0	0					1		512	0	0	0					1	
313	0	0	0					1		513	0	0	0					1	
314	0	0	0					1		514	0	0	0					1	
315	0	0	0					1		515	0	0	0					1	
316	0	0	0					1		516	0	0	0					1	
317	0	0	0					1		517	0	0	0					1	
318	0	0	0					1		518	0	0	0					1	
319	0	0	0					1		519	0	0	0					1	

Table 4-4 ALLOWED COS FOR AREA CODE (Page 2 of 2)

BIT	7	6	5	4	3	2	1	0		BIT	7	6	5	4	3	2	1	0	
COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX	COS	X	X	C-5	C-4	C-3	C-2	C-1	ON	HEX
600	0	0	0					1		800	0	0	0					1	
601	0	0	0					1		801	0	0	0					1	
602	0	0	0					1		802	0	0	0					1	
603	0	0	0					1		803	0	0	0					1	
604	0	0	0					1		804	0	0	0					1	
605	0	0	0					1		805	0	0	0					1	
606	0	0	0					1		806	0	0	0					1	
607	0	0	0					1		807	0	0	0					1	
608	0	0	0					1		808	0	0	0					1	
609	0	0	0					1		809	0	0	0					1	
610	0	0	0					1		810	0	0	0					1	
611	0	0	0					1		811	0	0	0					1	
612	0	0	0					1		812	0	0	0					1	
613	0	0	0					1		813	0	0	0					1	
614	0	0	0					1		814	0	0	0					1	
615	0	0	0					1		815	0	0	0					1	
616	0	0	0					1		816	0	0	0					1	
617	0	0	0					1		817	0	0	0					1	
618	0	0	0					1		818	0	0	0					1	
619	0	0	0					1		819	0	0	0					1	
700	0	0	0					1		900	0	0	0					1	
701	0	0	0					1		901	0	0	0					1	
702	0	0	0					1		902	0	0	0					1	
703	0	0	0					1		903	0	0	0					1	
704	0	0	0					1		904	0	0	0					1	
705	0	0	0					1		905	0	0	0					1	
706	0	0	0					1		906	0	0	0					1	
707	0	0	0					1		907	0	0	0					1	
708	0	0	0					1		908	0	0	0					1	
709	0	0	0					1		909	0	0	0					1	
710	0	0	0					1		910	0	0	0					1	
711	0	0	0					1		911	0	0	0					1	
712	0	0	0					1		912	0	0	0					1	
713	0	0	0					1		913	0	0	0					1	
714	0	0	0					1		914	0	0	0					1	
715	0	0	0					1		915	0	0	0					1	
716	0	0	0					1		916	0	0	0					1	
717	0	0	0					1		917	0	0	0					1	
718	0	0	0					1		918	0	0	0					1	
719	0	0	0					1		919	0	0	0					1	

Table 4-5 PROGRAM RECORD FORM, STATIONS, TCX-128 (Page 1 of 4)

STA. NO.	PORT NO.[1]		TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8[2]	CO AUD 9-16[2]	CO AUD 17-24[2]	CO AUD 25-32[2]	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP ON ORIG.	CAMP ON RECEIVE	PAGE ZONE REC'D[3]	PICK UP GROUP	PRIVATE LINE
INITIALIZED			KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
301	001																					01		
302	002																					01		
303	003																					01		
304	004																					01		
305	005																					01		
306	006																					01		
307	007																					01		
308	008																					01		
309	009																					01		
310	010																					01		
311	011																					01		
312	012																					01		
313	013																					01		
314	014																					01		
315	015																					01		
316	016																					01		
317	017																					02		
318	018																					02		
319	019																					02		
320	020																					02		
321	021																					02		
322	022																					02		
323	023																					02		
324	024																					02		
325	025																					02		
326	026																					02		
327	027																					02		
328	028																					02		
329	029																					02		
330	030																					02		
331	031																					02		
332	032																					02		

[1] Enter the port number to which the station is assigned if different from the initialized assignment.

[2] For default assignment, refer to page 4-84.

[3] Default assignments indicated in left side of each block.

TS013A
March 1985

Printed in U.S.A.

Table 4-5 PROGRAM RECORD FORM, STATIONS, TCX-128 (Page 2 of 4)

STA. NO.	PORT NO.[1]		TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8[2]	CO AUD 9-16[2]	CO AUD 17-24[2]	CO AUD 25-32[2]	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP ON ORIG.	CAMP ON RECEIVE	PAGE ZONE REC'D[3]	PICK UP GROUP	PRIVATE LINE
INITIALIZED			KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
333	033																					04		
334	034																					04		
335	035																					04		
336	036																					04		
337	037																					04		
338	038																					04		
339	039																					04		
340	040																					04		
341	041																					04		
342	042																					04		
343	043																					04		
344	044																					04		
345	045																					04		
346	046																					04		
347	047																					04		
348	048																					04		
349	049																					03		
350	050																					03		
351	051																					03		
352	052																					03		
353	053																					03		
354	054																					03		
355	055																					03		
356	056																					03		
357	057																					03		
358	058																					03		
359	059																					03		
360	060																					03		
361	061																					03		
362	062																					03		
363	063																					03		
401	064																					03		

[1] Enter the port number to which the station is assigned if different from the initialized assignment.

[2] For default assignment, refer to page 4-84.

[3] Default assignments indicated in left side of each block.

T5013A
March 1985

Printed in U.S.A.

Table 4-5 PROGRAM RECORD FORM, STATIONS, TCX-128 (Page 3 of 4)

STA. NO.	PORT NO.[1]		TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8[2]	CO AUD 9-16[2]	CO AUD 17-24[2]	CO AUD 25-32[2]	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP ON ORIG.	CAMP ON RECEIVE	PAGE ZONE REC'D[3]	PICK UP GROUP	PRIVATE LINE
INITIALIZED			KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
402	065																					10		
403	066																					10		
404	067																					10		
405	068																					10		
406	069																					10		
407	070																					10		
408	071																					10		
409	072																					10		
410	073																					10		
411	074																					10		
412	075																					10		
413	076																					10		
414	077																					10		
415	078																					10		
416	079																					10		
417	080																					10		
418	081																					20		
419	082																					20		
420	083																					20		
421	084																					20		
422	085																					20		
423	086																					20		
424	087																					20		
425	088																					20		
426	089																					20		
427	090																					20		
428	091																					20		
429	092																					20		
430	093																					20		
431	094																					20		
432	095																					20		
433	096																					20		

[1] Enter the port number to which the station is assigned if different from the initialized assignment.

[2] For default assignment, refer to page 4-04.

[3] Default assignments indicated in left side of each block.

Table 4-5 PROGRAM RECORD FORM, STATIONS, TCX-128 (Page 4 of 4)

STA. NO.	PORT NO.[1]		TYPE OF PHONE	HOTLINE KEY	CLASS OF SERVICE	CO AUD 1-8[2]	CO AUD 9-16[2]	CO AUD 17-24[2]	CO AUD 25-32[2]	CO ACC 1-8	CO ACC 9-16	CO ACC 17-24	CO ACC 25-32	RECEIVE ALL-PAGE	BARGE IN ENABLED	BLOCK BARGE ENABLED	NIGHT RING ENABLED	DIL OFF HOOK SIGNAL	DIAL CO GROUP	CAMP ON ORIG.	CAMP ON RECEIVE	PAGE ZONE REC'D[3]	PICK UP GROUP	PRIVATE LINE
INITIALIZED			KEY		00					FF	FF	FF	FF	YES	NO	NO	YES	NO	NO	YES	YES		00	NONE
434	097																					40		
435	098																					40		
436	099																					40		
437	100																					40		
438	101																					40		
439	102																					40		
440	103																					40		
441	104																					40		
442	105																					40		
443	106																					40		
444	107																					40		
445	108																					40		
446	109																					40		
447	110																					40		
448	111																					40		
449	112																					40		
450	113																					80		
451	114																					80		
452	115																					80		
453	116																					80		
454	117																					80		
455	118																					80		
456	119																					80		
457	120																					80		
458	121																					80		
459	122																					80		
460	123																					80		
461	124																					80		
462	125																					80		
463	126																					80		
464	127																					80		
465	128																					80		

[1] Enter the port number to which the station is assigned if different from the initialized assignment.

[2] For default assignment, refer to page 4-84.

[3] Default assignments indicated in left side of each block.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 5, INSTALLATION

1. INTRODUCTION

1.01 The INSTALLATION Section provides detailed procedures for installing the components of an TCX-128 Computerized Branch Exchange. Read this entire section. Installation of optional equipment is presented in Section 6 of this manual.

2. PREPARATION

2.01 Before beginning the installation, be sure the installation site is adequate. The site should comply with the guidelines of the Bell Functional Product Class Criteria (PUB 48002 - September 1978), section 3.4.3.2, paragraph C, Indoors With Environmental Control.

2.02 The Key Service Unit (KSU), expansion cabinet and related control equipment mounting area should be clean, dry, temperature controlled and not accessible to unauthorized personnel. The site should be away from static electricity (dry copiers), caustic chemicals and heavy machinery. There should be ample room to mount and maintain the equipment.

NOTE: Standard quad station cable (or equivalent) is used to connect the station blocks to the telephone instruments. All station cable, including the cable for the DSS console, must be home run to the connecting blocks. Cable runs must not exceed 2000 feet for keysets, 10,000 feet for single line (2500 type) and one button sets and 800 feet for display telephones.

WARNING: OPERATION OF THIS EQUIPMENT OUTSIDE OF THESE LIMITS WILL DECREASE ITS EXPECTED RELIABILITY AND WILL VOID ANY APPLICABLE WARRANTY.

2.03 There must be a dedicated 3-wire 120 V AC (nominal), 60 Hz, 15 AMP circuit for each power supply. If any other receptacles are on the same branch, they must be clearly labeled (to prohibit use) or disabled. To prevent accidental shutdown, a lock clip on the service panel is recommended. The outlet must be a three-prong receptacle (NEMA 5-15R). A three-prong to two-prong adaptor must never be used. The receptacle must be within 8 feet (2.4m) of the power supply location.

NOTE: If an external paging amplifier or other external device is to be installed, it must be connected to an AC circuit other than the dedicated AC line. In addition, all electrical tools (such as an electric drill) must not be plugged into the dedicated AC receptacle.

2.04 An earth ground connection, in addition to the third wire ground, must be within 25 feet (7.6m) of the installation. The grounding wire must be 14 AWG or larger insulated wire. The ground wire should be as short as possible. A cold water pipe that is metallic throughout (including all joints and sections) will generally provide a suitable ground. Check the ground to ensure continuity. If a cold water piping system is found to be inadequate, an alternate grounding means must be used.

2.05 The operating telephone company must be notified of the proposed cut-over date and supplied with the information outlined in Section 1 of this manual. The telco lines, terminated in RJ21X connectors, must be within 25 feet (7.6m) of the KSU location.

2.06 Read this entire section and prepare a KSU installation layout similar to Figure 5-1. Customize the layout for the particular site application.

Site Summary Check

- Location acceptable (para. 2.02).
- AC line(s) installed (para. 2.03).
- Provisions for ground (para. 2.04).
- Telco notified (para. 2.05).
- Telco lines available (para. 2.05).
- KSU installation layout prepared (para. 2.06).

TOOLS AND TEST EQUIPMENT

2.Ø7 The following tools are required:

(a) Tape measure for equipment layout
(b) Level for mounting equipment
(c) Drill for mounting equipment on backboard
(d) Screwdrivers (Straight and Philips)
(e) Punchdown tool for cross connecting wires
(f) Wire stripper for wiring modular jacks
(g) Wrist ground strap for removing and inserting PCBs
(h) Needle-nose pliers for strapping PCBs
(i) Digital voltmeter with a high input impedance and accuracy within 1% for testing
(j) User-provided RS-232-C compatible programming terminal
(k) Work light or flash light for working in dark areas
(l) AC power extension cords
(m) Pens or pencils for marking backboard, 66M1-5Ø blocks and modular jacks
(n) Electrical tape
(o) "Snake" for running cables through walls
(p) Sheathing tool for 25-pair cable
(q) Alignment tool for adjusting volume controls on PCBs

- FOR YOUR NOTES -

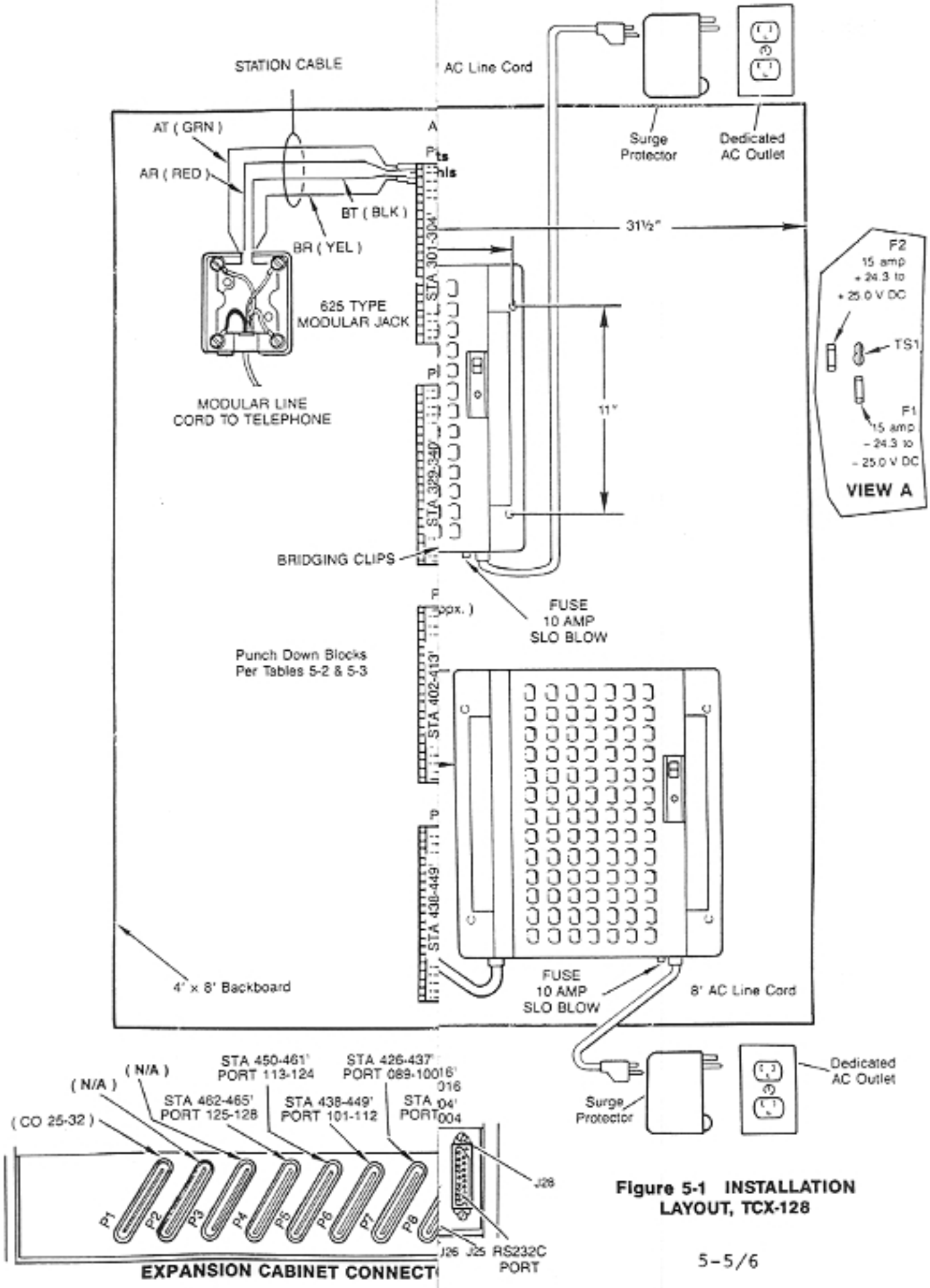

Figure 5-1 INSTALLATION LAYOUT, TCX-128

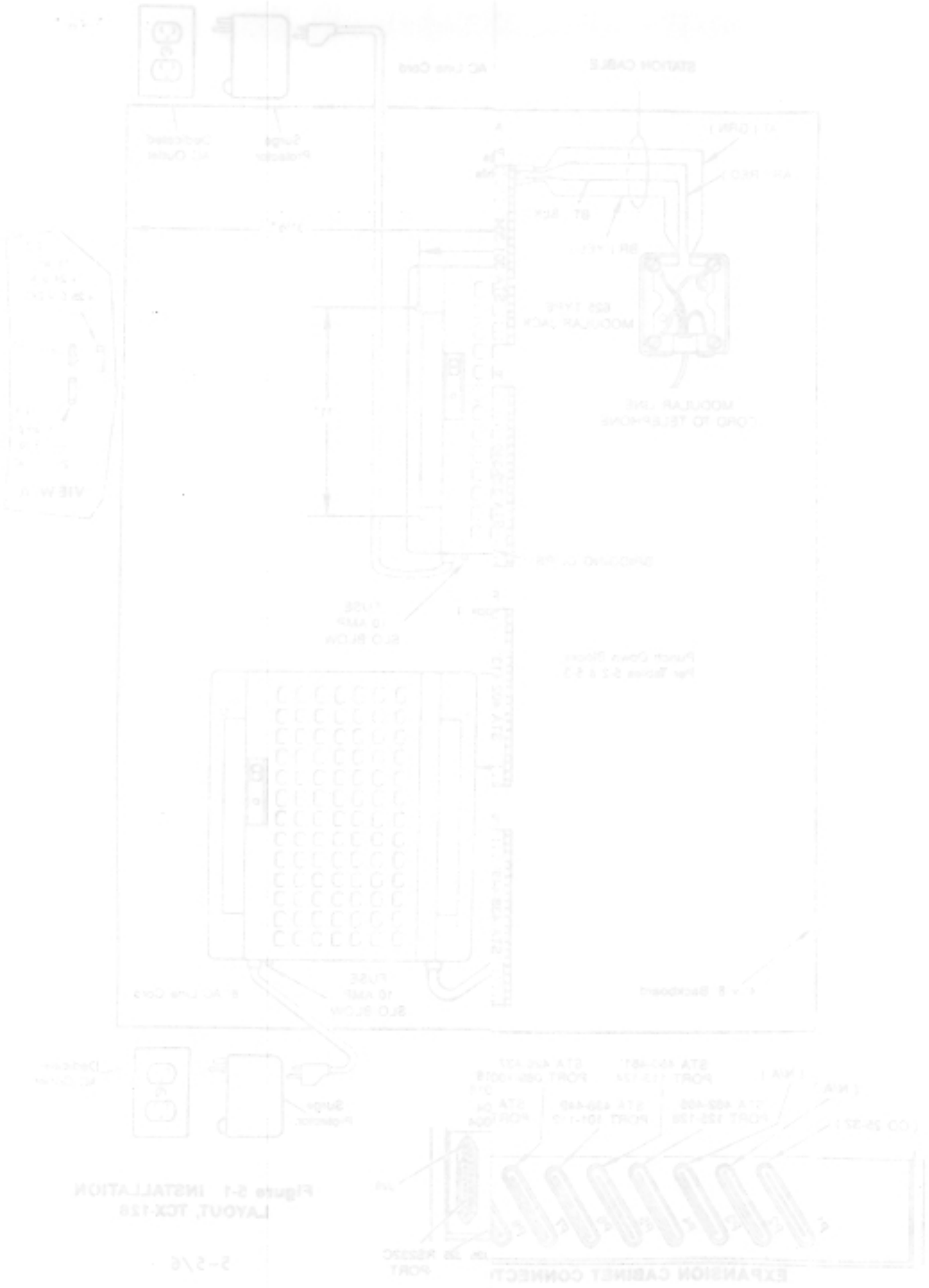

Table 5-1 INSTALLATION CHECKLIST, TCX-128

KSU, EXPANSION CABINET AND POWER SUPPLY INSTALLATION

- ☐ 1. CHECK INSTALLATION SITE (¶2.01)
  - ☐ Adequately ventilated site
  - ☐ Temperature range of 40° F (4°C) to 100° F (38°C)
  - ☐ Relative humidity of 5 to 95%, non-condensing
  - ☐ Adequate lighting conditions
  - ☐ Adequate space for servicing
  - ☐ AC line dedicated exclusively for each power supply
  - ☐ Lock-clip on service panel to prevent accidental shutdown
  - ☐ AC receptacle is NEMA 5-15R
  - ☐ Service capacity of 15 amps RMS
  - ☐ 3 prong to 2 prong adapter not used
  - ☐ Earth ground connection within 25' of installation
- ☐ 2. MOUNT BACKBOARD (¶3.02)
  - ☐ Exterior grade plywood used on damp mounting surfaces
  - ☐ Install surge protector
- ☐ 3. MOUNT KSU AND EXPANSION CABINET (¶3.05)
  - ☐ Ensure that hanger bolts are tightened
  - ☐ Check KSU fuses for correct ratings
- ☐ 4. MOUNT POWER SUPPLIES (¶3.07)
  - ☐ Ensure that power supply hanger bolts are tightened
  - ☐ Check AC input fuse for correct rating
- ☐ 5. GROUND KSU AND EXPANSION CABINET (3.10)
  - ☐ Use 14 AWG ground wire for connections
  - ☐ Connect KSU XP GND to expansion cabinet XP GND
  - ☐ Connect KSU CWP GND to earth ground
- ☐ 6. CONNECT KSU TO EXPANSION CABINET (¶3.11)
- ☐ 7. CONNECT POWER SUPPLIES TO KSU & EXP. CABINET (¶3.12)
  - ☐ Plug power supplies into AC service
- ☐ 8. MOUNT 66M1-50 BLOCKS (¶3.13)

STATION CABLING

- ☐ 9. CONNECT KSU TO BLOCKS (¶3.13)
- ☐ 10. HOMERUN STATION CABLE (¶3.14)
- ☐ 11. CONNECT STATION CABLE TO BLOCKS (¶3.14)
  - ☐ Install bridging clips
- ☐ 12. INSTALL MODULAR JACKS (¶3.15)

INSTALLING PCBS, TELEPHONES AND LINES

- ☐ 13. STRAP, SET SWITCHES AND INSTALL PCBS (¶3.16)
- ☐ 14. INSTALL TELEPHONES (¶4.01)
- ☐ 15. CHECK SYSTEM VOLTAGES (¶5.01)
  - ☐ Refer to Section 9, MAINTENANCE, if problems occur
- ☐ 16. CONNECT TELCO LINES (¶6.01)

EQUIPMENT REQUIREMENTS

2.08 Unpack the telephone equipment and compare the equipment received to a list of equipment ordered to be sure that all components are on site. Check for any physical damage.

2.09 Have the necessary installation equipment available. This includes:
- 4'x 8' sheet of exterior grade plywood, 3/4" recommended (for KSU, expansion cabinet and power supply mounting)
- 25-pair cable (female type 57 connector on one end and male on the other) to connect to the RJ21Xs from the telco
- 14 AWG ground wire
- 66M1-50 connecting blocks with bridging clips
- 25-pair cable (female type 57 connector on one end) for each 66M1-50 connecting block
- 625A, 625F or equivalent modular station jacks (screw type terminals only)
- Surge protector (1 required for each power supply)
- Miscellaneous mounting hardware and fasteners

2.10 Before starting the installation, verify that the following documents are complete and on the premises:

(a) A building plan with station location and type marked.
(b) The Order Sheet (Table 3-1) detailing equipment requirements.
(c) The Program Record Forms (Table 4-2 through 4-5) with all programming information completed.

Equipment Summary Check

- Equipment present (para. 2.08).
- Hardware present (para. 2.09).
- Necessary documents on site (para. 2.10).

3. INSTALLATION

3.01 This part is divided into three major sub-parts: KSU, Expansion Cabinet and Power Supply Installation; Station Cabling; and Installing PCBs. Read the entire section and Table 5-1 before proceeding with the actual installation.

WARNING: MODIFICATIONS OF THIS EQUIPMENT NOT EXPRESSLY SHOWN IN THIS INSTALLATION MANUAL VOID APPLICABLE WARRANTEES.

KSU, EXPANSION CABINET AND POWER SUPPLY INSTALLATION

3.Ø2 Review the installation layout prepared for the specific site. Locate the area for the plywood backboard on the wall. It should be at a convenient working height and positioned so that the power supplies are within 8 feet (2.4m) of the dedicated AC receptacles.

3.Ø3 Mount the plywood in the designated location with appropriate fasteners. Mark the equipment layout on the board using the installation layout drawing (Figure 5-1).

> WARNING: IF THE KSU POWER SUPPLY IS LOCATED CLOSER THAN 3 FEET (Ø.9m) TO THE CEILING, IT MAY OVERHEAT.

3.Ø4 A surge protector must be installed at the dedicated AC receptacle for each power supply to minimize the effects from high static voltages, low level transients and line ripple. The protector should be self-contained 3-prong grounded device with 15-amp capacity. Connect this unit according to manufacturer's instructions.

Backboard Installation Check

- Review site layout (para. 3.Ø2).
- Mount backboard and mark equipment layout (para. 3.Ø3).
- Install surge protector(s) (para. 3.Ø4).

KSU Installation

3.Ø5 Mount the KSU on the backboard as follows:

- Locate the upper right KSU mounting screw, approximately 31.5 inches (8Ø.6cm) from the right edge of the backboard and 1Ø.5 inches (26.9cm) from the top, according to Figure 5-1.
- Mark the remaining three points on the backboard that correspond to the mounting hole centers (Figure 5-1).
- Drill pilot holes at these points and insert suitable fasteners having a 1/4 inch shank diameter.
- Screw in fasteners until the clearance between the fastener head and the mounting surface is 1/4 inch.
- Mount KSU on the four fasteners and tighten each fastener until the KSU is securely attached to the mounting surface.

> CAUTION: DO NOT INSTALL PCBS AT THIS POINT.

Expansion Cabinet Installation

3.Ø6 To mount the expansion cabinet:

- Using Figure 5-1 as a guide, mark the expansion cabinet mounting hole centers.
- Drill pilot holes, screw in fasteners and mount expansion cabinet identically to the KSU.

Power Supply Installation

3.Ø7 Mount the power supplies on the backboard in the proper location. The power supplies are cooled by convection currents; therefore, they must be staggered (with the cables at the bottom of the unit).

- Mark the points on the backboard that correspond to the mounting hole centers for each power supply (Figure 5-1).
- Drill pilot holes at these points and insert suitable fasteners having a 1/4 inch shank diameter.
- Screw in fasteners until the clearance between the fastener head and the mounting surface is 1/4 inch.
- Mount the power supply on the four fasteners. Tighten each fastener until the power supply is securely attached to the mounting surface.

3.Ø8 A Thermal Protection Device is located on the KSU (Figure 5-3). When the maximum operating temperature for the system is exceeded, the Thermal Protection Device causes the reset button on the front face of the power supply to pop up, revealing a white band. This band indicates that the system is operating at dangerously high temperatures. The Thermal Protection Device will not shut down the power on the power supply.

Permanent Wiring Instructions

3.Ø9 In some installations it may be preferred to permanently wire the power supplies, rather than plugging them into the dedicated AC receptacle. If permanent wiring is required, follow the permanent wiring instructions on the tag attached to the power supply, and consult local and national codes.

WARNING: DISCONNECT POWER SUPPLIES FROM AC POWER SOURCE BEFORE BEGINNING THE PERMANENT WIRING PROCEDURE.

NOTE: Permanent wiring must be done by a qualified electrician.

Grounding the KSU and Expansion Cabinet

3.1Ø Ground the KSU by connecting the 14AWG ground wire to a cold water pipe or other known ground. The ground wire should be as short as possible. Connect the ground wire to the grounding lug (CWP GND) on the KSU backplane and the grounding clamp on the cold water pipe (Figure 5-1). To ground the expansion cabinet, run a short 14AWG ground wire from the XP GND lug on the KSU to the XP GND lug on the expansion cabinet.

Connecting the KSU to the Expansion Cabinet

3.11 The three multiconductor ribbon cables are used to connect the expansion cabinet to the KSU. The ribbon cable connections are as follows:

KSU	EXPANSION CABINET
J25	J19 (18")
J26	J18 (15")
J27	J17 (15")

Connecting the Power Supplies

CAUTION: DO NOT ALTER THE CABLE WHICH CONNECTS POWER SUPPLY TO THE CABINET. ALTERING CABLE WILL CHANGE LEAD RESISTANCE AND COULD RESULT IN DAMAGE TO THE POWER SUPPLY.

3.12 Connect the power supplies to the KSU and expansion cabinet. The shorter, multiconductor cable has a connector that plugs into the connector on the right side of the cabinet. This connector is keyed to plug in only one way. Plug the power supplies into the surge protectors but do not turn the units on.

3.13 Mount the connecting blocks to the left of the KSU (Figure 5-1). The number of blocks is dependent on the number of Station PCBs to be installed in the system (see Table 3-1). Connect each 25-pair cable (with type 57 female connector on one end) to the connecting blocks using Tables 5-2 and 5-3 for station assignments. The female connectors mate with the station plugs (P3-P8 in the KSU, P4-P9 in the expansion cabinet).

Equipment Mounting Check

- Mount KSU (para. 3.Ø5).
- Mount expansion cabinet (para. 3.Ø6)
- Mount power supplies (para. 3.Ø7)
- Ground KSU and expansion cabinet (para. 3.1Ø).
- Connect KSU to expansion cabinet (para. 3.11).
- Connect power supplies and install surge protectors (para. 3.12).
- Mount connecting blocks (para. 3.13).
- Wire KSU to connecting blocks (para. 3.13).

Table 5-2 BLOCK CONNECTIONS, KSU, TCX-128

25 Pair Cable		66M1-50							
Conn Pin	Color Code	Block Term.	P8	P7	P6	P5	P4	P3	STA LEAD DESIG
26	WHT-BLU	1		AT (305)	AT (317)	AT (329)	AT (341)	AT (353)	GRN
1	BLU-WHT	2	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
27	WHT-ORN	3	USED	BT 005	BT 017	BT 029	BT 041	BT 053	BLK
2	ORN-WHT	4		BR J14	BR J12	BR J11	BR J9	BR J8	YEL
28	WHT-GRN	5		AT (306)	AT (318)	AT (330)	AT (342)	AT (354)	GRN
3	GRN-WHT	6	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
29	WHT-BRN	7	USED	BT 006	BT 018	BT 030	BT 042	BT 054	BLK
4	BRN-WHT	8		BR J14	BR J12	BR J11	BR J9	BR J8	YEL
30	WHT-SLT	9		AT (307)	AT (319)	AT (331)	AT (343)	AT (355)	GRN
5	SLT-WHT	10	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
31	RED-BLU	11	USED	BT 007	BT 019	BT 031	BT 043	BT 055	BLK
6	BLU-RED	12		BR J14	BR J12	BR J11	BR J9	BR J8	YEL
32	RED-ORN	13		AT (308)	AT (320)	AT (332)	AT (344)	AT (356)	GRN
7	ORN-RED	14	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
33	RED-GRN	15	USED	BT 008	BT 020	BT 032	BT 044	BT 056	BLK
8	GRN-RED	16		BR J14	BR J12	BR J11	BR J9	BR J8	YEL
34	RED-BRN	17	Relay	AT (309)	AT (321)	AT (333)	AT (345)	AT (357)	GRN
9	BRN-RED	18	#1	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
35	RED-SLT	19	Relay	BT 009	BT 021	BT 033	BT 045	BT 057	BLK
10	SLT-RED	20	#3	BR J13	BR J12	BR J10	BR J9	BR J7	YEL
36	BLK-BLU	21	Relay	AT (310)	AT (322)	AT (334)	AT (346)	AT (358)	GRN
11	BLU-BLK	22	#2	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
37	BLK-ORN	23	Relay	BT 010	BT 022	BT 034	BT 046	BT 058	BLK
12	ORN-BLK	24	#4	BR J13	BR J12	BR J10	BR J9	BR J7	YEL
38	BLK-GRN	25		AT (311)	AT (323)	AT (335)	AT (347)	AT (359)	GRN
13	GRN-BLK	26	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
39	BLK-BRN	27	USED	BT 011	BT 023	BT 035	BT 047	BT 059	BLK
14	BRN-BLK	28		BR J13	BR J12	BR J10	BR J9	BR J7	YEL
40	BLK-SLT	29		AT (312)	AT (324)	AT (336)	AT (348)	AT (360)	GRN
15	SLT-BLK	30	NOT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
41	YEL-BLU	31	USED	BT 012	BT 024	BT 036	BT 048	BT 060	BLK
16	BLU-YEL	32		BR J13	BR J12	BR J10	BR J9	BR J7	YEL
42	YEL-ORN	33	AT (301)	AT (313)	AT (325)	AT (337)	AT (349)	AT (361)	GRN
17	ORN-YEL	34	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
43	YEL-GRN	35	BT 001	BT 013	BT 025	BT 037	BT 049	BT 061	BLK
18	GRN-YEL	36	BR J14	BR J13	BR J11	BR J10	BR J8	BR J7	YEL
44	YEL-BRN	37	AT (302)	AT (314)	AT (326)	AT (338)	AT (350)	AT (362)	GRN
19	BRN-YEL	38	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
45	YEL-SLT	39	BT 002	BT 014	BT 026	BT 038	BT 050	BT 062	BLK
20	SLT-YEL	40	BR J14	BR J13	BR J11	BR J10	BR J8	BR J7	YEL
46	VIO-BLU	41	AT (303)	AT (315)	AT (327)	AT (339)	AT (351)	AT (363)	GRN
21	BLU-VIO	42	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
47	VIO-ORN	43	BT 003	BT 015	BT 027	BT 039	BT 051	BT 063	BLK
22	ORN-VIO	44	BR J14	BR J13	BR J11	BR J10	BR J8	BR J7	YEL
48	VIO-GRN	45	AT (304)	AT (316)	AT (328)	AT (340)	AT (352)	AT (401)	GRN
23	GRN-VIO	46	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
49	VIO-BRN	47	BT 004	BT 016	BT 028	BT 040	BT 052	BT 064	BLK
24	BRN-VIO	48	BR J14	BR J13	BR J11	BR J10	BR J8	BR J7	YEL
50	VIO-SLT	49							
25	SLT-VIO	50							

NOTE: Default station numbers are shown in parenthesis.

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Table 5-3 BLOCK CONNECTIONS, EXPANSION CABINET, TCX-128

25 Pair Cable		66M1-50							
Conn Pin	Color Code	Block Term.	P9	P8	P7	P6	P5	P4	STA LEAD DESIG
26	WHT-BLU	1	AT (402)	AT (414)	AT (426)	AT (438)	AT (450)	AT (462)	GRN
1	BLU-WHT	2	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
27	WHT-ORN	3	BT 065	BT 077	BT 089	BT 101	BT 113	BT 125	BLK
2	ORN-WHT	4	BR J15	BR J14	BR J12	BR J11	BR J9	BR J8	YEL
28	WHT-GRN	5	AT (403)	AT (415)	AT (427)	AT (439)	AT (451)	AT (463)	GRN
3	GRN-WHT	6	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
29	WHT-BRN	7	BT 066	BT 078	BT 090	BT 102	BT 114	BT 126	BLK
4	BRN-WHT	8	BR J15	BR J14	BR J12	BR J11	BR J9	BR J8	YEL
30	WHT-SLT	9	AT (404)	AT (416)	AT (428)	AT (440)	AT (452)	AT (464)	GRN
5	SLT-WHT	10	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
31	RED-BLU	11	BT 067	BT 079	BT 091	BT 103	BT 115	BT 127	BLK
6	BLU-RED	12	BR J15	BR J14	BR J12	BR J11	BR J9	BR J8	YEL
32	RED-ORN	13	AT (405)	AT (417)	AT (429)	AT (441)	AT (453)	AT (465)	GRN
7	ORN-RED	14	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	RED
33	RED-GRN	15	BT 068	BT 080	BT 092	BT 104	BT 116	BT 128	BLK
8	GRN-RED	16	BR J15	BR J14	BR J12	BR J11	BR J9	BR J8	YEL
34	RED-BRN	17	AT (406)	AT (418)	AT (430)	AT (442)	AT (454)		GRN
9	BRN-RED	18	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
35	RED-SLT	19	BT 069	BT 081	BT 093	BT 105	BT 117	USED	BLK
10	SLT-RED	20	BR J15	BR J13	BR J12	BR J10	BR J9		YEL
36	BLK-BLU	21	AT (407)	AT (419)	AT (431)	AT (443)	AT (455)		GRN
11	BLU-BLK	22	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
37	BLK-ORN	23	BT 070	BT 082	BT 094	BT 106	BT 118	USED	BLK
12	ORN-BLK	24	BR J15	BR J13	BR J12	BR J10	BR J9		YEL
38	BLK-GRN	25	AT (408)	AT (420)	AT (432)	AT (444)	AT (456)		GRN
13	GRN-BLK	26	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
39	BLK-BRN	27	BT 071	BT 083	BT 095	BT 107	BT 119	USED	BLK
14	BRN-BLK	28	BR J15	BR J13	BR J12	BR J10	BR J9		YEL
40	BLK-SLT	29	AT (409)	AT (421)	AT (433)	AT (445)	AT (457)		GRN
15	SLT-BLK	30	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
41	YEL-BLU	31	BT 072	BT 084	BT 096	BT 108	BT 120	USED	BLK
16	BLU-YEL	32	BR J15	BR J13	BR J12	BR J10	BR J9		YEL
42	YEL-ORN	33	AT (410)	AT (422)	AT (434)	AT (446)	AT (458)	NOT	GRN
17	ORN-YEL	34	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
43	YEL-GRN	35	BT 073	BT 085	BT 097	BT 109	BT 121	USED	BLK
18	GRN-YEL	36	BR J14	BR J13	BR J11	BR J10	BR J8		YEL
44	YEL-BRN	37	AT (411)	AT (423)	AT (435)	AT (447)	AT (459)		GRN
19	BRN-YEL	38	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
45	YEL-SLT	39	BT 074	BT 086	BT 098	BT 110	BT 122	USED	BLK
20	SLT-YEL	40	BR J14	BR J13	BR J11	BR J10	BR J8		YEL
46	VIO-BLU	41	AT (412)	AT (424)	AT (436)	AT (448)	AT (460)		GRN
21	BLU-VIO	42	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
47	VIO-ORN	43	BT 075	BT 087	BT 099	BT 111	BT 123	USED	BLK
22	ORN-VIO	44	BR J14	BR J13	BR J11	BR J10	BR J8		YEL
48	VIO-GRN	45	AT (413)	AT (425)	AT (437)	AT (449)	AT (461)		GRN
23	GRN-VIO	46	AR PORT	AR PORT	AR PORT	AR PORT	AR PORT	NOT	RED
49	VIO-BRN	47	BT 076	BT 088	BT 100	BT 112	BT 124	USED	BLK
24	BRN-VIO	48	BR J14	BR J13	BR J11	BR J10	BR J8		YEL
50	VIO-SLT	49							
25	SLT-VIO	50							

NOTE: Default station numbers are shown in parenthesis.

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STATION CABLING

3.14 Use station cable to link the connecting blocks to the modular jacks. All station cable, including cable for the DSS console, must be home run to the connecting blocks and must not exceed 2000 feet for keysets, 10,000 feet for (2500) type single line and one button sets and 800 feet for display telephones. Punch down the cable at the connecting blocks (using Tables 5-2, 5-3 and 5-4).

Table 5-4 CABLING AND VOLTAGES, TCX-128

KEY TELEPHONE VOLTAGES[1]			
COLOR	DESIG-NATION	FUNCTION	VOLTAGE
GRN	AT	DATA / POWER –	–24 V DC
RED	AR	DATA / POWER +	+24 V DC
BLK	BT	AUDIO	N / A
YEL	BR	AUDIO	N / A
SINGLE LINE TELEPHONE VOLTAGES [1]			
COLOR	DESIG-NATION	FUNCTION	VOLTAGE
GRN	AT	AUDIO / POWER +	+24 V DC
RED	AR	AUDIO / POWER –	–24 V DC
BLK	BT	GROUND	0 V DC
YEL	BR	RINGER POWER	+24 V DC

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3.15 The cable is terminated at the station location in a screw type 625A or 625F (4-wire) modular jack or equivalent (Figure 5-1). Connect the RED, GRN, BLK and YEL conductors to the matching terminals. The telephones are plugged into the modular jacks.

System Cabling Check

- Home run all station cable (para. 3.14).
- Punch down cable at connecting blocks (para. 3.14).
- Terminate cable in modular jack at station locations (para. 3.15).

CAUTION: QUAD CABLE SHOULD BE ROUTED AWAY FROM ANY ELECTRO-MAGNETIC INTERFERENCE SOURCES SUCH AS ELECTRICAL MOTORS AND FLUORESCENT LIGHTS. ALL CABLE RUNS SHOULD BE AT LEAST 2 INCHES (50.8mm) FROM CONDUCTORS OF ANY ELECTRIC LIGHT, POWER CIRCUIT OR CLASS 1 CIRCUITS (REFERENCE NATIONAL ELECTRICAL CODE, ARTICLE 800-COMMUNICATION CIRCUITS).

INSTALLING PCBs

WARNING: ALL POWER SHOULD BE OFF WHEN INSERTING PCBs.

Static Precautions

3.16 The Printed Circuit Boards (PCBs) are sensitive to static electricity. Use the proper handling precautions to guard against static damage. The paragraphs below highlight safe handling techniques for static-sensitive equipment.

3.17 All PCBs should be handled in the conductive black velostat bags in which they were shipped.

3.18 To minimize static charges, three steps must be taken. First, discharge any accumulated body static by touching a grounded object. Second, wear a wrist ground strap attached to the CWP GND lug on the KSU. Third, keep foot movement to a minimum.

3.19 Only surfaces or items that are at ground potential should come in contact with PCBs.

WARNING: WHEN INSTALLING, REMOVING OR MAINTAINING PCBs USE THE PROPER PRECAUTIONS TO GUARD AGAINST STATIC DAMAGE.

3.20 Handle PCBs carefully while slowly inserting or removing them from the KSU or expansion cabinet slot.

System Check

- System must be off.
- Read static precautions (para. 3.16 through 3.20).

PCB Location

3.21 Use Figure 5-1 as reference for PCB location. Each PCB is keyed to fit only in its proper slot in the KSU or expansion cabinet backplane. When inserting the PCBs, the connector edge goes into the slot with the component side of the PCB to the installer's right. Use your thumbs to push the PCB until firmly seated. Do not use the heel of your hand or any tool to push a PCB into a connector.

Central Processing Unit (B-CPU-B) PCB

3.22 Before the B-CPU-B PCB (Figure 5-2) is installed in the KSU (and before the system is programmed), the Baud Rate Switch (S2) and the Serial Data Switch (S3) must be set to match the requirements of the programming terminal.

- Strap the B-CPU-B PCB from E1 to E2 for battery backup.
- To set the switches, refer to Figure 5-2.

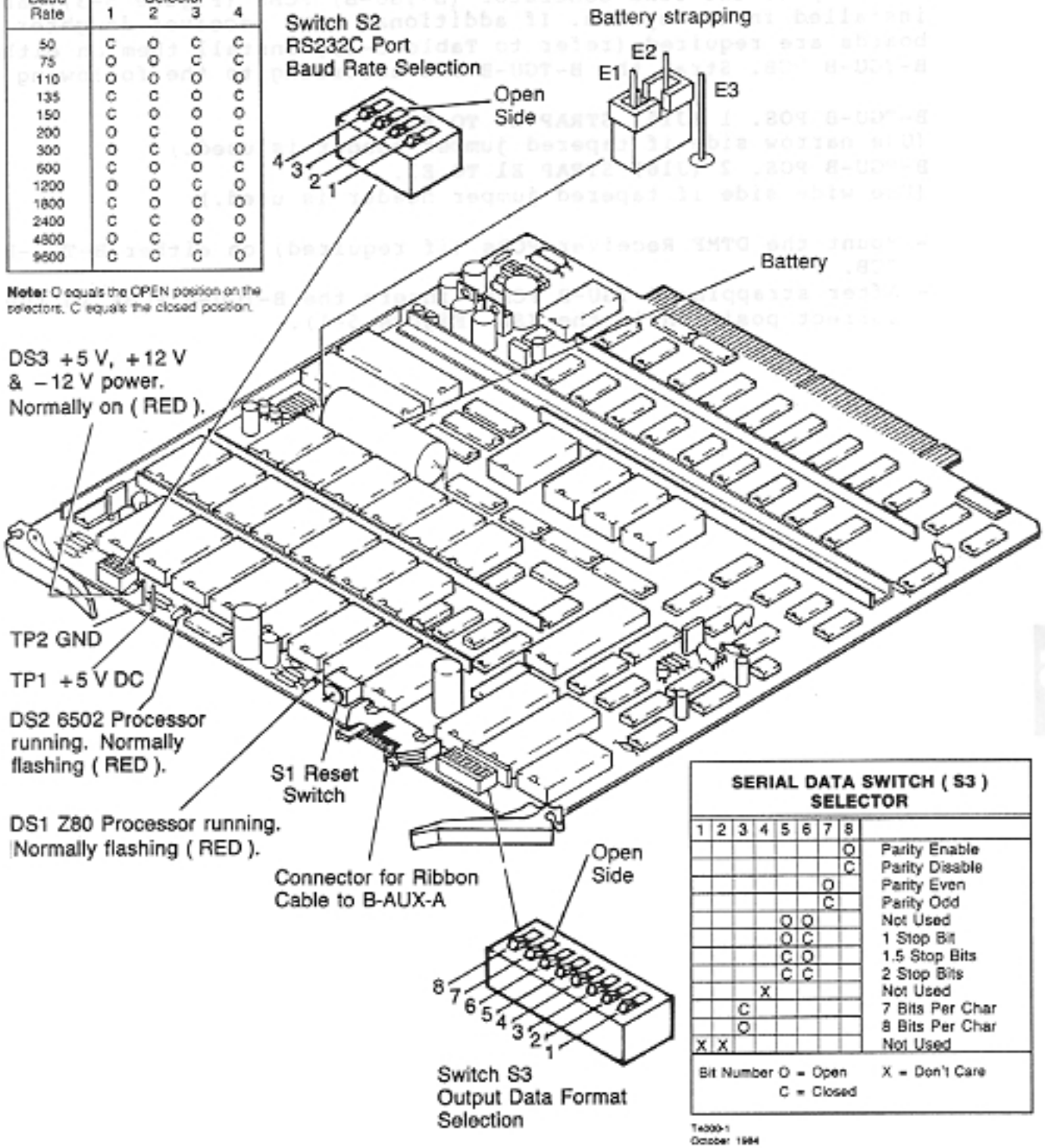
CAUTION: MAKE SURE THE B-CPU-B PCB IS STRAPPED FROM E1 TO E2 (FIGURE 5-2). IF THE PCB IS NOT STRAPPED E1 TO E2, THE SYSTEM WILL INITIALIZE EACH TIME THE POWER IS TURNED ON OR OFF. INITIALIZATION RETURNS ALL PROGRAMMED ENTRIES TO DEFAULT. A FULLY CHARGED BATTERY WILL HOLD USER-PROGRAMMED MEMORY FOR UP TO 1Ø DAYS.

3.23 A special clock/calendar is located on the B-CPU-B which allows the time and date to appear on all display telephones in the system. This clock may also be used for the SMDR. The clock/calendar may be set at the terminal during system programming or at the attendant's station. If a power outage occurs, the clock/calendar will stop, and must be reset when the power returns.

- Make sure that all power is shut off before inserting PCBs. After the switches have been set, insert the CPU PCB in KSU slot J1Ø (Figure 5-1).

SWITCH S2				
Baud Rate	Selector 1	2	3	4
50	C	O	C	C
75	O	O	C	C
110	O	O	O	O
135	C	C	O	C
150	C	O	O	O
200	O	C	O	C
300	O	C	O	O
600	C	O	O	C
1200	O	O	C	O
1800	C	O	C	O
2400	C	C	O	O
4800	O	C	C	O
9600	C	C	C	O

Note: O equals the OPEN position on the selectors. C equals the closed position.



SERIAL DATA SWITCH (S3) SELECTOR								
1	2	3	4	5	6	7	8	
							O	Parity Enable
							C	Parity Disable
						O		Parity Even
						C		Parity Odd
				O	O			Not Used
				O	C			1 Stop Bit
				C	O			1.5 Stop Bits
				C	C			2 Stop Bits
			X					Not Used
		C						7 Bits Per Char
		O						8 Bits Per Char
X	X							Not Used

Bit Number O = Open C = Closed X = Don't Care

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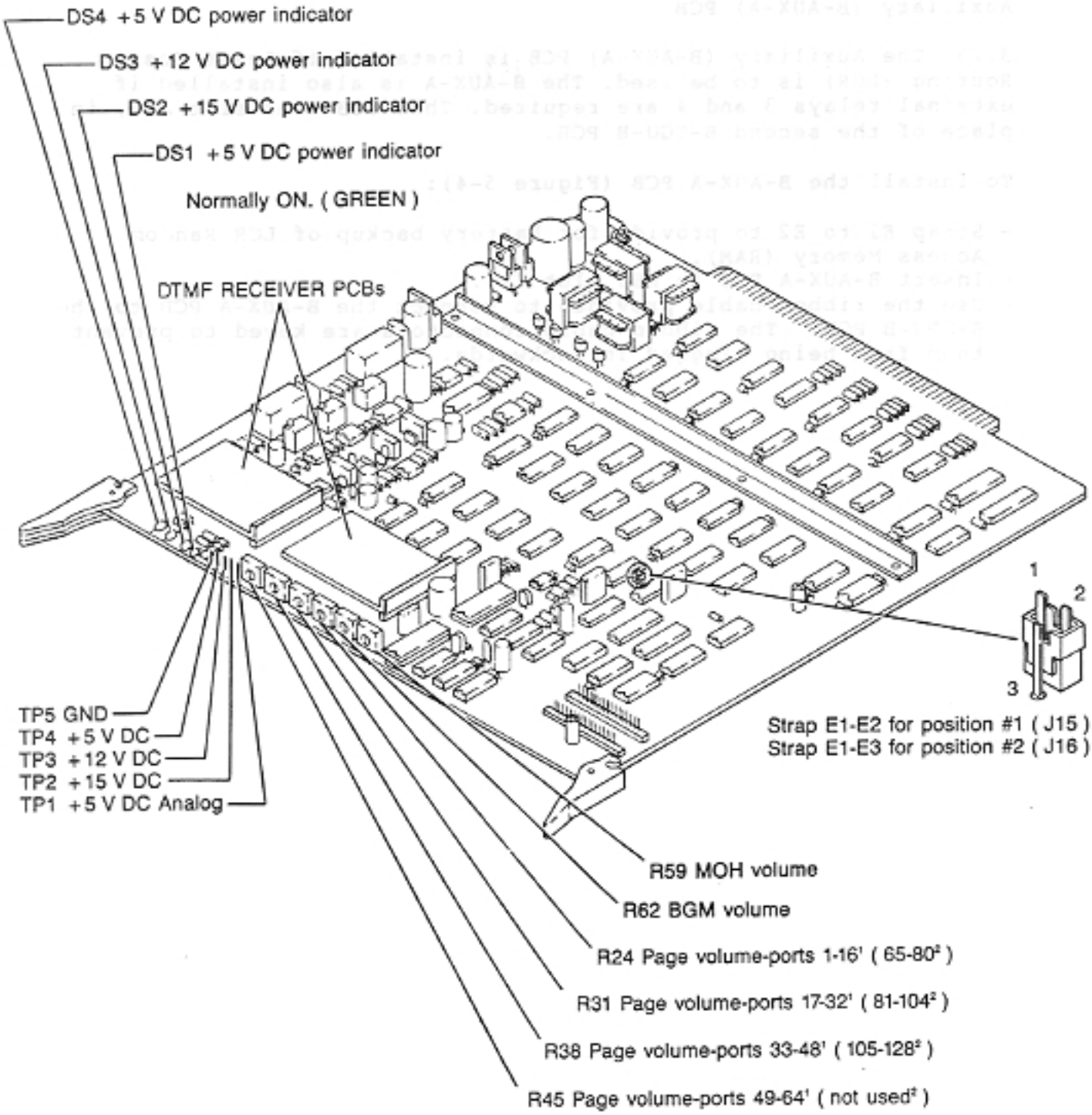
Figure 5-2 CENTRAL PROCESSING UNIT (B-CPU-B) PCB, TCX-128

Tone Generator (B-TGU-B) PCB

3.24 Up to two Tone Generator (B-TGU-B) PCBs (Figure 5-3) can be installed in the system. If additional DTMF receiver daughter boards are required (refer to Table 3-1), install them on either B-TGU-B PCB. Strap the B-TGU-B PCB according to the following:

B-TGU-B POS. 1 (J15) STRAP E1 TO E2.
(Use narrow side if tapered jumper header is used.)
B-TGU-B POS. 2 (J16) STRAP E1 TO E3.
(Use wide side if tapered jumper header is used.)

- Mount the DTMF Receiver PCBs (if required) on either B-TGU-B PCB.
- After strapping B-TGU-B PCBs, insert the B-TGU-B PCBs in the correct position in the KSU (Figure 5-1).



[1]Initialization ports (hardware Page zones) for KSU — PCB in slot J15.

NOTE: All voltages ±5%

[2]Initialization ports (hardware Page zones) for expansion cabinet — PCB in slot J16.

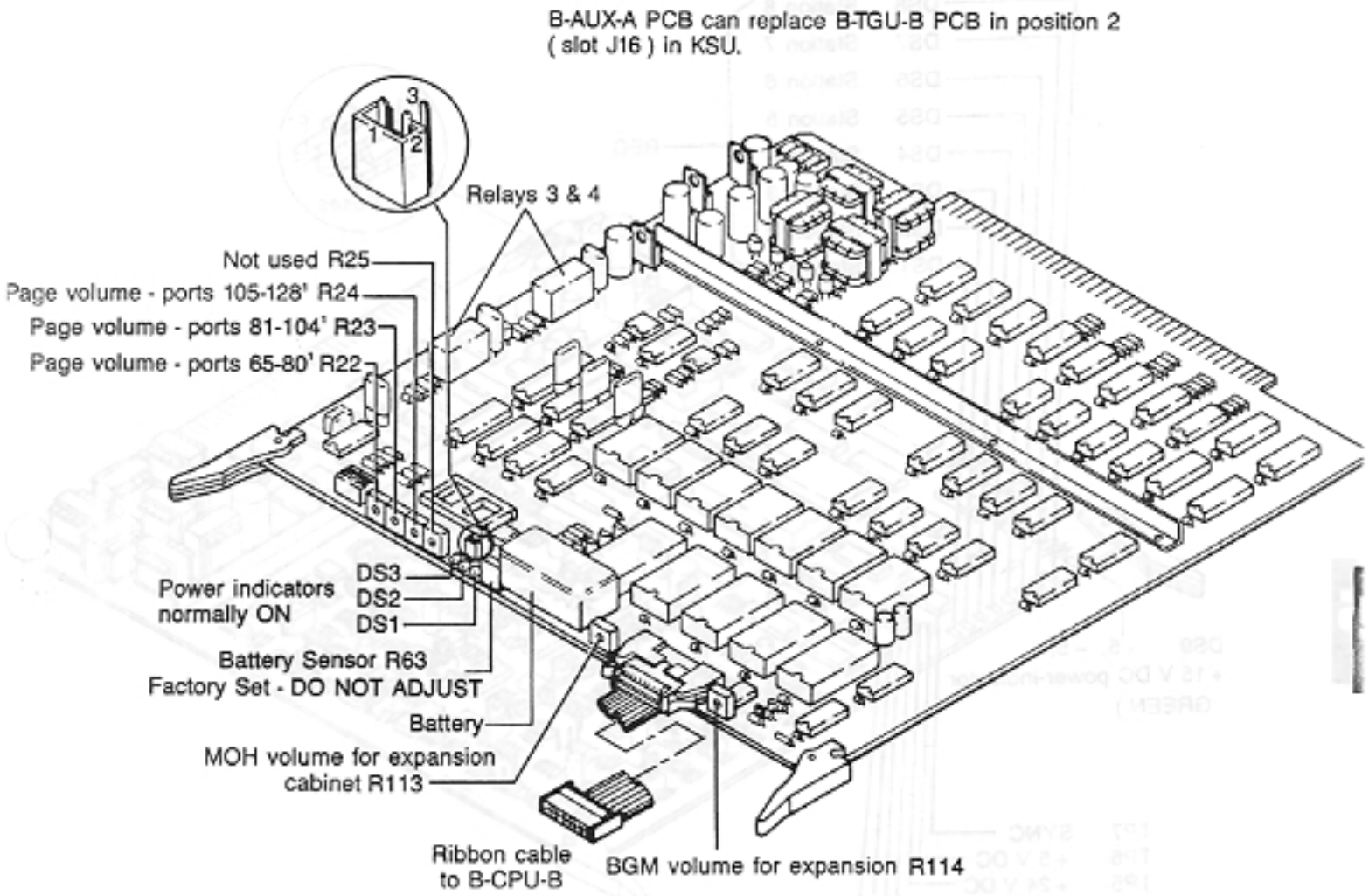
Figure 5-3 TONE GENERATOR UNIT (B-TGU-B) PCB, TCX-128

Auxiliary (B-AUX-A) PCB

3.25 The Auxiliary (B-AUX-A) PCB is installed if Least Cost Routing (LCR) is to be used. The B-AUX-A is also installed if external relays 3 and 4 are required. This PCB uses slot J16, in place of the second B-TGU-B PCB.

To install the B-AUX-A PCB (Figure 5-4):

- Strap E1 to E2 to provide for battery backup of LCR Random Access Memory (RAM).
- Insert B-AUX-A PCB in KSU slot J16.
- Use the ribbon cable provided to connect the B-AUX-A PCB to the B-CPU-B PCB. The ribbon cable connectors are keyed to prevent them from being plugged in backwards.



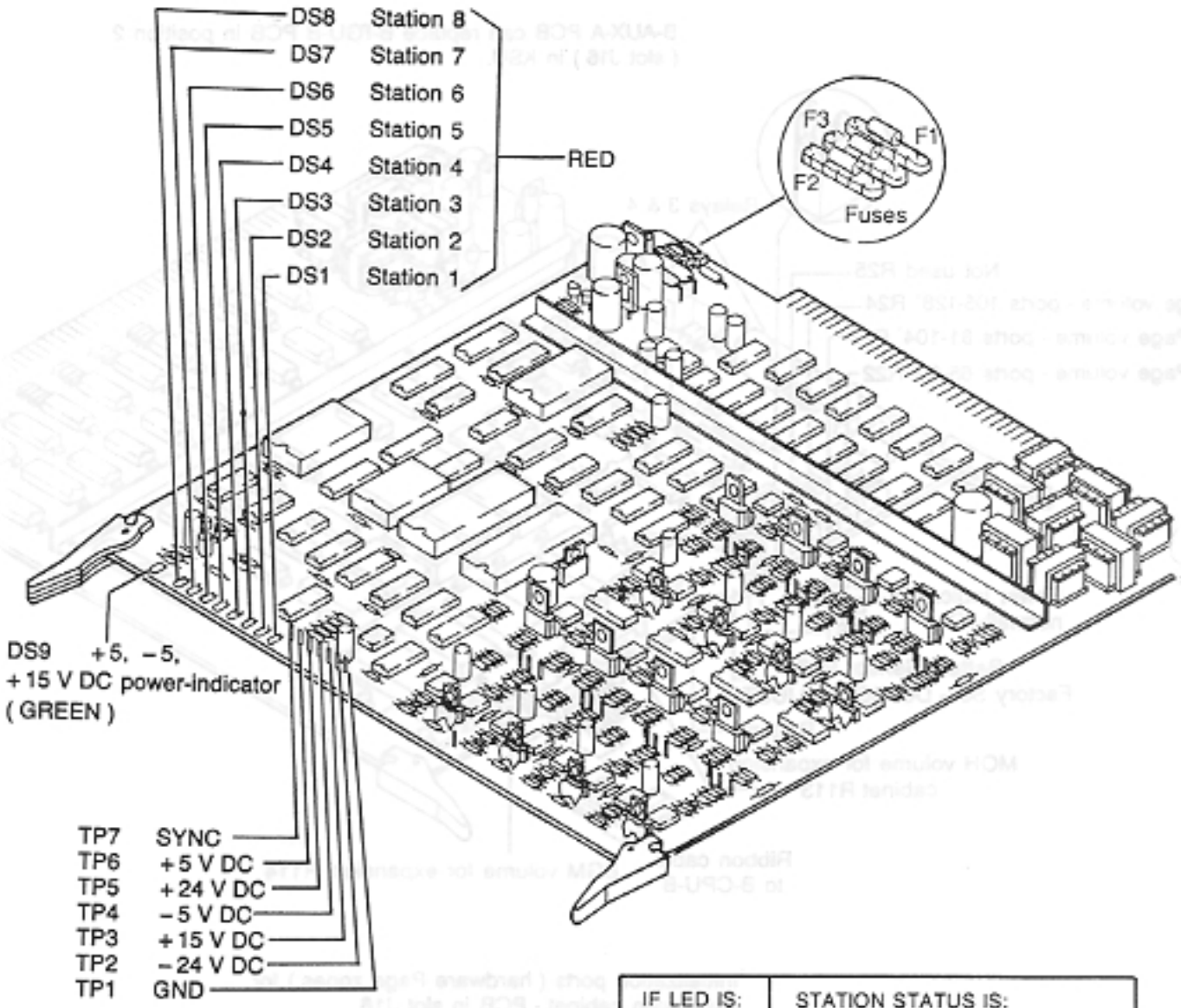
'Initialization ports (hardware Page zones) for expansion cabinet - PCB in slot J16.

Figure 5-4 AUXILIARY (B-AUX-A) PCB, TCX-128

Station Control Unit (B-8SCU-C) PCB

3.26 The Station Control Unit (B-8SCU-C) PCBs (Figure 5-5) do not require any strapping. Each PCB has eight station circuits. Refer to Figure 5-1, Tables 5-2 and 5-3 for PCB placement.

- Insert the required number of Station PCBs for the system.



IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected
'ON STEADY'	- Telephone is connected and idle
'FLASHING'	- Station is busy

NOTE: All voltages ±5%

Figure 5-5 STATION CONTROL UNIT (B-8SCU-C) PCB, TCX-128

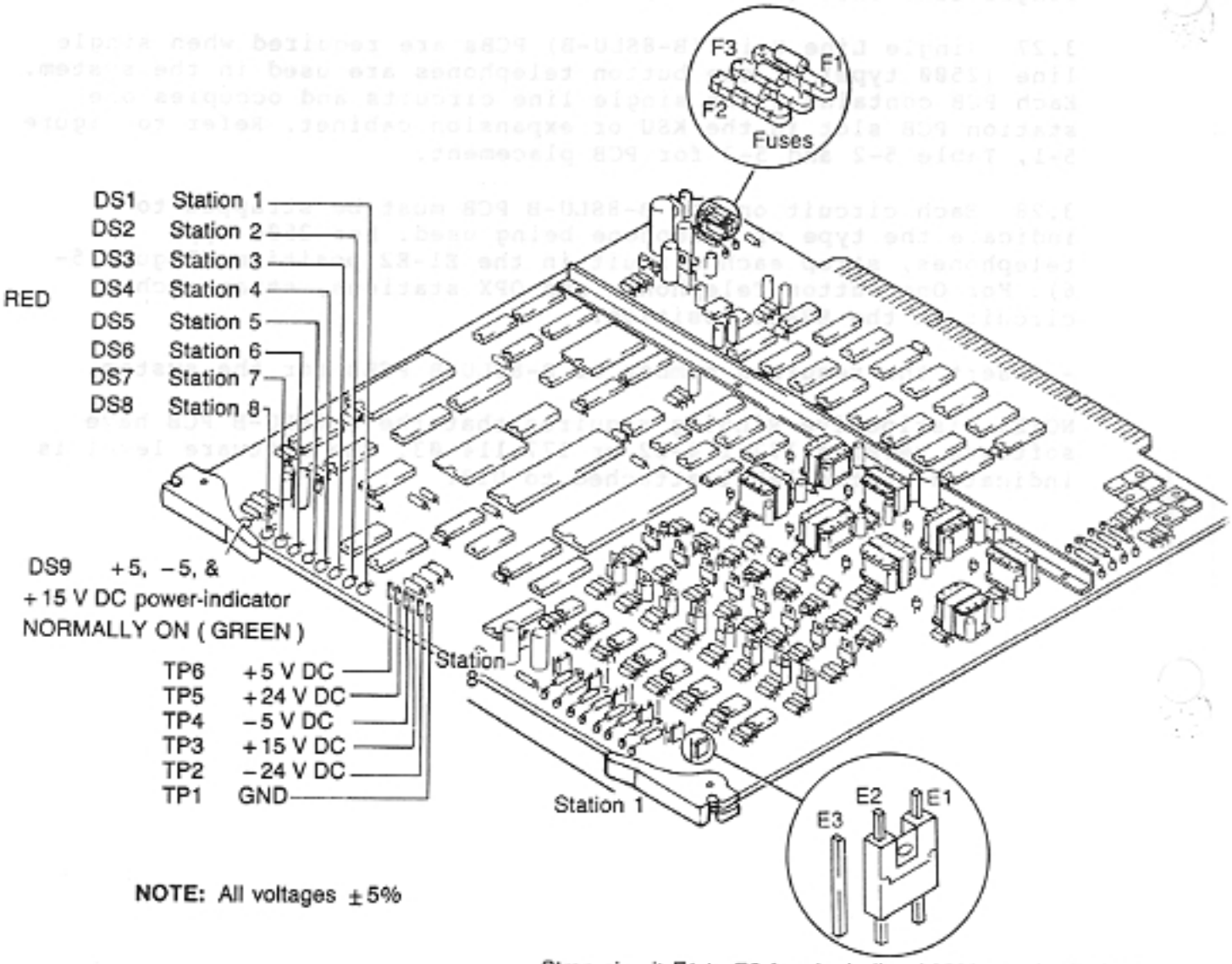
Single Line Unit (B-8SLU-B) PCB

3.27 Single Line Unit (B-8SLU-B) PCBs are required when single line (2500 type) or one button telephones are used in the system. Each PCB contains eight single line circuits and occupies one station PCB slot in the KSU or expansion cabinet. Refer to Figure 5-1, Table 5-2 and 5-3 for PCB placement.

3.28 Each circuit on the B-8SLU-B PCB must be strapped to indicate the type of telephone being used. For 2500 type telephones, strap each circuit in the E1-E2 position (Figure 5-6). For One Button Telephones and OPX stations, strap each circuit in the E2-E3 position.

- Insert the required number of B-8SLU-B PCBs for the system.

NOTE: Distinctive Ringing requires that the B-8SLU-B PCB have software version 177-114-Ø2 or 177-114-Ø3. The software level is indicated on the label attached to U13.



NOTE: All voltages ±5%

Strap circuit E1 to E2 for single line (2500 type) telephone.
Strap circuit E2 to E3 for one button and OPX telephones.

IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected.
'ON STEADY'	- Telephone is connected and idle.
'FLASHING'	- Station is busy.

Figure 5-6 SINGLE LINE UNIT (B-8SLU-B) PCB, TCX-128

Central Office Unit (B-4COU-A) PCB

3.29 The Central Office Unit (B-4COU-A) PCBs do not require strapping. Each PCB contains 4 CO line circuits. Refer to Figure 5-1 and the following chart for PCB placement.

CO LINES	PCB SLOT
KSU	
1 to 4	J6
5 to 8	J5
9 to 12	J4
13 to 16	J3
17 to 20	J2
21 to 24	J1
EXPANSION CABINET	
25 to 28	J4
29 to 32	J3

- Insert the required number of Central Office Unit (B-4COU-A) PCBs for the system.

5-25

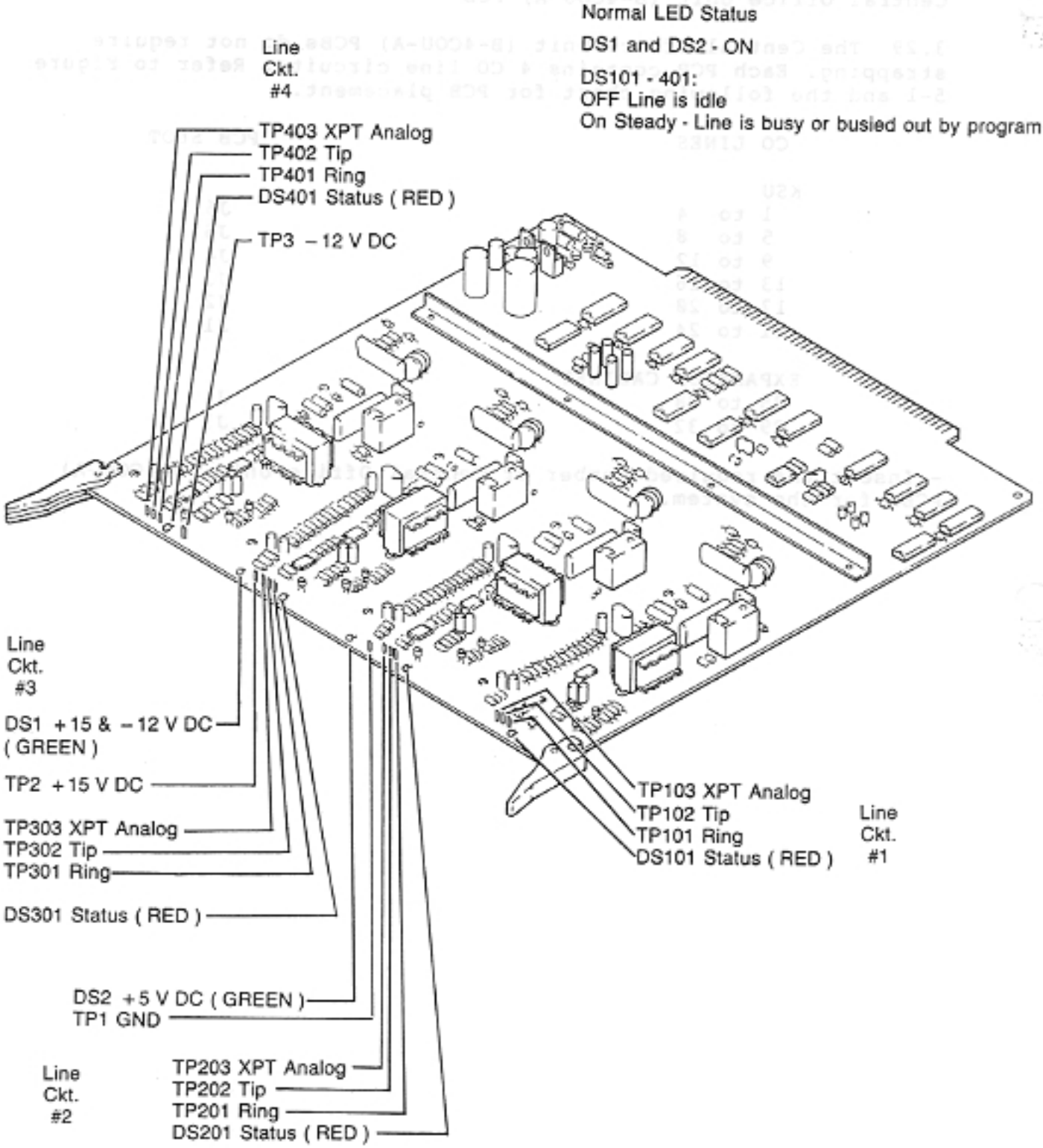


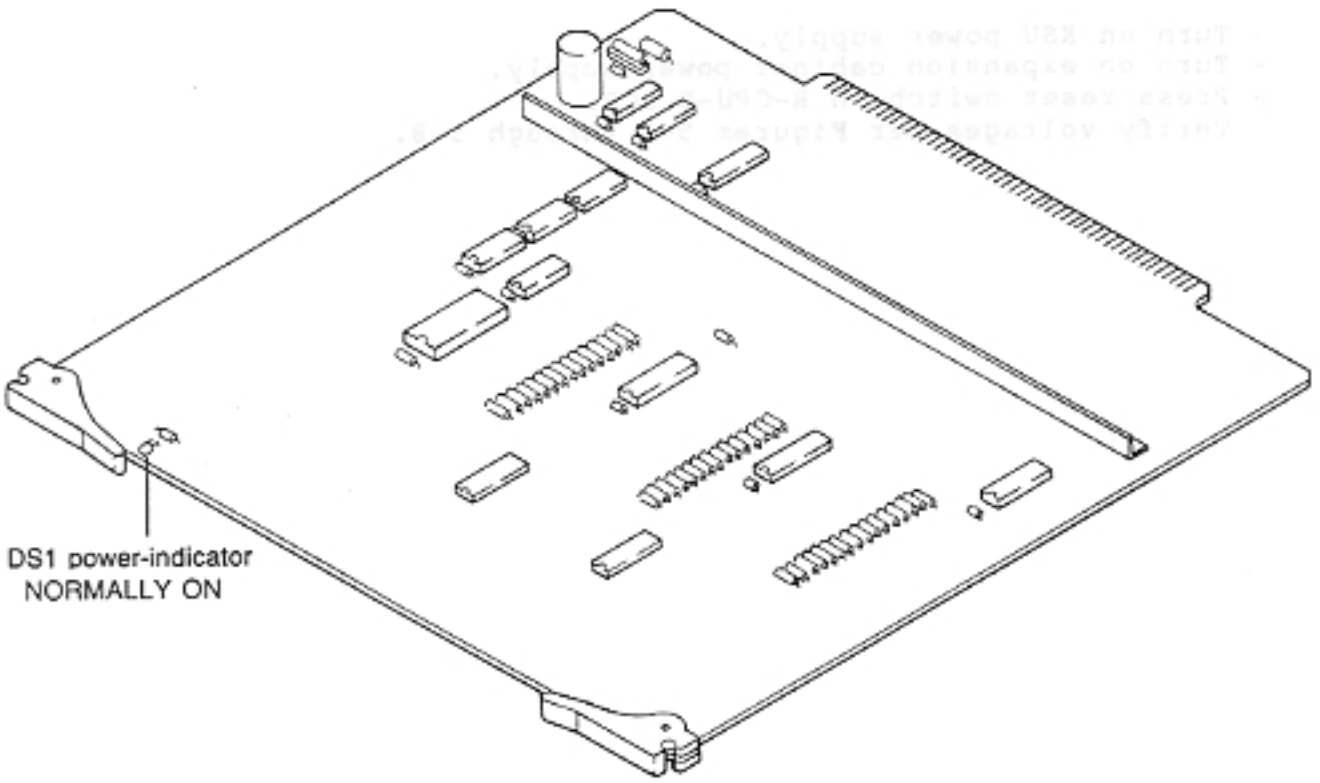
Figure 5-7 CENTRAL OFFICE UNIT (B-4COU-A) PCB, TCX-128

Buffer (B-BUF-A) PCB

3.3Ø The Buffer (B-BUF-A) PCB is always required when an expansion cabinet is used. This PCB plugs into expansion cabinet slot J16 and does not require any strapping or switch settings.

KSU PCB Check

- Set switches, strap and insert B-CPU-B PCB (para. 3.22 & 3.23).
- Strap and insert B-TGU-B PCBs (para. 3.24).
- Strap and insert B-AUX-A PCB (para. 3.25).
- Insert B-8SCU-C PCBs (para. 3.26).
- Strap and insert B-8SLU-B PCBs (para. 3.27 & 3.28).
- Insert B-4COU-A PCBs (para. 3.29).
- Insert B-BUF-A PCB (para. 3.3Ø).



NOTE: The B-BUF-A PCB is only used if an expansion cabinet is installed.

Figure 5-8 BUFFER (B-BUF-A) PCB, TCX-128

4. INSTALLING TELEPHONES

4.01 To install a telephone or console, simply plug the unit into the modular jack.

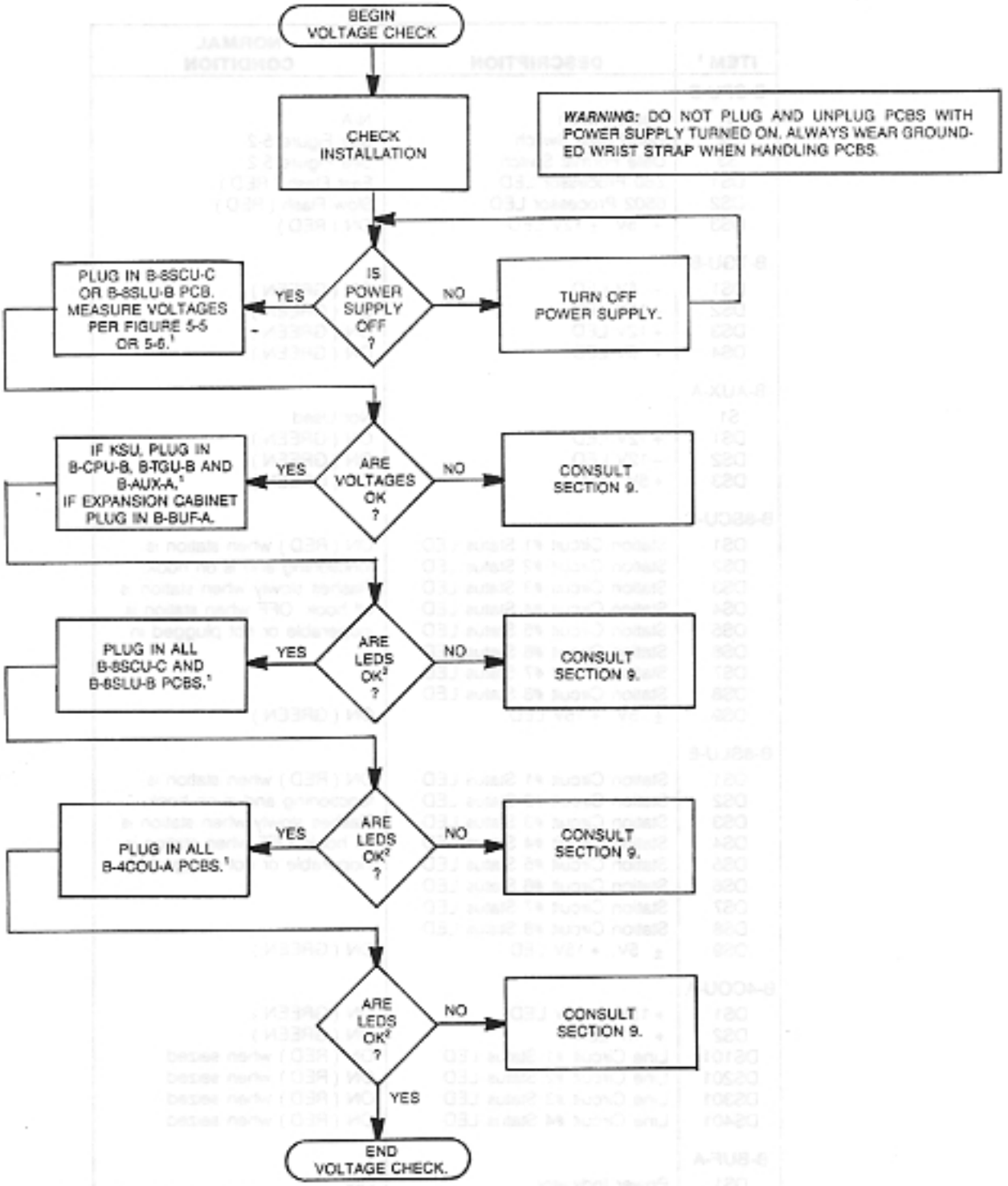
4.02 If wall mounting is required, refer to the instructions shipped with the wall mounting kits.

5. SYSTEM VOLTAGE CHECK

5.01 System voltage levels can be tested and/or verified at test points and LEDs (Figure 5-9 and Table 5-5). This procedure should be completed prior to connecting to the telco lines (or programming) to insure the system is functioning properly. If the LEDs do not respond as indicated (or the voltage measurements are incorrect), refer to Section 9, MAINTENANCE for instructions on how to solve the problem.

To verify system voltage levels:

- Turn on KSU power supply.
- Turn on expansion cabinet power supply.
- Press reset switch on B-CPU-B PCB.
- Verify voltages per Figures 5-2 through 5-8.



[1] Turn power supply off before inserting PCB. Turn power supply on after inserting PCB.
[2] Verify LEDs per Table 5-5.

Figure 5-9 VOLTAGE CHECK FLOWCHART, TCX-128

5-29

Table 5-5 SWITCHES AND LEDs, TCX-128

ITEM [1]	DESCRIPTION	NORMAL CONDITION
B-CPU-B		
S1	Reset Switch	N/A
S2	Baud Rate Switch	See Figure 5-2
S3	Data Format Switch	See Figure 5-2
DS1	Z80 Processor LED	Fast Flash (RED)
DS2	6502 Processor LED	Slow Flash (RED)
DS3	+ 5V, ±12V LED	ON (RED)
B-TGU-B		
DS1	+ 5V LED	ON (GREEN)
DS2	+15V LED	ON (GREEN)
DS3	+12V LED	ON (GREEN)
DS4	+ 5V LED	ON (GREEN)
B-AUX-A		
S1		Not Used
DS1	+12V LED	ON (GREEN)
DS2	−12V LED	ON (GREEN)
DS3	+5V LED	ON (GREEN)
B-8SCU-C		
DS1	Station Circuit #1 Status LED	ON (RED) when station is functioning and is on hook. Flashes slowly when station is off hook. OFF when station is inoperable or not plugged in.
DS2	Station Circuit #2 Status LED	
DS3	Station Circuit #3 Status LED	
DS4	Station Circuit #4 Status LED	
DS5	Station Circuit #5 Status LED	
DS6	Station Circuit #6 Status LED	
DS7	Station Circuit #7 Status LED	
DS8	Station Circuit #8 Status LED	
DS9	± 5V, +15V LED	ON (GREEN)
B-8SLU-B		
DS1	Station Circuit #1 Status LED	ON (RED) when station is functioning and is on hook. Flashes slowly when station is off hook. OFF when station is inoperable or not plugged in.
DS2	Station Circuit #2 Status LED	
DS3	Station Circuit #3 Status LED	
DS4	Station Circuit #4 Status LED	
DS5	Station Circuit #5 Status LED	
DS6	Station Circuit #6 Status LED	
DS7	Station Circuit #7 Status LED	
DS8	Station Circuit #8 Status LED	
DS9	± 5V, +15V LED	ON (GREEN)
B-4COU-A		
DS1	+15V, −12V LED	ON (GREEN)
DS2	+ 5V LED	ON (GREEN)
DS101	Line Circuit #1 Status LED	ON (RED) when seized
DS201	Line Circuit #2 Status LED	ON (RED) when seized
DS301	Line Circuit #3 Status LED	ON (RED) when seized
DS401	Line Circuit #4 Status LED	ON (RED) when seized
B-BUF-A		
DS1	Power Indicator	ON

[1] Refer to figures 5-2 through 5-8 for device location.

NOTE: On some PCBs the LEDs may be a different color than indicated.

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6. CONNECTING TELCO LINES

6.Ø1 The RJ21X connectors from the telco will provide service for the 32 CO lines (Table 5-6). Each RJ21X connector is joined to the system by using a 25-pair cable terminated with a type 57 connector, female on one end and male on the other. This cable cannot exceed 25 feet in length. Connect as follows:

- Plug the male end of the 25-pair cable into the RJ21X connector from the telco (Figure 5-1).
- Plug the female end of the 25-pair cable into the appropriate connector on the KSU or expansion cabinet (Figure 5-1).

Table 5-6 TELCO RJ21X CONNECTOR/ CO LINE REFERENCES, TCX-128

		CO LINES		
PIN	FUNCTION	P2 (KSU)	P1 (KSU)	P1 (Exp Cab)
26 1	TIP RING	1	13	25
27 2	TIP RING	2	14	26
28 3	TIP RING	3	15	27
29 4	TIP RING	4	16	28
30 5	TIP RING	5	17	29
31 6	TIP RING	6	18	30
32 7	TIP RING	7	19	31
33 8	TIP RING	8	20	32
34 9	TIP RING	9	21	
35 10	TIP RING	10	22	
36 11	TIP RING	11	23	
37 12	TIP RING	12	24	

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7. INSTALLING OPTIONAL EQUIPMENT, PROGRAMMING AND TESTING THE SYSTEM

7.01 Once the basic system is correctly set up, the optional equipment (if required) can be installed. Section 6, INSTALLATION OF OPTIONAL EQUIPMENT, provides guidelines for connecting various optional components to the standard hardware. After all standard and optional components are installed, the system must be programmed.

WARNING: ALL SYSTEMS MUST BE PROGRAMMED TO SOME DEGREE. DO NOT ATTEMPT TO OPERATE THE SYSTEM WITHOUT FOLLOWING THE INSTRUCTIONS PROVIDED IN SECTION 7, PROGRAM ENTRY.

7.02 Following programming, the various telephones can be individually tested. If a complete test of each station is required, the Operational Test Procedure (Table 9-1) should be helpful. Copies of this procedure can be used as an operational log for each station. Refer to Section 9, MAINTENANCE.

8. RADIO FREQUENCY INTERFERENCE

8.Ø1 The equipment generates and is susceptible to radio frequency energy. If the system is not installed and used according to the manufacturer's instructions, this equipment may interfere with radio and television reception. It has been type-tested and found to comply with the limits for a Class A computing device, according to the specifications in FCC Rules covering protection against such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. Interference caused by this equipment to radio or television reception can be determined by turning the equipment off and on. If an interference problem exists, the problem may be solved in one or more of the following ways:

(a) Re-orient the receiving antenna.
(b) Relocate the receiver with respect to the equipment.
(c) Plug the equipment and receiver into different outlets so that both are on different branch circuits.

8.Ø2 If necessary, consult your dealer for additional assistance. The following booklet, prepared by the FCC, may be helpful:

"How to Identify and Remove Radio-TV Interface Problems"

Order this booklet from:

U.S. Government Printing Office
Washington, D.C. 2Ø4Ø2
(Stock No. ØØ4-ØØØ-ØØ345-4).

9. RADIO FREQUENCY SUSCEPTIBILITY

9.Ø1 If the TCX-128 System is installed in a strong radio frequency (RF) field, proper system operation may be affected. The use of the proper installation and grounding procedures outlined in this manual will help to minimize the RF susceptibility.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 6, INSTALLATION OF OPTIONAL EQUIPMENT

1. INTRODUCTION

1.01 The INSTALLATION OF OPTIONAL EQUIPMENT Section provides information on the customer-provided optional equipment that can be used with the TCX-128 system. This equipment includes:

External Loud Ringers
External Paging Equipment
Programming/SMDR Terminal
Background Music/Music on Hold Music Source

2. EXTERNAL LOUD RINGERS

2.01 The TCX-128 has up to four loud ring relays that can be programmed to close when a night mode CO call rings into the system. These relays provide dry contact closures for external bells, chimes or buzzers, which in turn broadcast night ringing in areas where the audible from the telephones is not adequate or available. Relays 1 and 2 are located on the B-TGU-B PCB plugged into KSU slot J15. Relays 3 and 4 are located on the B-AUX-A PCB plugged into KSU slot J16. The user can connect to the relays at the P8 block.

2.02 The loud ring relays are rated as follows:

Maximum Power: 50 VA/30 Watts
Maximum Current: 1 Amp @ 30 VDC
Maximum Voltage: 125 VAC/150 VDC @ 200mA

If the device connected to the relays exceeds the above ratings, an additional external relay must be provided. For example, a loud ringing device which operates at 1 Amp @ 95 VDC dissipates 95 Watts. Although the current and voltage requirements are individually acceptable, the total power dissipation (Watts) is not. This device requires an external relay, which in turn is switched by the relay in the KSU.

ACCEPTABLE: 1 Amp x 24 VDC = 24 Watts
UNACCEPTABLE: 1 Amp x 90 VDC = 90 Watts

2.03 Figure 6-1 (relays 1 and 4) shows how two typical loud ringing devices are connected to the system. To connect to the relays:

(1) Verify that the 25-pair cable from KSU connector P8 is correctly punched down on the P8 block.

(2) To connect the relay 1 contacts to the ringer supply shown in Figure 6-1, punch down the conductors at P8 block pins 17 and 18.

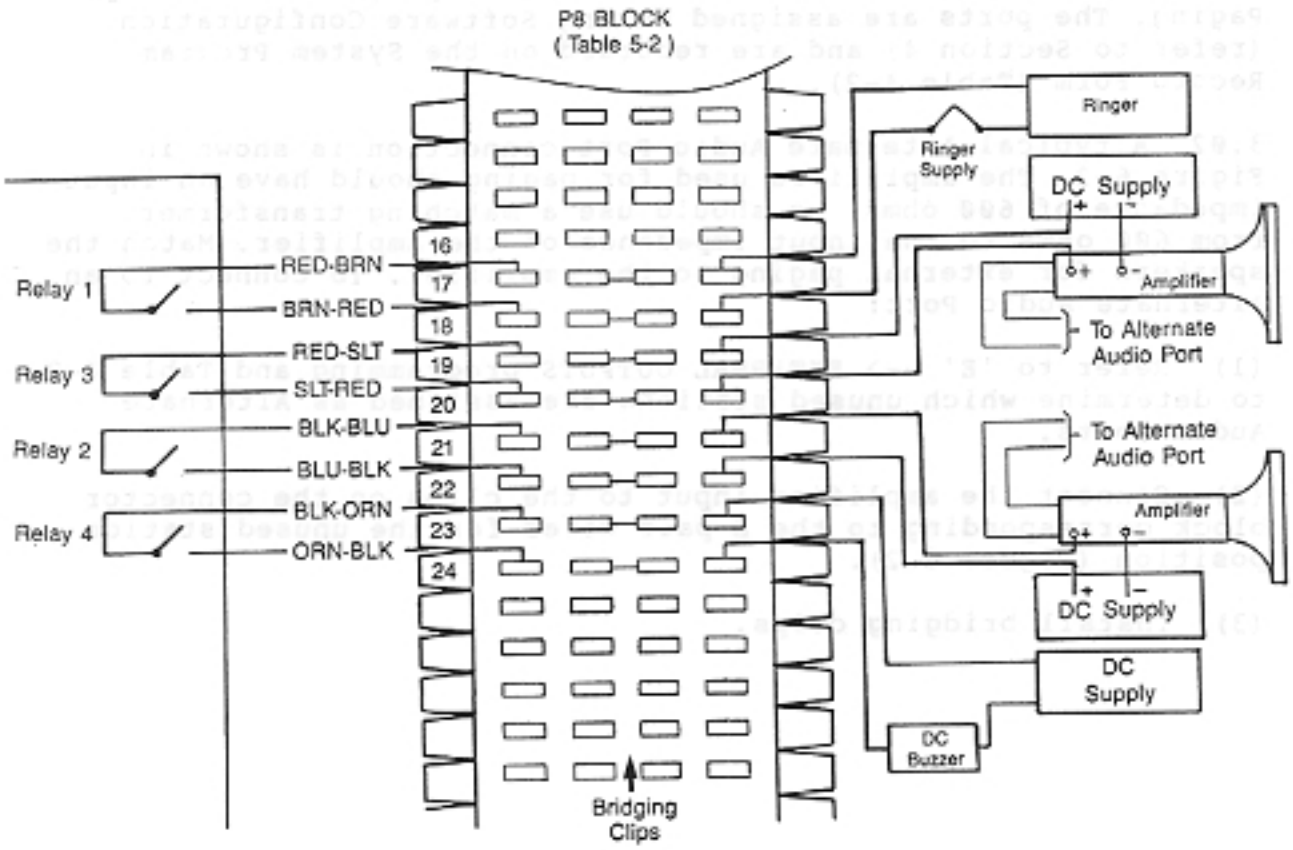
(3) To connect the relay 4 contacts to the ringer supply shown in Figure 6-1, punch down the conductors at P8 block pins 23 and 24.

(4) Install bridging clips.

(5) Refer to Section 7, PROGRAM ENTRY to verify that the relays have been correctly programmed.

Operation

2.04 When the system is in the night mode, an incoming UNA line will cause relay 1 to close. The closure will complete the circuit from the ringer supply to the ringer device, causing the ringer device to turn on. When the call is answered or terminated, the relay releases, turning off the ringer device. The DC buzzer hooked up to relay 4 works in an identical manner.



RELAY RATINGS

Maximum Power: 50 VA/30 Watts
Maximum Current: 1 Amp @ 30 VDC
Maximum Voltage: 125 VAC/150 VDC @ 200 mA

Figure 6-1 TYPICAL USE OF OPTIONAL EQUIPMENT, TCX-128

3. EXTERNAL PAGING EQUIPMENT

3.01 Facilities with large exterior or interior areas may require external paging equipment. This equipment usually consists of heavy-duty speakers driven by auxiliary amplifiers. The input into these amplifiers is provided by unused station positions configured as Alternate Audio Ports. There are a total of eight Alternate Audio Ports that can be programmed to output Paging. The ports are assigned during Software Configuration (refer to Section 4) and are recorded on the System Program Record Form (Table 4-2).

3.02 A typical Alternate Audio Port connection is shown in Figure 6-2. The amplifiers used for paging should have an input impedance of 600 ohms, or should use a matching transformer from 600 ohms to the input impedance of the amplifier. Match the speakers for external paging to the amplifier. To connect to an Alternate Audio Port:

(1) Refer to 'E' --> EXTERNAL OUTPUTS programming and Table 4-2 to determine which unused stations are assigned as Alternate Audio Ports.

(2) Connect the amplifier input to the clips on the connector block corresponding to the B pair wires for the unused station position (Figure 6-2).

(3) Install bridging clips.

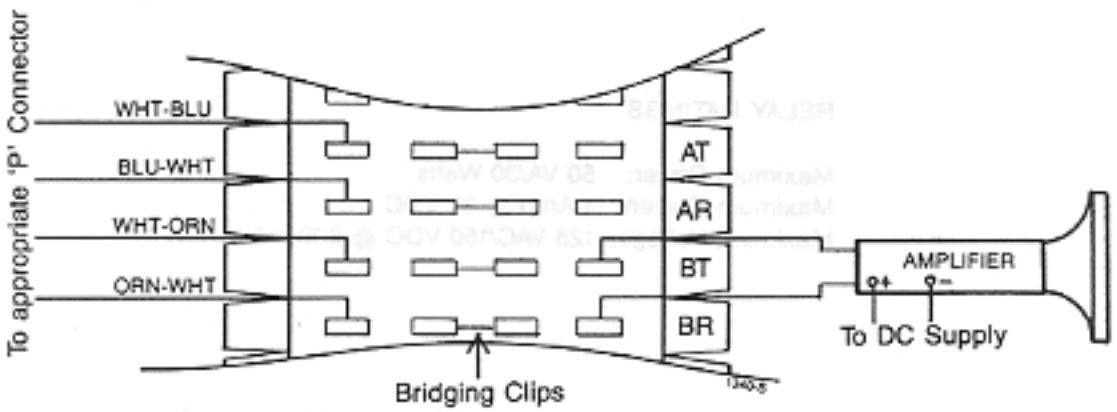


Figure 6-2 EXTERNAL PAGE ZONE CONNECTIONS USING ALL ALTERNATE AUDIO PORT, TCX-128

3.Ø3 The relays on the B-TGU-B PCB and the B-AUX-A PCB may be programmed to close whenever a Page is initiated. This allows the system to "gate" the power supply for the paging amplifier. This type of connection is shown in Figure 6-1 for relays 2 and 3. The contact ratings for the relays can not be exceeded (refer to paragraph 2.Ø2). If the power supply for the paging amplifier exceeds the stated ratings, an additional external relay must be used.

Operation

3.Ø4 Whenever a Page announcement is made, the audio is output from the Alternate Audio Port and amplified by the external paging amplifier. If the relays are used in conjunction with paging, the relay closure can be used to turn on the paging amplifier as the Page announcement occurs. In Figure 6-1, the relay 3 closure is used to turn on the paging amplifier DC supply as the Page audio is sent from the Alternate Audio Port.

3.Ø5 The Alternate Audio Ports can also output Background Music and/or night audible.

4. CONNECTING THE PROGRAMMING/SMDR TERMINAL

4.Ø1 The programming/SMDR terminal is connected to the KSU backplane at the RS-232-C connector (J28 in Figure 6-3). The baud rate switch (S2) and the data format switch (S3) on the B-CPU-B PCB (Figure 6-4) must be set to match the terminal.

4.Ø2 Call records are transmitted to the printer as they are completed. The output format is shown in Table 6-1; a sample printout is shown in Table 6-2. The heading repeats after every 22 lines of call data. The TCX-128 has the capability to store up to 27 lines of SMDR data, consisting of 5 lines of heading and 22 lines of call records.

4.Ø3 A call accounting system, such as the Tie TELE-RECORD, may be utilized with the TCX-128.

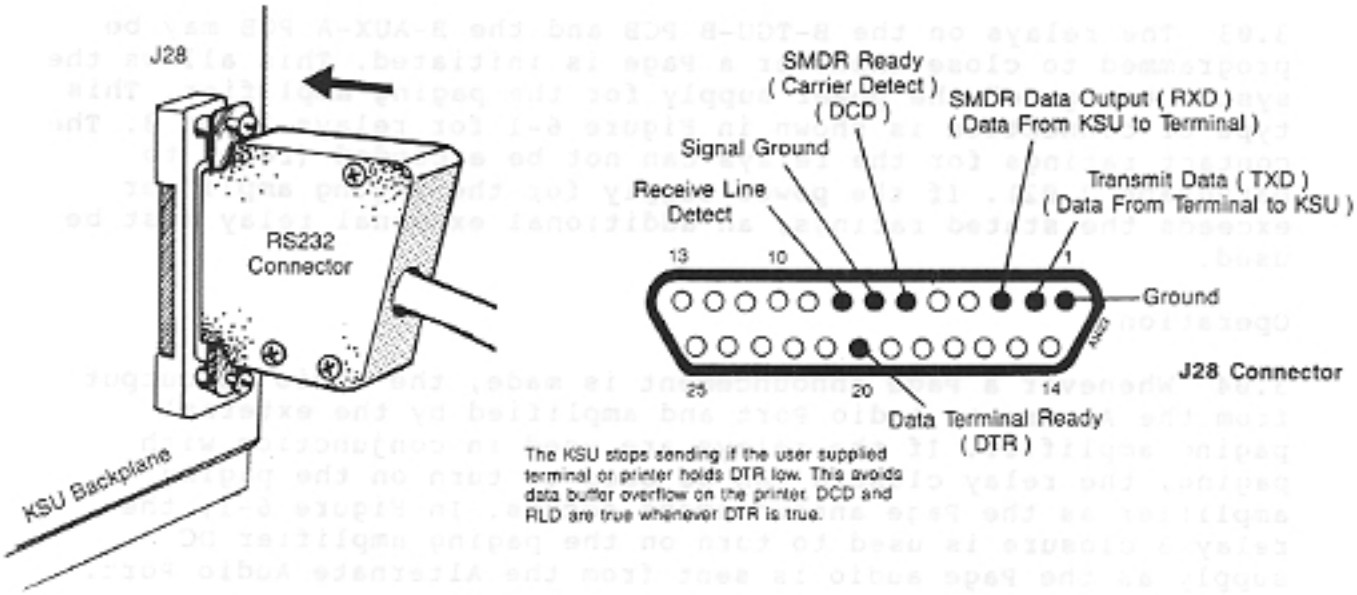


Figure 6-3 RS232C INTERFACE CONNECTOR AND PIN ASSIGNMENT (J28), TCX-128

SWITCH S2

Baud Rate	Selector 1	2	3	4
50	C	O	C	C
75	O	O	C	C
110	O	O	O	O
135	C	C	O	C
150	C	O	O	O
200	O	C	O	C
300	O	C	O	O
600	C	O	O	C
1200	O	O	C	O
1800	C	O	C	O
2400	C	C	O	O
4800	O	C	C	O
9600	C	C	C	O

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Note: O equals the OPEN position on the selectors. C equals the closed position.

SERIAL DATA SWITCH (S3) SELECTOR

1	2	3	4	5	6	7	8	
							O	Parity Enable
							C	Parity Disable
						O		Parity Even
						C		Parity Odd
				O	O			Not Used
				O	C			1 Stop Bit
				C	O			1.5 Stop Bits
				C	C			2 Stop Bits
			X					Not Used
		C						7 Bits Per Char
		O						8 Bits Per Char
X	X							Not Used

Bit Number O = Open C = Closed X = Don't Care

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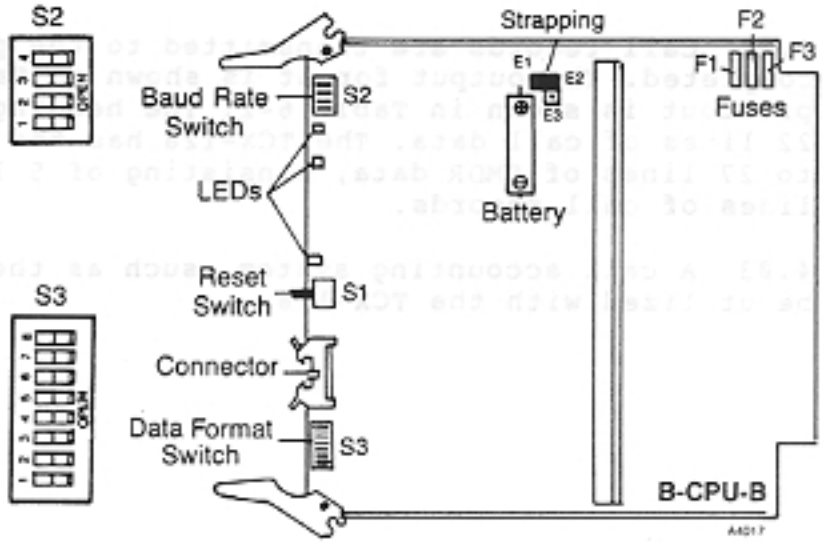

Figure 6-4 BAUD RATE AND SERIAL DATA SWITCH ON B-CPU-B, TCX-128

Table 6-1 FORMAT OF SMDR PRINTOUT, TCX-128

CHARACTER	FIELD
1	Delimiter
2 - 9	Date (MM/DD/YY) MM = Month DD = Date YY = Year
10	Delimiter
11 - 13	Calling Sta. – (XXX) X = Digit
14	Delimiter
15 - 16	Line – (XX) X = Digit
17	Delimiter
18 - 33	Number Called, Right Justified in 16 Character Field
34	Delimiter
35 - 42	Start Time (HH:MM:SS) HH = Hour, MM = Min, SS = Sec.
43	Delimiter
44 - 51	Call Duration (HH:MM:SS) H = Hour, MM = Min., SS = Sec.
52	Delimiter
53 - 58	* Charge (__DD.CC) DD = Dollars, CC = Cents, __ = Space
59	Delimiter
60 - 68	Account Code, Right Justified in 9 Character Field
69	Delimiter
70-76	Speed Dial bin no. (SSS/EEE) S = System Bin, E = Station Bin
77	Delimiter
78	Carriage return
79	Line Feed

* Charge Field only valid if system includes LCR.

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Table 6-2 TYPICAL SMDR PRINTER OUTPUT

```
TIE COMMUNICATIONS INC. TCX-128

 DATE     EXT LINE  NUMBER DIALED      START    ELAPSE   CHARGE ACC.CODE
+--------+---+---+----------------+--------+--------+------+---------+
 02/28/85 301 02       12039262000 06:10:26 00:00:09  00.24
 02/28/85 301 02       12039262000 06:10:52 00:00:13  00.24          ERD
 02/28/85 301 02       12039262000 06:11:21 00:00:16  00.24          ESV
 02/28/85 301 02       12038888000 06:12:15 00:00:16  00.24          S00
 02/28/85 301 02       12039262129 06:13:13 00:00:09  00.24          E01
 02/28/85 301 02 1203888800012039 06:13:45 00:00:18  00.24          S00 E01
```

Enn = Station Speed Dial bin
ERD = Last Number Redial
ESV = Save redial
Snn = System Speed Dial bin

5. BACKGROUND MUSIC/MUSIC ON HOLD

5.01 Any music source with an output impedance of 600-2000 ohms and an adjustable volume control may be used for Background Music (BGM) and/or Music on Hold (MOH). The music source can be an AM/FM radio, cassette tape deck, automatic turntable, etc. The source plugs into the KSU backplane with standard phono jacks. If the output impedance of the music source is much less or greater than the stated range, a matching transformer is required.

5.02 To install Background Music or Music on Hold (Figure 6-5):

(1) Connect the output from the music source to the BGM or MOH jack (J24 or J23).

(2) If BGM and MOH will use the same music source, strap the strapping bar from E1 to E2. If BGM and MOH are to use separate sources, strap from E2 to E3.

(3) Listen to the volume level of BGM. If necessary, turn down the adjustable volume control on the music source to eliminate distortion.

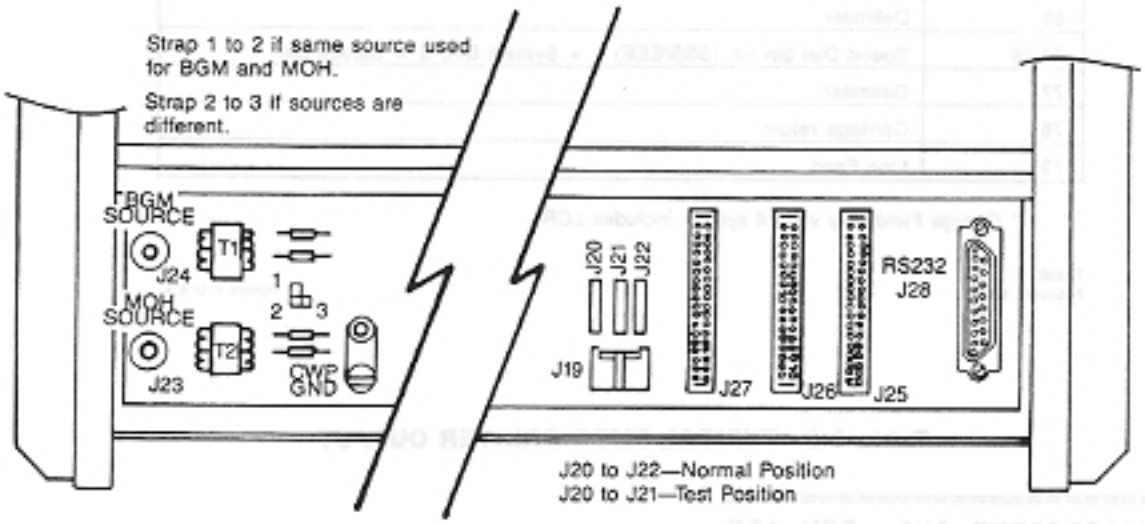

Figure 6-5 KSU CONNECTIONS FOR OPTIONAL EQUIPMENT, TCX-128

6. OPTIONAL EQUIPMENT PUBLICATIONS

6.01 The following publications on optional equipment are available:

	Document Number
SPECIAL LOUD RINGING TONE BOARD (P/N 86185)	01042
TIE ELECTRONIC RINGER (P/N 86187)	01084
TELE-RECORD (P/N 19500)	01026

Installation instructions for Off Premises Extensions are included at the end of this manual as Appendix F.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 7, PROGRAM ENTRY

1. INTRODUCTION

1.01 The PROGRAM ENTRY Section describes the procedures for programming the TCX-128 Computerized Branch Exchange. During programming, the data recorded on the Program Record Forms (PRFs) in Section 4, SOFTWARE CONFIGURATION, is entered into system memory. This section is divided into three parts: PREPARATION, SYSTEM INITIALIZATION and PROGRAM ENTRY.

2. PREPARATION

2.01 The following paragraphs outline the procedures that are required to prepare the system for programming.

(1) Programming information must be recorded on the PRFs before programming the system.

(2) Plug any ASCII terminal or printer having an RS-232-C interface into the J28 connector (Figure 7-1) on the KSU backplane.

(3) The baud rate switch (S2) and the serial data switch (S3) on the B-CPU-B Printed Circuit Board (PCB) must be set to match the programming terminal (Figure 7-2).

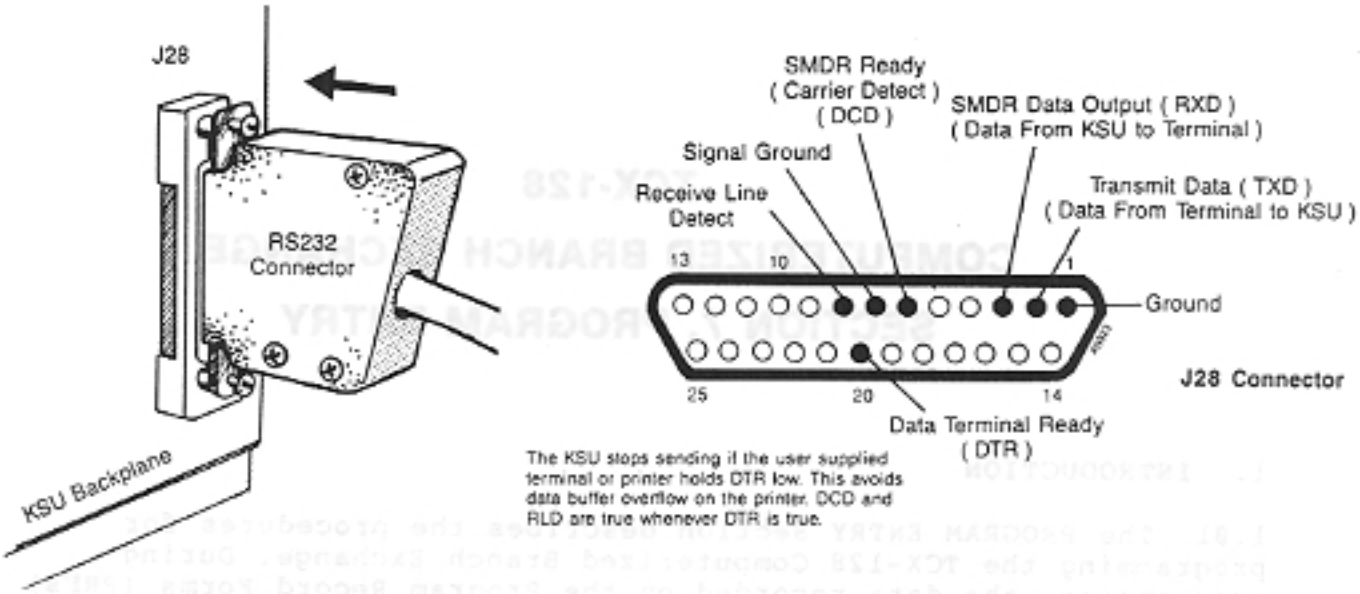

Figure 7-1 RS-232-C INTERFACE CONNECTOR AND PIN ASSIGNMENT (J28), TCX-128

SWITCH S2				
Baud Rate	Selector 1	2	3	4
50	C	O	C	C
75	O	O	C	C
110	O	O	O	O
135	C	C	O	C
150	C	O	O	O
200	O	C	O	C
300	O	C	O	O
600	C	O	O	C
1200	O	O	C	O
1800	C	O	C	O
2400	C	C	O	O
4800	O	C	C	O
9600	C	C	C	O

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Note: O equals the OPEN position on the selectors. C equals the closed position.

SERIAL DATA SWITCH (S3) SELECTOR								
1	2	3	4	5	6	7	8	
							O	Parity Enable
							C	Parity Disable
						O		Parity Even
						C		Parity Odd
				O	O			Not Used
				O	C			1 Stop Bit
				C	O			1.5 Stop Bits
				C	C			2 Stop Bits
			X					Not Used
		C						7 Bits Per Char
		O						8 Bits Per Char
X	X							Not Used
Bit Number O = Open C = Closed								X = Don't Care

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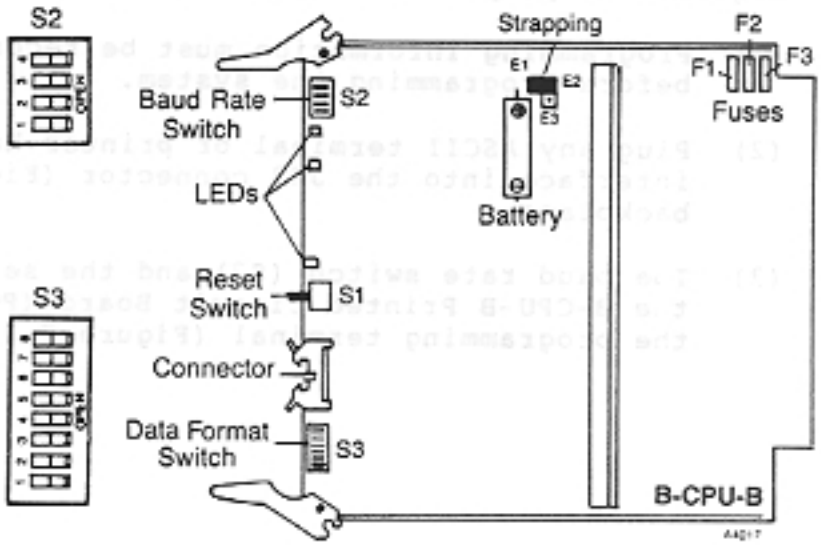


Figure 7-2 SERIAL DATA SWITCH (S3), BAUD RATE SWITCH (S2) AND RESET SWITCH (S1) LOCATIONS, TCX-128

3. SYSTEM INITIALIZATION

3.01 The system must be initialized, before options are programmed, to set all fields to default entries. Initialization erases all previously selected options.

> CAUTION: INITIALIZATION RETURNS ALL FIELDS TO DEFAULT ENTRIES. ALL PREVIOUS PROGRAMMING IS ERASED.

Initializing a System without Least Cost Routing (LCR)

3.02 To initialize a TCX-128 system without LCR:

(1) Press the M key. The following menu appears:

```
'E' -->  STATIONS FEATURES
'S' -->  SYSTEM FEATURES
'I' -->  SYSTEM INITIALIZATION
'Q' -->  EXIT PROGRAMMING MODE
'D' -->  DISPLAY SYSTEM STATUS
```

(2) Press the I key to start the Initialization program.

3.03 When Initialization is complete the following message appears:

```
PROGRAM COMPLETE BT15                    X10
```

(3) Press the reset switch (S1) on the CPU PCB (Figure 7-2), the following message appears: WELCOME TO CX-128. The system is now ready for programming.

Initializing a System with Least Cost Routing (LCR)

3.04 To initialize a TCX-128 system with LCR:

NOTE: The system must be re-initialized after an LCR update package is installed.

(1) Turn off the KSU power supply.

(2) Using proper static precautions, briefly unplug the battery strap on the B-CPU-B PCB (per Figure 7-1). This clears the on-board Random Access Memory (RAM).

(3) Connect the B-CPU-B PCB battery strap from E1 to E2 (refer to Figure 7-1).

(4) Turn on the power supply.

(5) Press the M key. The following menu appears:

```
'E' -->  STATIONS FEATURES
'S' -->  SYSTEM FEATURES
'I' -->  SYSTEM INITIALIZATION
'Q' -->  EXIT PROGRAMMING MODE
'D' -->  DISPLAY SYSTEM STATUS
```

(6) Press the I key to start the Initialization program.

3.Ø5 When Initialization is complete, the following message appears:

```
PROGRAM COMPLETE BT15                              X1Ø
```

(7) Repeat steps 5 and 6 above.

(8) Press the reset switch (S1) on the CPU PCB (Figure 7-2), the following message appears: WELCOME TO CX-128. The system is now ready for programming.

Changes To Entries

3.Ø6 If a specific field requires modification at a later date, follow the programming procedures in this section but do not initialize the system again.

CAUTION: INITIALIZATION RETURNS ALL FIELDS TO DEFAULT ENTRIES. ALL PREVIOUSLY ENTERED PROGRAMMING IS ERASED.

4. PROGRAM ENTRY

4.Ø1 This part is arranged in order of the Program Record Forms in Section 4; however, the programmer can enter data to any program in any order. To access a program, type the corresponding letter on the System Configuration Program menu.

4.Ø2 The following paragraphs outline the procedure to program system and station features. The system prompts, in order, as each entry is made. If no entry for a prompt is required, press the RETURN key; the system advances to the next prompt.

4.Ø3 To exit from a program:

(1) Press the Q key once.

To exit from the programming mode:

(1) Press the Q key twice.

Programming a System with Least Cost Routing (LCR)

4.04 If Least Cost Routing is to be used with the system (or if an LCR update package has been installed), programs must be entered in a specific order. After the system is initialized, program as follows:

```
'S' -->  SYSTEM FEATURES
     'A' -->  OFFICE CODE TYPES
     'G' -->  CO GROUPS
     'L' -->  LEAST COST ROUTING
     'T' -->  TIME OF DAY
     'D' -->  DATE
```

4.05 After the 'D' --> DATE field is programmed, the remaining fields can be programmed as required.

'S' --> SYSTEM FEATURES

4.06 To program 'S' --> SYSTEM FEATURES

(1) Press the M key for the main menu.

(2) Press the S key for the 'S' --> SYSTEM FEATURES menu.

```
'T' -->  TIME OF DAY
'D' -->  DATE
'O' -->  OPERATORS & DSS
'M' -->  TIMERS
'L' -->  LEAST COST ROUTING
'R' -->  RELAYS CONTROL
'P' -->  CO TYPE
'A' -->  OFFICE CODE TYPES
'K' -->  COS ALOWED AREA CODES
'E' -->  EXTERNAL OUTPUTS
'N' -->  OUT KEYS GROUPS
'F' -->  SYSTEM OPTIONS
'?' -->  COMMAND LIST
```

NOTE: At any point after the 'S' --> SYSTEM FEATURES program has been entered, the System Commands menu may be displayed.

4.07 To recall the menu:

(1) Press the Q key.
(2) Press ? while holding the SHIFT key.

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'T' --> TIME OF DAY

4.Ø8 To program the 'T' --> TIME OF DAY field, press the T key. The system prompts:

ENTER HOURS HH.....

(1) Enter 2-digits for the hour (ØØ-23).
(2) Press the RETURN key, the system prompts:

ENTER MINUTES MM...

(1) Enter 2-digits for the minutes past the hour (ØØ-59).
(2) Press the RETURN key.

'D' --> DATE

4.Ø9 To program the 'D' --> DATE, press the D key. The system prompts:

ENTER MONTH.....

(1) Enter 2-digits for the month (Ø1-12).
(2) Press the RETURN key, the system prompts:

ENTER DATE.....

(1) Enter 2-digits for the day of the month (Ø1-31).
(2) Press the RETURN key, the system prompts:

ENTER YEAR.....

(1) Enter 2-digits for the year (i.e., 1984, enter 84).

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'O' --> OPERATORS & DSS

4.10 To program 'O' --> OPERATORS & DSS, press the O key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.11 The prompts and default values for 'O' --> OPERATORS & DSS are:

```
OPERATOR 1 IS .............301_
DSS OPERATOR 1 IS .........NONE_
ALTERNATE OPERATOR 1 IS...NONE_
OPERATOR 2 IS .............NONE_
DSS OPERATOR 2 IS..........NONE_
ALTERNATE OPERATOR 2 IS...NONE_
OPERATOR 3 IS .............NONE
DSS OPERATOR 3 IS .........NONE_
ALTERNATE OPERATOR 3 IS...NONE_
OPERATOR 4 IS .............NONE_
DSS OPERATOR 4 IS..........NONE_
ALTERNATE OPERATOR 4 IS...NONE_
OPERATOR 5 IS .............NONE
DSS OPERATOR 5 IS .........NONE_
ALTERNATE OPERATOR 5 IS...NONE_
OPERATOR 6 IS .............NONE_
DSS OPERATOR 6 IS..........NONE_
ALTERNATE OPERATOR 6 IS...NONE_
```

'M' --> TIMERS

4.12 To program 'M' --> TIMERS, press the M key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.13 The prompts and default values for 'M' --> TIMERS are:

```
HOLD RECALL TIMER.(SEC)..060_
ORBIT RECALL TIMER.(SEC).060_
PAUSE TIME-OUT.(SEC).....006_
FLASH TIMER.(N*50MSEC)...020_
DIAL TONE TIME-OUT.(SEC).002_
SMDR TIMER..(SEC).........030_
TRANS RECALL.(SEC).......120_
```

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'L' --> LEAST COST ROUTING

4.14 To program 'L' --> LEAST COST ROUTING, press the L key. The system prompts:

```
LCR ENABLED....NO_
```

4.15 If LCR is not being used, press the RETURN key or the Q key to exit the field. If LCR is being used:

(1) Enter YES.
(2) Press the RETURN key.

4.16 For each of the prompts that follow:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.17 The prompts and default values for 'L' --> LEAST COST ROUTING are:

```
LCR SERVICE # 01
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 02
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 03
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 04
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 05
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 06
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
LCR SERVICE # 07
   LINE GROUP......_77_
   OCC DIALUP SYS BIN..._00_
   FX SERVICE/OTHER..1/0..._00_
```

> WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

```
LCR SERVICE # 08
   LINE GROUP......_77_
   OCC DIALUP SYS BIN.._00_
   FX SERVICE/OTHER..1/0.._00_
LCR SERVICE # 09
   LINE GROUP......_77_
   OCC DIALUP SYS BIN.._00_
   FX SERVICE/OTHER..1/0.._00_
LCR SERVICE # 10
   LINE GROUP......_77_
   OCC DIALUP SYS BIN.._00_
   FX SERVICE/OTHER..1/0.._00_
```

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'R' --> RELAYS CONTROL

4.18 To program 'R' --> RELAYS CONTROL, press the R key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.19 The prompts and default values for 'R' --> RELAYS CONTROL are:

BIT NUMBER	7	6	5	4	3	2	1	Ø
FUNCTION	NIGHT	ALL-P	ANY-P			NRNGR	ZPAGE	RINGR

```
RELAY #1 CONTROL.....ØØ_
RELAY #2 CONTROL.....ØØ_
RELAY #3 CONTROL.....ØØ_
RELAY #4 CONTROL.....ØØ_
```

'G' --> CO GROUPS

4.20 To program 'G' --> CO GROUPS, press the G key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.21 The prompts and default values for 'G' --> CO GROUPS are:

```
LINE..Ø1..GROUP IS......Ø1_
LINE..Ø2..GROUP IS......Ø1_
LINE..Ø3..GROUP IS......Ø1_
LINE..Ø4..GROUP IS......Ø1_
LINE..Ø5..GROUP IS......Ø1_
LINE..Ø6..GROUP IS......Ø1_
LINE..Ø7..GROUP IS......Ø1_
LINE..Ø8..GROUP IS......Ø1_
LINE..Ø9..GROUP IS......Ø2_
LINE..1Ø..GROUP IS......Ø2_
LINE..11..GROUP IS......Ø2_
LINE..12..GROUP IS......Ø2_
LINE..13..GROUP IS......Ø2_
LINE..14..GROUP IS......Ø2_
LINE..15..GROUP IS......Ø2_
LINE..16..GROUP IS......Ø2_
```

> WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

```
LINE..17..GROUP IS......03_
LINE..18..GROUP IS......03_
LINE..19..GROUP IS......03_
LINE..20..GROUP IS......03
LINE..21..GROUP IS......03_
LINE..22..GROUP IS......03_
LINE..23..GROUP IS......03_
LINE..24..GROUP IS......03_
LINE..25..GROUP IS......77_
LINE..26..GROUP IS......77_
LINE..27..GROUP IS......77_
LINE..28..GROUP IS......77_
LINE..29..GROUP IS......77_
LINE..30..GROUP IS......77_
LINE..31..GROUP IS......77_
LINE..32..GROUP IS......77_
```

NOTE: Enter 77 for all unused lines.

> WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'P' --> CO TYPE

4.22 To program 'P' --> CO TYPE, press the P key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.23 The prompts and default values for 'P' --> CO TYPE are:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	IN	PBX	P/T				TOLLF	UNA

```
LINE..01..TYPE  IS.......01_
LINE..02..TYPE  IS.......01_
LINE..03..TYPE  IS.......01_
LINE..04..TYPE  IS.......01_
LINE..05..TYPE  IS.......01_
LINE..06..TYPE  IS.......01_
LINE..07..TYPE  IS.......01_
LINE..08..TYPE  IS.......01_
LINE..09..TYPE  IS.......01_
LINE..10..TYPE  IS.......01_
LINE..11..TYPE  IS.......01_
LINE..12..TYPE  IS.......01_
LINE..13..TYPE  IS.......01_
LINE..14..TYPE  IS.......01_
LINE..15..TYPE  IS.......01_
LINE..16..TYPE  IS.......01_
LINE..17..TYPE  IS.......01_
LINE..18..TYPE  IS.......01_
LINE..19..TYPE  IS.......01_
LINE..20..TYPE  IS.......01_
LINE..21..TYPE  IS.......01_
LINE..22..TYPE  IS.......01_
LINE..23..TYPE  IS.......01_
LINE..24..TYPE  IS.......01_
LINE..25..TYPE  IS.......01_
LINE..26..TYPE  IS.......01_
LINE..27..TYPE  IS.......01_
LINE..28..TYPE  IS.......01_
LINE..29..TYPE  IS.......01_
LINE..30..TYPE  IS.......01_
LINE..31..TYPE  IS.......01_
LINE..32..TYPE  IS.......01_
```

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'A' --> OFFICE CODE TYPES

4.24 To program 'A' --> OFFICE CODE TYPES, press the A key. The system prompts:

```
 OFFICE CODE TYPE.
0 : 10-11 DIGITS TOLL (Area Codes)
1 : TOLL IF 1-NNN..., OTHERWISE LOCAL (Conflict Codes)
2 : LOCAL 3-4 DIGITS (Emergency Assistance Numbers)
3 : LOCAL 7-8 DIGITS (Office Code Only)
4 : SPECIAL 1NN PREFIX (not used)

ENTER EXCHANGE...(NNN)._
000_
```

4.25 Programming is done for each individual code, in ranges, or globally for all codes.

(a) Programming Individual Codes

When the system prompts:

ENTER EXCHANGE...(NNN).

enter code to be programmed and press the RETURN key. When the system prompts:

UP TO AND INCLUDE.....

enter the same exchange again and press the RETURN key. When the system returns:

EXCHANGE TYPE IS....

enter code type from Table 4-3 and press the RETURN key.

(b) Programming in Ranges

4.26 When the system prompts:

ENTER EXCHANGE...(NNN).

enter the lowest numbered code in the range to be programmed and press the RETURN key.

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

When the system prompts:

UP TO AND INCLUDE .....

enter the highest numbered code in the range to be programmed and press the RETURN key.

When the system prompts:

EXCHANGE TYPE IS....

enter code type from Table 4-3 and press the RETURN key. The entire range is now assigned that code type.

(c) Global Programming

4.27 When the system prompts:

ENTER EXCHANGE..(NNN)

enter 100 and press the RETURN key. When the system prompts:

UP TO AND INCLUDE .....

enter 999 and press the RETURN key. When the system prompts:

EXCHANGE TYPE IS....

enter code from Table 4-3 and press the RETURN key. The entire table is now assigned that code.

4.28 To check the assignment for a code, when the system prompts:

ENTER EXCHANGE...(NNN)_

enter code to be checked and press the RETURN key. When the system prompts:

UP TO AND INCLUDE.....

press the RETURN key.

The EXCHANGE TYPE IS.... prompt will display the assignment for the code checked.

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'K' --> COS ALOWED AREA CODES

4.29 To program 'K' --> COS ALOWED AREA CODES, press the K key. The system prompts:

```
ALLOWED COS FOR OFFICE CODE.
BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Ø |
COS | X | X |C-5|C-4|C-3|C-2|C-1| ON|

ENTER EXCHANGE...(NNN)._
ØØØ_
```

4.30 Programming is done for each individual area code, in ranges, or globally for all codes.

(a) Programming Individual Area Codes

4.31 When the system prompts:

```
ENTER EXCHANGE...(nnn).
```

enter code to be programmed and press the RETURN key. When the system prompts:

```
UP TO AND INCLUDE.....
```

enter the same exchange and press the RETURN key. When the system prompts:

```
COS RECORDED/NEW...._Ø1
```

enter data from Table 4-4 and press the RETURN key. Prompts continue until the Q key is pressed.

(b) Programming in Ranges

4.32 When the system prompts:

```
ENTER EXCHANGE...(NNN).
```

enter the lowest numbered code in the range to be programmed and press the RETURN key. When the system prompts:

```
UP TO AND INCLUDE .....
```

enter the highest numbered code in the range to be programmed and press the RETURN key. When the system prompts:

```
ENTER NEW COS....._
```

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

enter data from Table 4-4 and press the RETURN key. The entire range is now assigned that code type. The * prompt will display, indicating that the entire range has been programmed.

(c) Global Programming

4.33 When the system prompts:

ENTER EXCHANGE...(NNN)

enter 200 and press the RETURN key. When the system prompts:

UP TO AND INCLUDE .....

enter 999 and press the RETURN key. When the system prompts:

ENTER NEW COS....._

enter data from Table 4-4 and press return. The entire table is now assigned that code. The * prompt will display, indicating that the entire table has been programmed.

4.34 To check the Class of Service for an area code, when the system prompts:

ENTER EXCHANGE...(NNN)_

enter area code to be checked and press the RETURN key. When the system prompts:

UP TO AND INCLUDE.....

press the RETURN key.

The COS RECORDED/NEW.... prompt will display the Class of Service data for the area code.

> **WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.**

'E' --> EXTERNAL OUTPUTS

4.35 To program 'E' --> EXTERNAL OUTPUTS, press the E key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.36 The prompts and default values for 'E' --> EXTERNAL OUTPUTS are:

BIT NUMBER	7	6	5	4	3	2	1	0
FUNCTION	NIGHT	BGM	PAGE			PG-DZ	ON	C-OFF

```
OUTPUT..01..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..02..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..03..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..04..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..05..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..06..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..07..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
OUTPUT..08..CONTROL  IS...20_
ALTERNATE AUDIO PORT IS..NONE_
```

'N' --> OUT KEYS GROUPS

4.37 To program 'N' --> OUT KEYS GROUPS, press the N key. For each prompt:

(1) Enter data from Table 4-2.
(2) Press the RETURN key.

4.38 The prompts and default values for 'N' --> OUT KEYS GROUPS are:

```
OUT_KEY # 01 SELECT GROUP # _01_
OUT_KEY # 02 SELECT GROUP # _01_
OUT_KEY # 03 SELECT GROUP # _02_
OUT_KEY # 04 SELECT GROUP # _02_
OUT_KEY # 05 SELECT GROUP # _03_
OUT_KEY # 06 SELECT GROUP # _03_
```

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'F' --> SYSTEM OPTIONS

4.39 To program 'F' --> SYSTEM OPTIONS, press the F key. The system prompts:

SYS OPTION EDIT

ENTER OPTION#..

4.40 To program an option:

(1) Enter the option number.
(2) Press the RETURN key. The system prompts:

OPTION ENABLED...

(3) Refer to Table 4-2 and enter Y (for YES) or N (for NO).
(4) Press the RETURN key. The system prompts:

OPTION ENABLED...

(5) Press the RETURN key to access the sub-field for the next consecutive option, enter another option number or press the Q key to leave the field.

'?' --> COMMAND LIST

4.41 To bring up the System Commands menu, press the ? key while pressing the SHIFT key.

SYSTEM PROGRAMMING COMPLETE

4.42 When all data for 'S' --> SYSTEM FEATURES has been programmed:

(1) Press the Q key twice, the system prompts:

PROGRAM COMPLETE BT15 X10

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

'E' --> STATIONS FEATURES

How to Program Stations

4.43 To program features for each station:

(1) Press the M key for the main menu.

(2) Press the E key, the system prompts:

ENTER STATION NUMBER..

(3) Press the RETURN key to program station 3Ø1 or enter the number of the station to be programmed (and press RETURN).

(4) Enter data from Table 4-5 for each field pertaining to the station being programmed.

(5) Repeat procedure until all stations are programmed.

4.44 To program another station:

(1) Press the Q key to access another station number without stepping through all the fields.

How to Program Stations for a Selected Field

4.45 To program only a selected field for each station:

(1) Enter data from Table 4-5 for first field to be programmed.
(2) Press the X key instead of the return key.

4.46 The entry is recorded for the station being programmed. The same field for the next consecutive station number automatically appears. (Note that when using the X key to program selected fields, the system treats CO AUDIBLE [Ø1..Ø8] IS.. through CO ACCESS [25..32] IS.. as one block. The X key can only be pressed after the entry for CO ACCESS [25..32] IS.. is made. The X key cannot be used to sequence through one of these fields individually.)

4.47 For each additional station to be programmed:

(1) Enter data from Table 4-5.
(2) Press return.

4.48 The same field for the next consecutive station number automatically appears.

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

4.49 The prompts and default assignments (where applicable) for 'E' --> STATIONS FEATURES are:

```
PROGRAMMING STATION.......

PORT NUMBER..............
TYPE OF PHONE..........KEY
HOT-LINE KEY.............
CLASS OF SERVICE........ØØ
CO AUDIBLE [Ø1..Ø8] IS..*
CO AUDIBLE [Ø9..16] IS..*
CO AUDIBLE [17..24] IS..*
CO AUDIBLE [25..32] IS..*
CO ACCESS  [Ø1..Ø8] IS..FF*
CO ACCESS  [Ø9..16] IS..FF*
CO ACCESS  [17..24] IS..FF*
CO ACCESS  [25..32] IS..FF*
RECEIVE ALL-PAGE.......YES
BARGE   IN   ENABLED....NO
BLOCK BARGE  ENABLED....NO
NIGHT RING   ENABLED...YES
DIL OFF HOOK SIGNAL.....NO
DIAL C.O. GROUP.........NO
CAMP-ON   ORIGINATE....YES
CAMP-ON   RECEIVE......YES
PAGE ZONE RECEIVED.....  *
PICK UP GROUP IS........ØØ
PRIVATE LINE.......IS...NONE
```

* These are hexadecimal entries. Refer to Table 4-5 for assignment.

WARNING: ALWAYS PRESS THE RESET SWITCH (S1) ON THE B-CPU-B PCB AFTER PROGRAMMING OR REPROGRAMMING THE SYSTEM.

PROGRAMMING COMPLETE

4.50 When all data for system and station features has been entered:

(1) Press the Q key twice to exit the programming mode.
(2) Press the reset switch (S1) on the CPU PCB to set the program (Figure 7-2).

NOTE: After programming is complete, the SMDR printer (if installed) will be enabled.

CAUTION: AFTER PROGRAMMING, ALWAYS PRESS THE RESET SWITCH ON THE CPU PCB. THIS MUST BE DONE TO INSURE THAT ALL THE ENTRIES YOU MADE ARE LOADED INTO SYSTEM MEMORY.

CAUTION: AFTER THE CPU RESET SWITCH IS PRESSED, OR ANY TIME THE SYSTEM IS TURNED OFF AND ON, THE HANDSET ON EACH SINGLE LINE AND ONE BUTTON TELEPHONE MUST BE CYCLED (OFF HOOK, THEN ON HOOK).

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 8, THEORY OF OPERATION

1. INTRODUCTION

1.01 The THEORY OF OPERATION Section presents the module (plug-replaceable unit) level theory of operation for the TCX-128 telephone system. It is to be used with Section 9, MAINTENANCE, to allow the service technician to isolate system troubles to the plug-replaceable unit. This section is divided into five parts: Introduction, System Description, Printed Circuit Boards, Telephones and Analysis of Signal Flow.

1.02 Part 1, Introduction, is what you are reading now. Part 2, System Description, provides the Hardware and Software Overview. This part also contains the System Summary, which is a general discussion of how the components of the system function together. Part 3, Printed Circuit Boards, consists of an explanation and block diagram for each Printed Circuit Board (PCB) in the system. An evaluation of each telephone instrument is presented in Part 4, Telephones. Part 5 is the Analysis of Signal Flow. This part is used to explain what happens when a user receives an outside call, places an outside call, or places an Intercom call.

2. SYSTEM DESCRIPTION

HARDWARE OVERVIEW

2.01 The TCX-128 Key Service Unit (KSU) contains the plug-in Printed Circuit Boards (PCBs) that serve as the common equipment between the 128 system telephones, 32 incoming telephone company (telco) or PBX lines, and the optional equipment. A network of microprocessors in the KSU work with the system software and microprocessors in each telephone. This allows internal and external traffic to be processed on a real time basis (i.e., without delay).

Printed Circuit Boards

2.02 The TCX-128 system (Figure 8-1) uses the following common equipment Printed Circuit Boards:

B-CPU-B (Central Processing Unit) PCB

2.03 The B-CPU-B PCB contains the Z80 executive microprocessor, the 6502 traffic control microprocessor, and the system operating software and memory. The B-CPU-B also contains the Common RAM (Random Access Memory) circuits which interface the Z80 executive microprocessor to the 6502 traffic controller.

B-TGU-B (Tone Generator Unit) PCB

2.04 This board provides system tones, Dual Tone Multifrequency (DTMF) generators and receivers for processing telephone dial commands, and amplifiers for Background Music (BGM), Music on Hold (MOH) and Page. The B-TGU-B PCB also contains an analog switch matrix (crosspoints) to connect the tones and amplifiers to the stations and the incoming lines.

B-AUX-A (Auxiliary) PCB

2.05 The B-AUX-A PCB has additional DTMF generators, amplifiers and crosspoint circuits. The B-AUX-A also contains the rate circuitry for Least Cost Routing (LCR).

B-8SCU-C (Station Control Unit) PCB

2.06 The Station Control Unit (B-8SCU-C) PCB is used to connect key telephones to the system. Each B-8SCU-C PCB has the data and power circuits for eight stations, as well as the crosspoints to link the system analog (speech) paths to each station.

B-8SLU-B (Single Line Unit) PCB

2.07 The B-8SLU-B PCB connects eight single line (2500 type) telephones with special ringers to the system.

B-4COU-A (Central Office Unit) PCB

2.08 This Printed Circuit Board is used to interface four Central Office (CO) or Private Branch Exchange (PBX) lines to the system. This PCB also contains circuitry for ring detection, DC loop supervision, and multi-line conferencing.

B-BUF-A (Buffer) PCB

2.09 The B-BUF-A PCB is installed in systems with an expansion cabinet (i.e., systems that require more than 24 lines and/or 64 stations). The B-BUF-A PCB connects the data from the 6502 Traffic Controller in the B-CPU-B PCB to the expansion cabinet backplane. This PCB plugs into the expansion cabinet.

System Capacity

2.1Ø A typical single KSU TCX-128 system can contain up to eight B-8SCU-C or B-8SLU-B PCBs (for station ports Ø01-Ø64), and up to six B-4COU-A PCBs (for lines 1-24). If an expansion cabinet is added, the system can accommodate an additional eight B-8SCU-C or B-8SLU-B PCBs (for station ports Ø65-128), and two more B-4COU-A PCBs (for lines 25-32). A single B-TGU-B PCB (B-TGU-B1) can support a fully loaded KSU. If an expansion cabinet is used, an additional B-TGU-B PCB (B-TGU-B2) or a B-AUX-A PCB must be used to provide the Page, MOH and BGM amplifiers for the expansion components. The extra PCB is usually added as standard equipment anyway, to provide for additional DTMF receivers and/or generators. Refer to Section 3, HARDWARE CONFIGURATION.

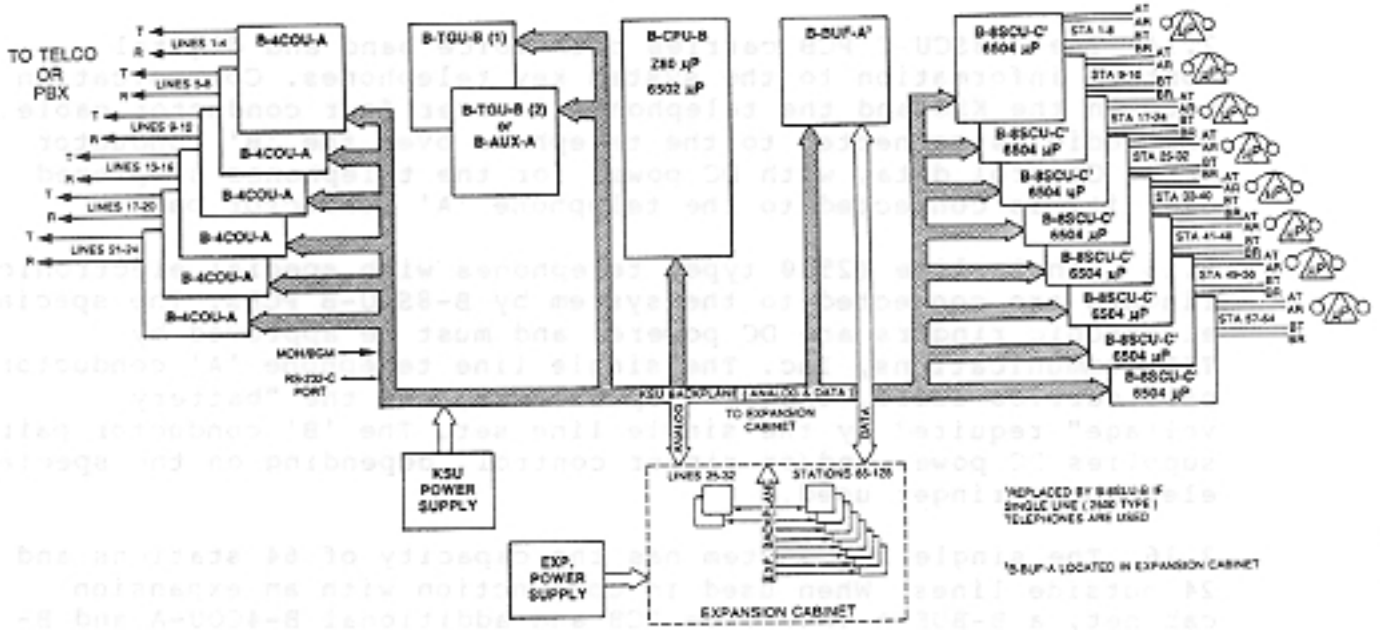


Figure 8-1 SYSTEM BLOCK DIAGRAM, TCX-128

System Summary

2.11 The B-CPU-B PCB is the Central Processing Unit for the TCX-128 Telephone System. It uses a Z80 executive microprocessor and stored programs to make system traffic processing decisions. The Z80 communicates with a 6502 traffic control microprocessor to monitor the status of all stations and lines. The user can program selected configuration options by using a programming terminal, connected to the Z80 through the KSU RS-232-C data port.

2.12 The 6502, under Z80 control, sends commands and receives interrupts from the B-4COU-A, B-8SCU-C and B-8SLU-B PCBs in the system. It provides, through the 6502 Data Bus, the signals that control the voice connections (analog crosspoints) between the telephones and the telephone company network.

2.13 Dual Tone Multifrequency (DTMF) circuits in the B-TGU-B PCB (s) process dial commands from every station. In addition, the B-TGU-B provides tone generators for system supervisory tones, and amplifiers for Background Music, Music on Hold and Page. Analog crosspoints for lines 20 through 32 are also resident on the B-TGU-B. The B-AUX-A PCB provides the stored program for Least Cost Routing (LCR), as well as DTMF and supervisory tone generators, and amplifiers for music and Page.

2.14 The B-8SCU-C PCB carries both voice band and digital control information to the system key telephones. Communication between the KSU and the telephones is over four conductor cable. The audio is connected to the telephone over the 'B' conductor pair. Control data, with DC power for the telephones simplexed over it, is connected to the telephone 'A' conductor pair.

2.15 Single line (2500 type) telephones with special electronic ringers are connected to the system by B-8SLU-B PCBs. The special electronic ringers are DC powered and must be approved by TIE/communications, Inc. The single line telephone 'A' conductor pair carries audio, the DC loop current, and the "battery voltage" required by the single line set. The 'B' conductor pair supplies DC power and/or ringer control, depending on the special electronic ringer used.

2.16 The single KSU system has the capacity of 64 stations and 24 outside lines. When used in conjunction with an expansion cabinet, a B-BUF-A interface PCB and additional B-4COU-A and B-8SCU-C/B-8SLU-B PCBs, the system capacity is extended to 128 stations and 32 lines.

2.17 DC circuit power is derived from a separate power supply. The KSU and the expansion cabinet each have their own power supply.

Analog (Audio) Connections

2.18 The TCX-128 analog network (Figure 8-2) connects the audio (speech) circuits of 128 telephones to each other, to the tone generators and DTMF circuits in the B-TGU-B and B-AUX-A PCBs, and to the 32 outside lines. There are 32 talkpaths (audio paths) in the system. Twenty talkpaths are for the Direct Access Lines (lines 1-20). The remaining 12 are for the 10 Intercom links, Page and Background Music. The audio connections in the KSU backplane are formed into three busses: the Direct Access Line Bus, the Link Bus, and the Dial-Up Line Bus.

Direct Access Line Bus

2.19 The first twenty lines in the system are the Direct Access Lines, connected to the first five B-4COU-A PCBs in the KSU. The audio circuits for each line (1-20) are connected to discrete paths in the Direct Access Bus. The bus presents audio for the Direct Access Lines to each of the eight B-8SCU-C PCBs. These lines are termed Direct Access Lines since they can be connected to any station through a single crosspoint (digitally controlled analog switch) closure on a B-8SCU-C or B-8SLU-B PCB.

2.20 The Direct Access Bus also connects the Direct Access Lines to the B-TGU-B PCB (s) and the B-AUX-A PCB. These PCBs interact with the lines to process dial commands and send supervisory tones back to the telephone.

Link Bus

2.21 The Link Bus is principally used to carry the Intercom traffic. It is comprised of 10 Intercom links (analog paths), a Page link and a Background Music (BGM) link. The KSU backplane circuitry connects the Link Bus to the eight B-8SCU-C and/or B-8SLU-B PCBs. One Intercom link is used when two stations are connected on an Intercom call. Key telephone voice information is connected to the B-8SCU-C PCBs over the station cable 'B' pair. Single line (2500 type) voice information is connected to the B-8SLU-B PCBs over the station cable 'A' pair.

2.22 The B-TGU-B PCB(s) and the B-AUX-A PCB are also connected to the Link Bus. This allows for dial command processing (as with the Direct Access Lines) and provides supervisory tones for each station using the Intercom. In addition, the B-TGU-B and B-AUX-A PCBs contain the Page and Background Music amplifiers. Amplified Page and BGM signals are sent throughout the system on the dedicated Page and BGM links.

Dial-up Line Bus

2.23 Lines 21-32 are not Direct Access Lines, but can be used through the Dial-up Line Bus. The audio circuits for these dial-up lines are routed in the KSU backplane to a crosspoint matrix on the B-TGU-B PCB. The audio path to these lines is from the station, through an Intercom link, through the matrix to a dial-

up line circuit, terminating at the selected line. Lines 21-32 are not Direct Access Lines since they require two crosspoint closures for a connection: one in the B-8SCU-C/B-8SLU-B PCB and one in the B-TGU-B PCB.

Connection to the Expansion Cabinet

2.24 The KSU audio paths are connected to the expansion cabinet through two ribbon cables. The Direct Access Line Bus and the Link Bus are extended to the expansion cabinet B-8SCU-C/B-8SLU-C PCBs. The stations connected to the expansion cabinet have full access to the Direct Access Lines (1-20) and the links. The Dial-up Line bus is extended to the two B-4COU-A PCBs assigned to lines 25-32.

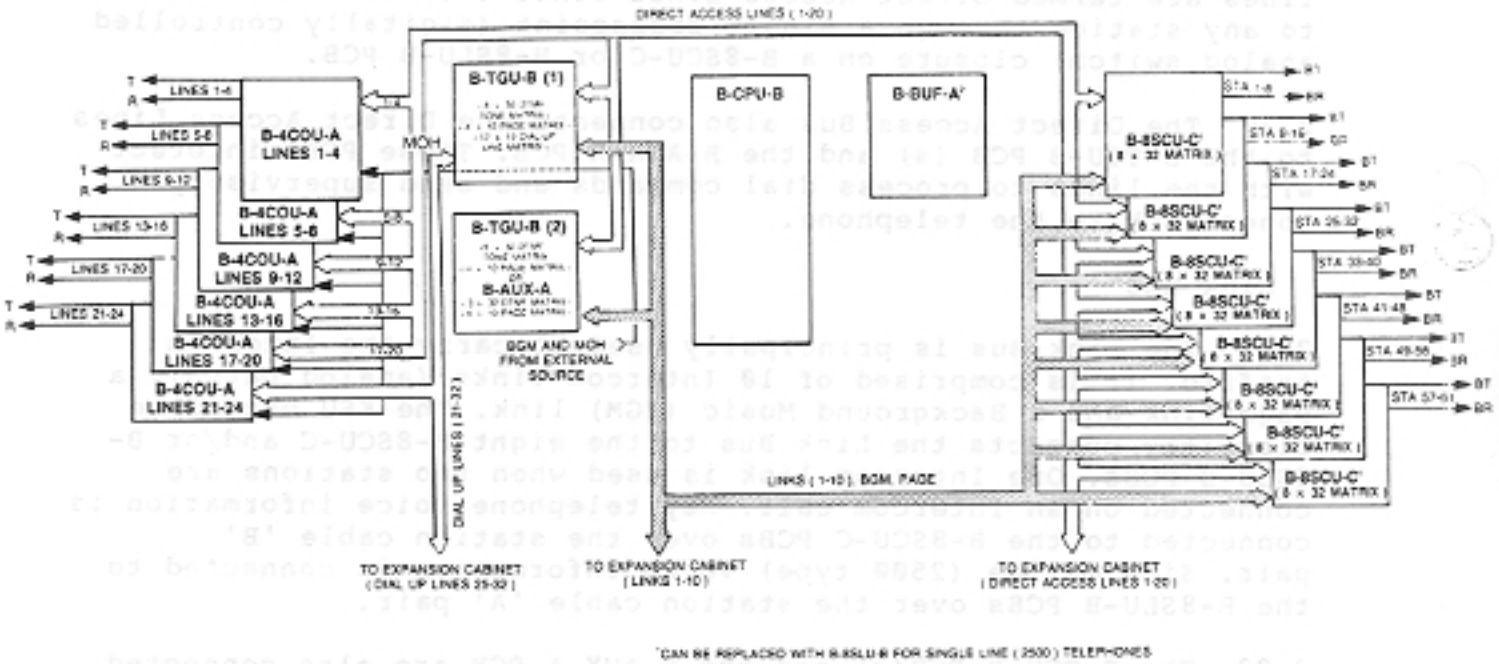


Figure 8-2 ANALOG (AUDIO) CONNECTIONS, TCX-128

Data Connections

2.25 Data communication between the PCBs in the KSU is over two backplane data busses (Figure 8-3): the Z8Ø Data Bus and the 65Ø2 Data Bus.

Z8Ø Data Bus

2.26 The Z8Ø Data Bus is connected to the Z8Ø microprocessor and the Z8Ø family of components (called the Z8Ø chip set). The system memory, the B-TGU-B PCB (s) and the B-AUX-A PCB are also on the Z8Ø Bus. The Z8Ø Data Bus permits the Z8Ø executive microprocessor to communicate (through data buffers) to these system elements without interference from other components in the system.

65Ø2 Data Bus

2.27 The 65Ø2 Data Bus is driven by the 65Ø2 traffic control microprocessor and its chip set. It establishes a network of buffered handshake and control signals that link the 6502 traffic control microprocessor to the six B-4COU-A PCBs and the eight B-8SLU-B/B-8SCU-C PCBs. This structure allows the status of these circuit boards to be supervised independently of the Z8Ø executive. The 65Ø2 traffic control microprocessor and the Z8Ø executive microprocessor communicate with each other through common interface circuitry called the Common RAM (Common Random Access Memory). The Common RAM will be discussed later on.

Other Digital Signals

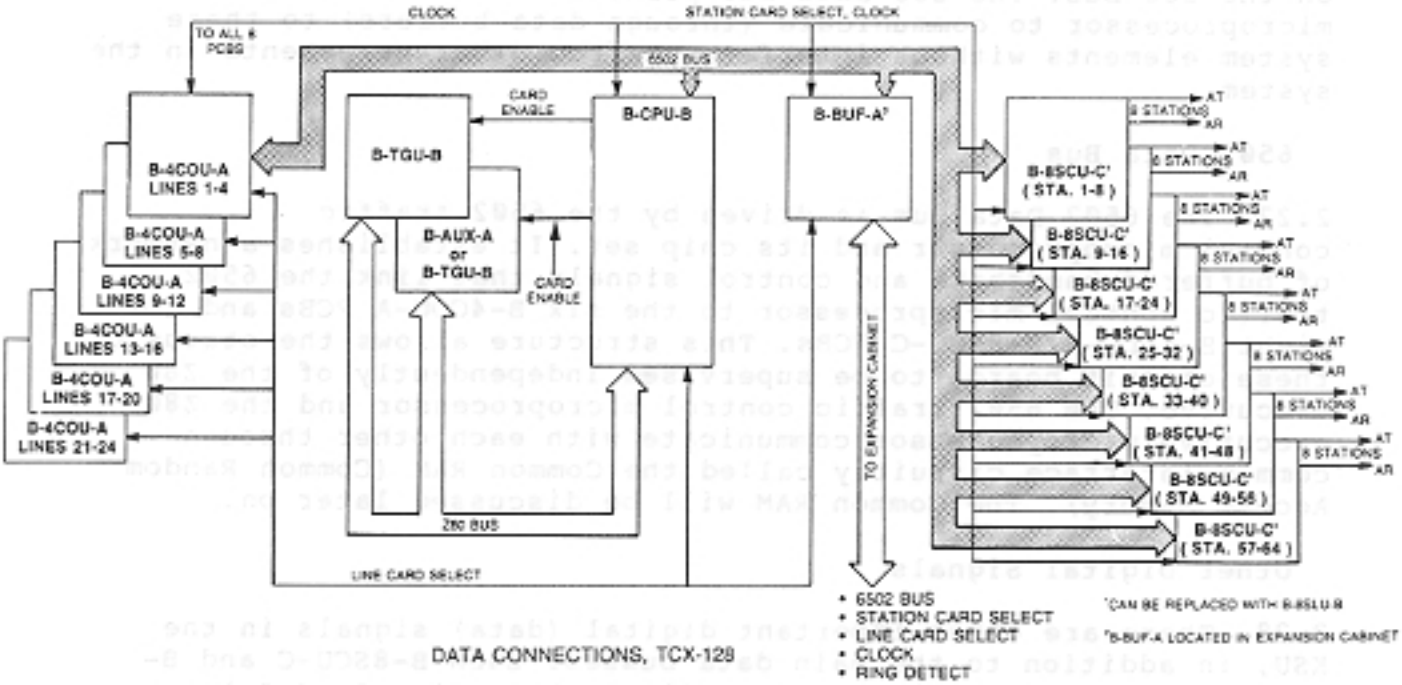
2.28 There are other important digital (data) signals in the KSU, in addition to the main data busses. Each B-8SCU-C and B-8SLU-B PCB is controlled by an individual Station Card Select signal from the 65Ø2 microprocessor. The B-4COU-A PCBs are similarly controlled by individual Line Card Select signals.

2.29 To assure synchronous operation, a system clock signal is shared by the 65Ø2 circuits, the B-4COU-A PCBs and the B-8SLU-B/B-8SCU-C PCBs.

Data Connections to the Expansion Cabinet

2.30 The ribbon cables that connect the KSU to the expansion cabinet contain the expansion data signals, as well as the analog signals previously discussed. The 65Ø2 Data Bus, Station Card Select, Line Card Select and system clock pass through the B-BUF-A PCB before being routed in the expansion cabinet. The distribution of these signals in the expansion cabinet backplane is identical to the KSU, except that the expansion cabinet contains only two B-4COU-A PCBs. The Z8Ø data bus does not go to the expansion cabinet.

8-7



DATA CONNECTIONS, TCX-128

Figure 8-3 DATA CONNECTIONS, TCX-128

DC Power Distribution

2.31 DC power for the common equipment PCBs (Figure 8-4) is provided by a separate convection cooled power supply. The power supply produces regulated voltages of +5VDC, +24VDC and -24VDC. These voltages are connected in the KSU backplane to all the PCBs, excluding the B-BUF-A PCB. The B-BUF-A PCB is connected to the +5VDC line only. Each PCB in the system uses additional on-board DC regulation to maximize circuit stability and reliability.

2.32 The DC power for the expansion cabinet PCBs is from a separate power supply connected only to the expansion cabinet. The expansion cabinet power supply is identical to the KSU power supply. Connection from the power supply to the KSU or expansion cabinet is through the power supply multiconductor cable.

2.33 A temperature sensing device in the KSU works with circuitry in the power supply to monitor the temperature inside the KSU. When the maximum allowable temperature inside the KSU is exceeded (greater than 120 degrees F), these circuits cause the reset switch on the front of the power supply to pop up, revealing a white band. The power supply does not shut down.

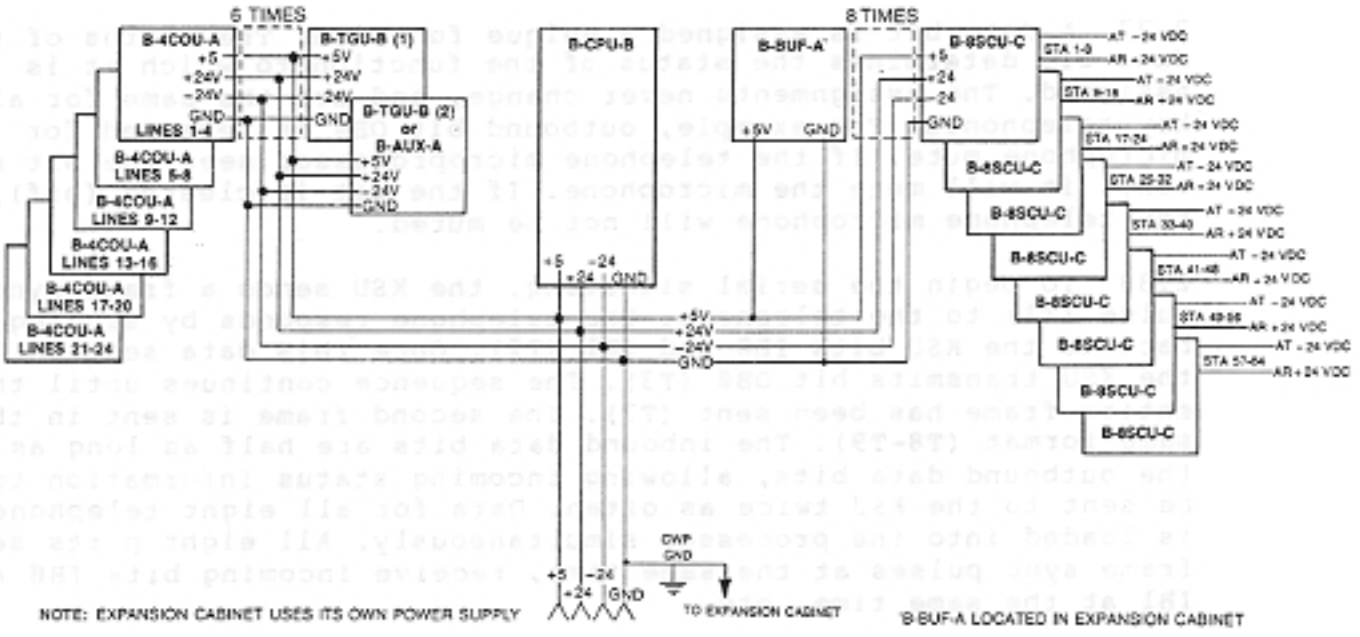


Figure 8-4 DC POWER DISTRIBUTION, TCX-128

SOFTWARE OVERVIEW

2.34 The TCX-128 software is structured in a three-tier hierarchy. This maximizes the efficiency of the Z80 executive microprocessor, the 6502 traffic control microprocessor and the 6504 station processors.

6504 Station Processor

2.35 The 6504 station processor is the first tier in the hierarchy. Each B-8SCU-C PCB has a 6504 station processor that uses eight serial output ports to communicate with eight key telephones simultaneously. A complete update of telephone status requires two data frames (Figure 8-5). Each frame consumes approximately 50mS, allowing a complete update of telephone status every 100mS.

2.36 A frame consists of 32 outbound data bits (OB0-OB31) and 64 inbound data bits (IB0-IB64). Outbound data bits are sent from the KSU to the telephone, and tell the telephone what to do (e.g., disable the dialpad, light a key LED). Inbound data bits are sent from the telephone to the KSU, and tell the KSU what the telephone user wants to do (e.g., seize a line, dial a digit). Each frame is preceded by a frame sync pulse, which synchronizes the 6504 processor in the B-8SCU-C PCB to the processor in the telephone.

2.37 A data bit is assigned a unique function. The status of the data bit determines the status of the function to which it is assigned. The assignments never change, and are the same for all key telephones. For example, outbound bit OB0 is reserved for microphone mute. If the telephone microprocessor sees the bit set (on), it will mute the microphone. If the bit is cleared (off), the telephone microphone will not be muted.

2.38 To begin the serial signaling, the KSU sends a frame sync pulse (T1) to the telephone. The telephone responds by sending back to the KSU bits IB0 and IB1 (T2). Once this data settles, the KSU transmits bit OB0 (T3). The sequence continues until the entire frame has been sent (T7). The second frame is sent in the same format (T8-T9). The inbound data bits are half as long as the outbound data bits, allowing incoming status information to be sent to the KSU twice as often. Data for all eight telephones is loaded into the processor simultaneously. All eight ports send frame sync pulses at the same time, receive incoming bits IB0 and IB1 at the same time, etc.

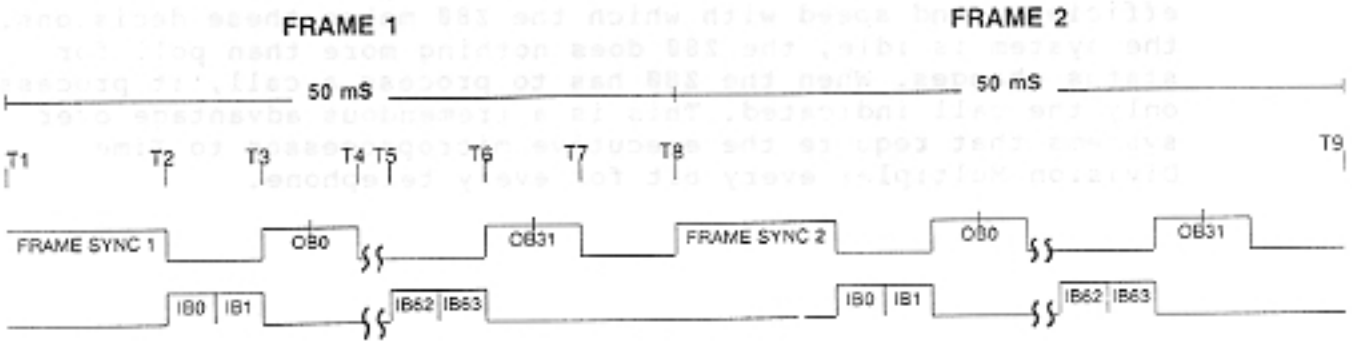


Figure 8-5 DATA FORMAT, TCX-128

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6502 Traffic Control Processor

2.39 The 6502 traffic control processor is the second tier. It monitors the 6504 for telephone status changes, and is in turn monitored by the Z80 executive. The 6504 station processor sets a status flag if there is any change of state in the telephone (for example, if a user tries to place a call). The 6502 traffic controller polls each B-8SCU-C PCB and looks for these status flags. If it finds one set, it pulls the data from the appropriate 6504 in parallel across the 6502 Data Bus and sets its own status flag. The Z80 executive continually polls the 6502 traffic controller, looking for a set status flag. If it finds one, it takes the data in parallel from the 6502 and processes it. Commands from the Z80 executive to the telephone use the inverse of this relationship. The 6502 also polls the B-4COU-A PCBs, looking for line status (Ring Detect, etc.).

2.40 To communicate with the B-4COU-A, B-8SCU-C and B-8SLU-B PCBs, the 6502 uses card enable signals (interrupts) in conjunction with system address and read/write controls. In other words, before the 6502 can look at a PCB two conditions must be met: the PCB must be receiving a card enable signal (Line Card Enable or Station Card Enable) and the PCB must be correctly addressed (i.e., have the correct combination of bus address signals). The read/write controls determine whether the 6502 is writing (sending data) into the card or reading (receiving data) from it.

Z8Ø Executive Microprocessor

2.41 The Z8Ø executive microprocessor is the third tier, and makes virtually all the traffic processing decisions for the system. The three-tier scheme dramatically increases the efficiency and speed with which the Z8Ø makes these decisions. If the system is idle, the Z8Ø does nothing more than poll for status changes. When the Z8Ø has to process a call, it processes only the call indicated. This is a tremendous advantage over systems that require the executive microprocessor to Time Division Multiplex every bit for every telephone.

3. PRINTED CIRCUIT BOARDS

B-CPU-B CENTRAL PROCESSING UNIT PCB

3.01 The B-CPU-B PCB (Figure 8-6) contains the microprocessors, memory elements and control circuits that allow all system traffic to be under direct executive program control. The B-CPU-B is structured around the Z80 executive microprocessor and the 6502 traffic control microprocessor, communicating with each other through common interface circuitry (the Common RAM).

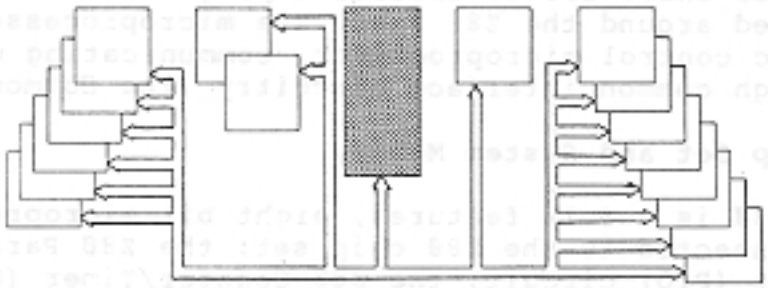
The Z80 Chip Set and System Memory

3.02 The Z80 is a full featured, eight bit microprocessor. It is directly connected to the Z80 chip set: the Z80 Parallel Input/Output (PIO) circuit, the Z80 Counter/Timer (CTC) circuit, and the Z80 Dual Asynchronous Receiver/Transmitter (DART) circuit. The outputs of the Z80 and the Z80 chip set provide the signals for the Z80 Data Bus.

3.03 The Z80 PIO is a dual port input/output device. Channel A of the PIO looks at the settings of the 8-bit data option switch, and sends the switch status to the Z80. This switch is used to match the output of the RS-232-C port to the requirements of the programming/SMDR terminal. The B channel of the PIO generates the system reset signal (to the B-8SLU-B and B-8SCU-C PCBs) and the 6502 traffic reset signal. It also selects the block (map) of system memory that the Z80 will address. (The TCX-128 uses a three map memory mapping technique to extend the memory capacity of the Z80 past its normal limits.) The PIO B channel and reset switch S1 provide the inputs to the watchdog timer. If the PIO stops outputting data, or S1 is pressed, a reset signal is sent to the Z80. Additionally, the PIO drives Z80 status LED DS1. This LED flashes 250mS on and 250mS off to indicate that the Z80 executive microprocessor is running. The PIO also can control the Z80-6502 common interface circuitry (the Common RAM).

3.04 The Z80 CTC sets the timing for the Z80. It provides the intervals used for the various flash rates and tone signals. It also controls the B-CPU-B PCB system clock.

3.05 The Dual Asynchronous Receiver/Transmitter (DART) is a bi-directional, two port device. The A port is connected to the RS-232-C programming/SMDR port. This permits an external terminal or teleprinter to be used to program system options and record Station Message Detail Recording (SMDR) data. This port is also connected to the crystal driven Baud Rate Generator. The Baud Rate Generator matches the speed of the DART A port to the speed of the external terminal. This allows for error free communication between the Z80 and the terminal. The DART B port interfaces with the B-AUX-A PCB ribbon cable. This cable connects the B-AUX-A PCB to the B-CPU-B PCB for Least Cost Routing (LCR) circuit control.



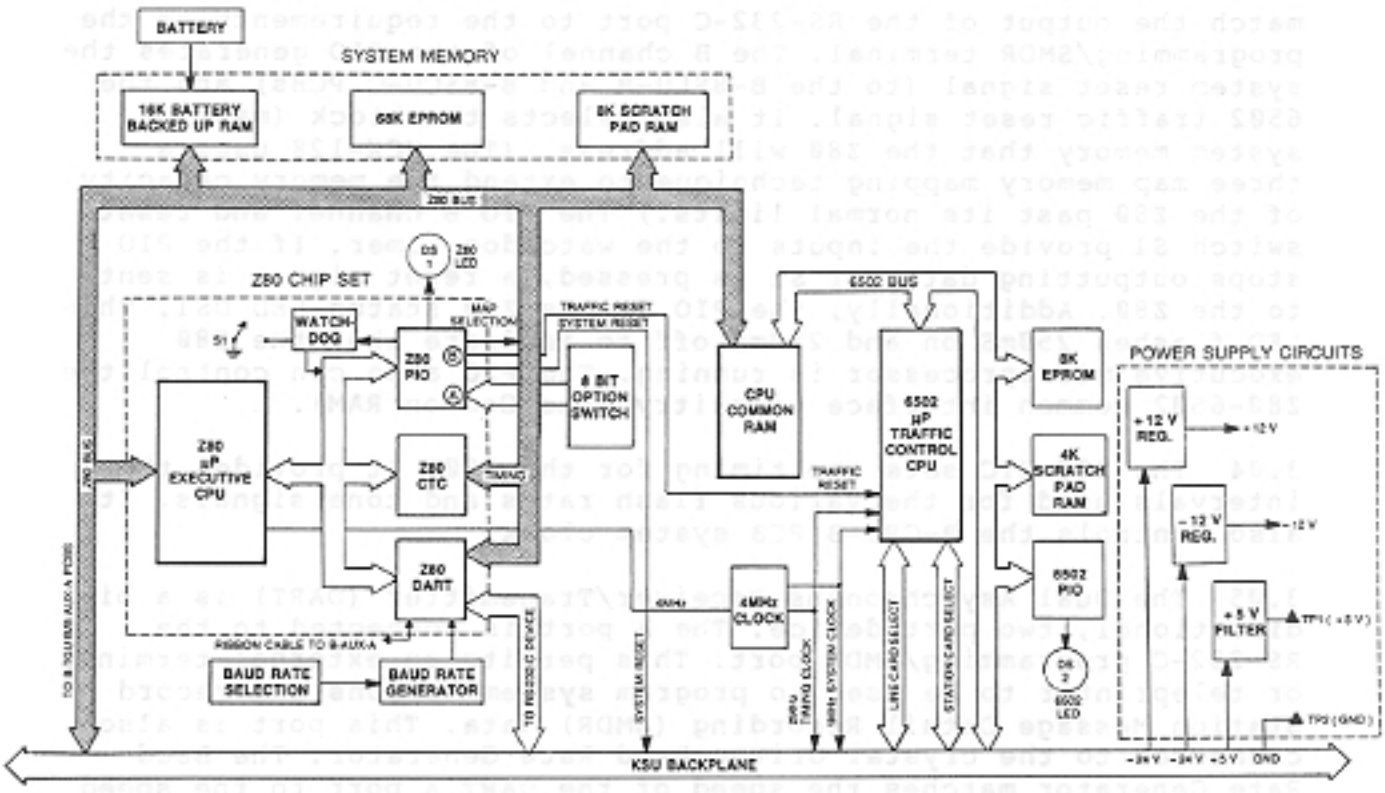


Figure 8-6 B-CPU-B CENTRAL PROCESSING UNIT PCB BLOCK DIAGRAM, TCX-128

3.06 The Z80 executive is connected over the Z80 Data Bus to the system memory. This memory consists of 68K of Erasable Programmable Read Only Memory (EPROM), 16K of battery backed-up Random Access Memory (RAM), and 8K of scratch pad RAM. The EPROM contains the system operating software. This software is factory installed and cannot be erased or altered. The 16K of battery backed-up RAM is used to store the programmable system options and Speed Dial numbers. The scratch pad RAM is used by the B-CPU-B for temporary storage of data during traffic processing.

The 6502 Chip Set

3.07 The 6502 is a sophisticated eight bit microprocessor, with somewhat less the capabilities of the Z80. Its main function is to monitor the 6504 station processors (in the B-8SCU-C/B-8SLU-B PCBs) for call activity. The traffic control microprocessor also is responsible for display telephone message generation and Dial Pulse control. The 6502 works with its own chip set: the 8K traffic control EPROM, the 4K traffic control scratch pad RAM, and the 6502 PIO.

3.08 The 8K traffic control EPROM stores the 6502 factory-installed operating software. The 4K RAM is used during traffic processing, and is not battery backed-up. The 6502 PIO is similar to the Z80 PIO, and is used to control the common interface circuitry (the Common RAM). The PIO also flashes the 6502 status LED DS2 approximately one second on and two seconds off. The 6502 chip set outputs to the 6502 Data Bus, which is extended throughout the KSU backplane to the system PCBs.

3.09 Control interrupts are sent to the B-4COU-A PCBs and the B-8SCU-C/B-8SLU-B PCBs. The interrupts sent to the B-4COU-A PCBs are the Line Card Select signals. The interrupts sent to the B-8SCU-C/B-8SLU-B PCBs are the Station Card Select signals. The system uses these control interrupts to attach a PCB to the 6502 Data Bus for processing.

CPU Common RAM

3.10 The CPU Common RAM is the interface between the Z80 and 6502 microprocessors (Figure 8-7). The Common RAM frees the Z80 executive from the burden of repetitive polling of all the stations in the system. This structure increases the efficiency of both the Z80 executive and 6502 traffic controller since the two processors do not have to run in synchronization.

3.11 The CPU Common RAM functions as a dual directional, interrupt driven data buffer. For example, if the 6502 sees the status flag for a 6504 station processor set, it pulls the data from the 6504 and loads it into the common RAM. The 6502 then notifies the Z80 that information is waiting to be acted on. The Z80 then reads the data from Common RAM and processes it. Similarly, data output from the Z80 is buffered in the Common RAM until pulled out by the 6502. Access to the CPU Common RAM is controlled by the Z80 and 6502 PIO circuits. The Station Common RAM is discussed below in paragraph 3.37.

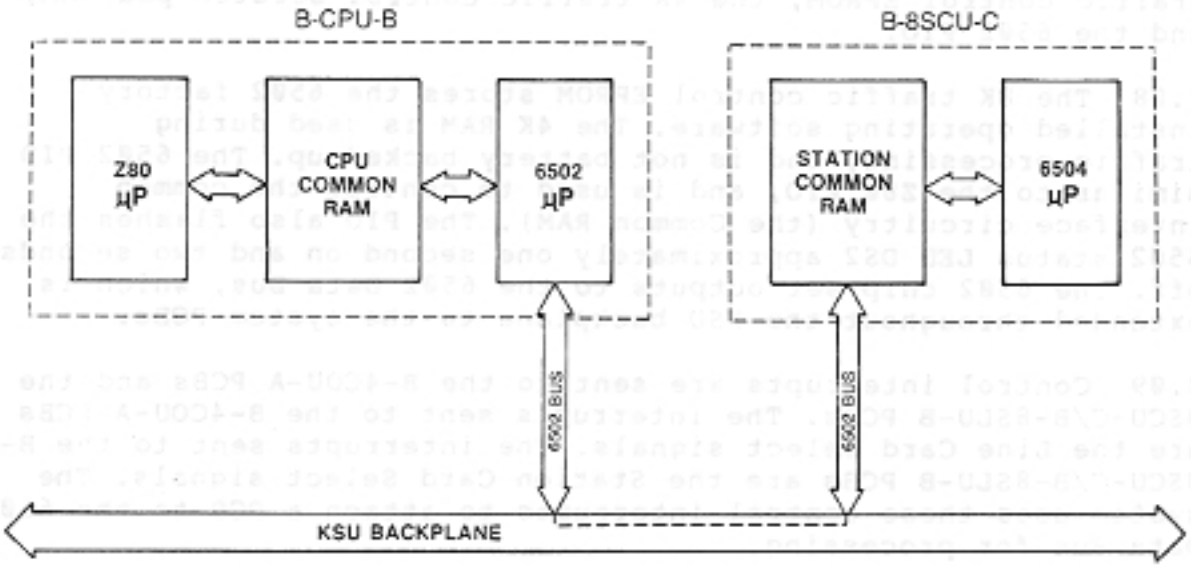


Figure 8-7 CPU COMMON RAM, TCX-128

System Clocks

3.12 All synchronous system timing is based on the 4MHz crystal controlled clock. The clock circuitry outputs a stable 4MHz to the Z80. It also generates a 2MHz timing clock and a 1MHz system clock. These latter signals are connected to the 6502, the B-BUF-A PCB and all the B-8SCU-C/B-8SLU-B PCBs in the system.

DC Power Distribution

3.13 The B-CPU-B uses the +24VDC, -24VDC and +5VDC from the backplane to drive on-board regulators for circuit power. The +24V is regulated down to +12V; the -24V is regulated to -12V. The +5V from the backplane passes through additional filters and is output (TP1) to the B-CPU-B components.

Summary

3.14 The B-CPU-B PCB contains the Z8Ø executive microprocessor, the 65Ø2 traffic control processor, and the interface circuits that allow these devices to control the system. The processors communicate with each other through the Common RAM. This PCB also contains the system stored operating software, memory and clock circuits. The B-CPU-B PCB is connected to the system over two data busses: the Z8Ø Data Bus and the 65Ø2 Data Bus.

B-TGU-B TONE GENERATOR UNIT PCB

3.15 The B-TGU-B PCB (Figure 8-8) consists of Dual Tone Multifrequency (DTMF) generators and receivers; system tone generators; amplifiers for Background Music (BGM), Music on Hold (MOH) and internal Page Zones; and relay contacts to control external ringers and audio equipment. The B-TGU-B is connected directly to the Z80 Data Bus, and is addressed by the Z80 as if it were memory.

DTMF Generators

3.16 DTMF generators accept digital signals from the Z80 Data Bus and convert them to DTMF tones. For telephones with data dialers (such as the multibutton display set), these generators allow dial commands to be sent as part of the telephone serial data stream, processed by the Z80, and then converted to tones by the DTMF generators. The Z80 time shares (multiplexes) the DTMF generators, which allows many calls to be manually dialed without delay. Generators are only seized for an entire dialing sequence when using Speed Dial numbers and Last Number Redial. Input to the DTMF generators is from the Z80 Data Bus. Output is to the DTMF/Tone Matrix (crosspoints). Each B-TGU-B PCB has two DTMF generators. If two B-TGU-B PCBs are installed, the position of an on-board address jumper identifies each PCB to the Z80.

DTMF Receivers

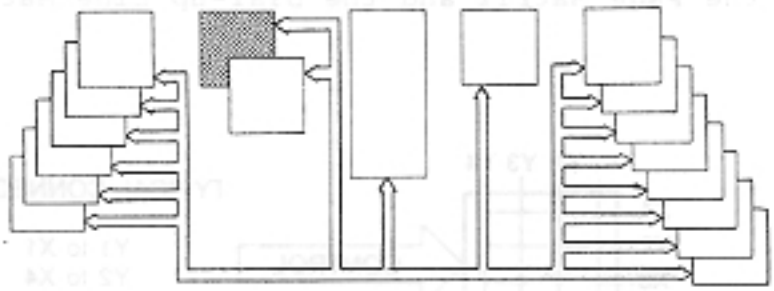
3.17 DTMF receivers accept DTMF tones from the telephones (via the DTMF/Tone Matrix) and convert them to digital signals. These signals are sent out on the Z80 Data Bus and received by the Z80 for processing. Single line (2500 type), one button, four button and multibutton telephones (without displays) have DTMF dialers. When one of these telephones places a call, a DTMF Receiver is attached (through an Intercom link) until the dialing is completed, or until a six second timeout occurs. Although the dialed tones are coupled to the telco via the station audio pair, the digital equivalent of the tones is used by the Z80 for Toll Restriction and SMDR purposes. Each B-TGU-B PCB has two on-board DTMF receivers. Two more DTMF receiver daughter boards can be plugged into each B-TGU-B PCB, for a system total of eight.

Tone Generators

3.18 Tone generators produce the various tones used by the system. Tone 1 is a combination of 350Hz and 440Hz, and is used for Intercom dial tone. Tone 2 is a combination of 440Hz and 550Hz, and is used for incoming ring, busy and other supervisory tones. The output from the tone generators is constant. The tone switching is all done in the DTMF/Tone Matrix.

External Relays

3.19 The B-TGU-B PCB contains two dry relay contacts, under program control, that can be used to control external paging and loud ring equipment. The relays (designated 1 and 2) receive control signals from the Z80 Data Bus. The relay contacts are connected, through the KSU backplane and a Type 57 'P' connector, to a designated 66M1-50 connecting block on the installation backboard.



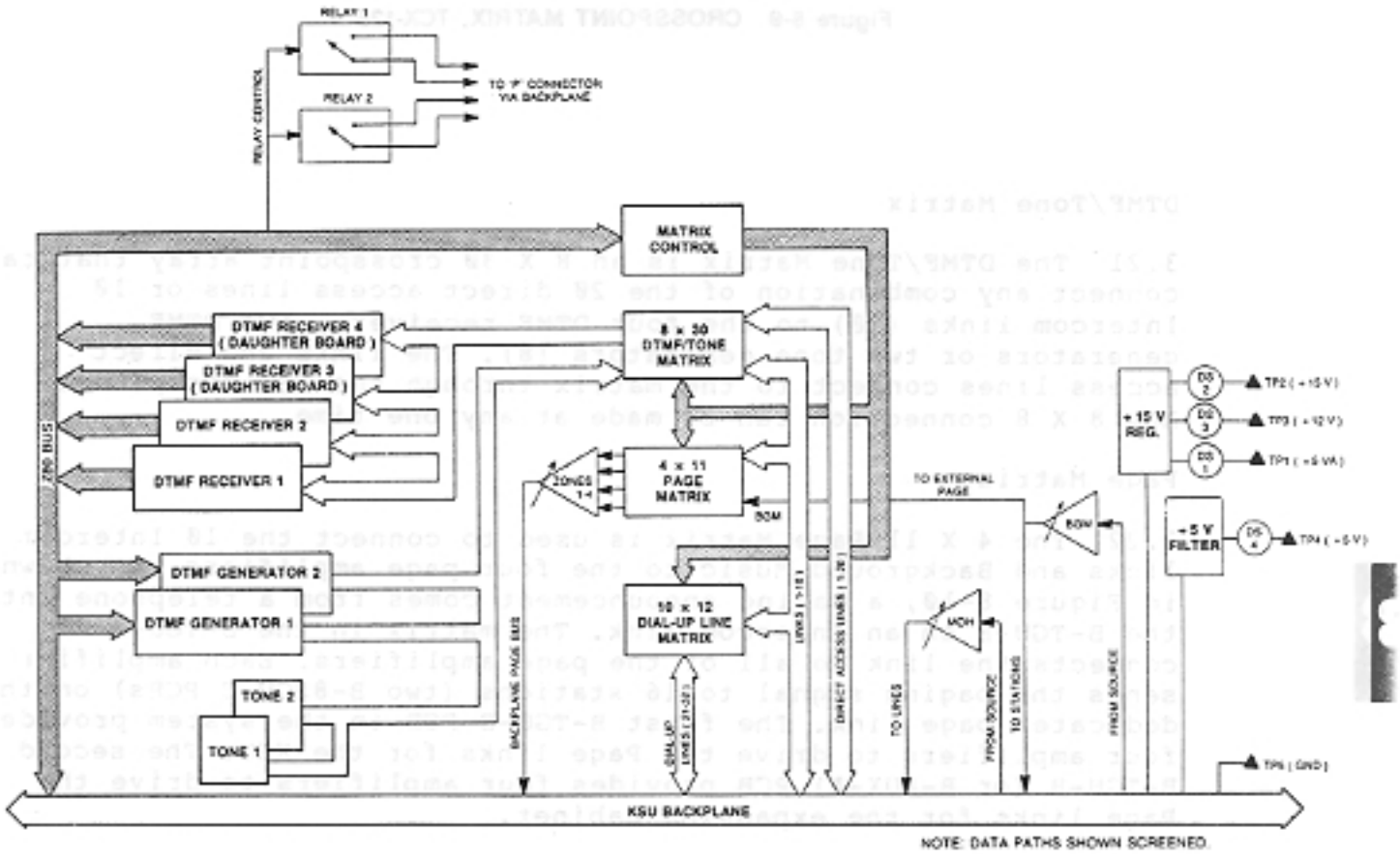


Figure 8-8 B-TGU-B TONE GENERATOR UNIT PCB BLOCK DIAGRAM, TCX-128

Crosspoint Matrixes

3.20 All analog (voice) switching is done in crosspoint matrixes, which are electronic switching circuits controlled by digital signals. Depending on the state of the digital control signals, any input can be connected to any output. A typical crosspoint arrangement is shown in Figure 8-9. In the TCX-128, the crosspoint matrixes on the B-TGU-B PCB are controlled by the Matrix Control decoder, which is in turn controlled by the Z80 data bus. There are three crosspoint matrixes: the DTMF/Tone Matrix, the Page Matrix and the Dial-up Line Matrix.

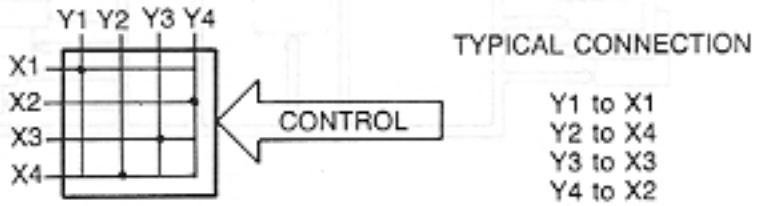


Figure 8-9 CROSSPOINT MATRIX, TCX-128

DTMF/Tone Matrix

3.21 The DTMF/Tone Matrix is an 8 X 30 crosspoint array that can connect any combination of the 20 direct access lines or 10 Intercom links (30) to the four DTMF receivers, two DTMF generators or two tone generators (8). The links and direct access lines connect to the matrix through the KSU backplane. Any 8 X 8 connection can be made at any one time.

Page Matrix

3.22 The 4 X 11 Page Matrix is used to connect the 10 Intercom links and Background Music to the four page amplifiers. As shown in Figure 8-10, a paging announcement comes from a telephone into the B-TGU-B on an Intercom link. The matrix in the B-TGU-B connects the link to all of the page amplifiers. Each amplifier sends the paging signal to 16 stations (two B-8SCU-C PCBs) on the dedicated page link. The first B-TGU-B PCB in the system provides four amplifiers to drive the Page links for the KSU. The second B-TGU-B (or B-AUX-A) PCB provides four amplifiers to drive the Page links for the expansion cabinet.

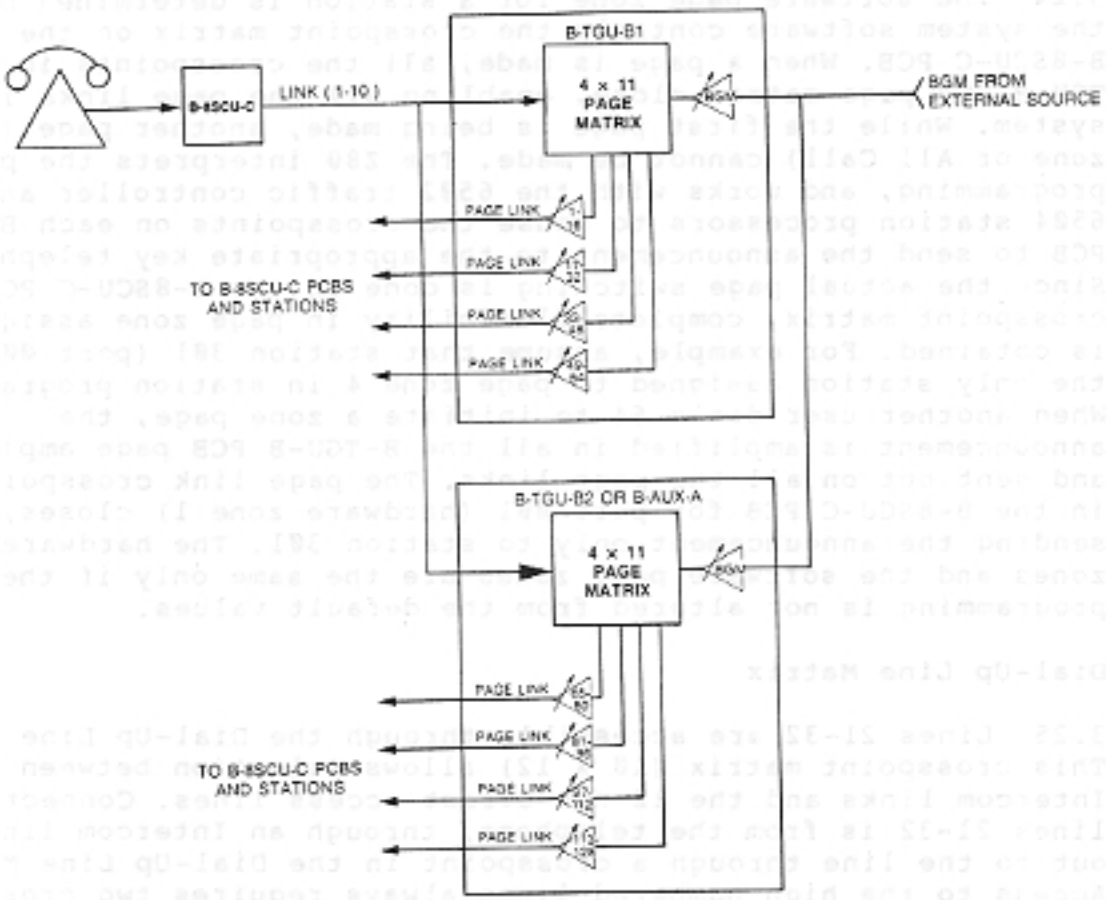


Figure 8-10 PAGING, TCX-128

3.23 The paging announcements a station receives are determined by the hardware page zone and the software page zone to which it is assigned. There are four hardware page zones on each B-TGU-B PCB, with one page amplifier in each zone. Each page amplifier on the B-TGU-B PCB drives the page link for 16 consecutive station ports (i.e., one hardware page zone serves two B-8SCU-C PCBs). The hardware page zone for a station is derived from the KSU slot its B-8SCU-C PCB is plugged into. (Note that the level of the signal on the page link is regulated by its dedicated potentiometer, located on the front edge the B-TGU-B PCB.) For example, the first page amplifier drives the page link for the B-8-SCU-C PCBs plugged into slots J13 and J14 (ports 001 through 0016).

3.24 The software page zone for a station is determined by how the system software controls the crosspoint matrix on the B-8SCU-C PCB. When a page is made, all the crosspoints in the B-TGU-B PCB page matrix close, enabling all the page links in the system. While the first page is being made, another page (either zone or All Call) cannot be made. The Z8Ø interprets the page programming, and works with the 65Ø2 traffic controller and the 65Ø4 station processors to cause the crosspoints on each B-8SCU-C PCB to send the announcement to the appropriate key telephones. Since the actual page switching is done in the B-8SCU-C PCB crosspoint matrix, complete flexibility in page zone assignments is obtained. For example, assume that station 3Ø1 (port ØØ1) is the only station assigned to page zone 4 in station programming. When another user dials 64 to initiate a zone page, the announcement is amplified in all the B-TGU-B PCB page amplifiers and sent out on all the page links. The page link crosspoint in the B-8SCU-C PCB for port ØØ1 (hardware zone 1) closes, sending the announcement only to station 3Ø1. The hardware page zones and the software page zones are the same only if the page programming is not altered from the default values.

Dial-Up Line Matrix

3.25 Lines 21-32 are accessible through the Dial-Up Line Matrix. This crosspoint matrix (1Ø X 12) allows selection between the 1Ø Intercom links and the 12 non-direct access lines. Connection to lines 21-32 is from the telephone, through an Intercom link, and out to the line through a crosspoint in the Dial-Up Line Matrix. Access to the high numbered lines always requires two crosspoint closures: one on the B-8SCU-C/B-8SLU-B PCB to a link, and the other on the B-TGU-B PCB to the line circuit.

Music on Hold and Background Music Amplifiers

3.26 Music on Hold and Background Music from the external music source (s) is connected to the TCX-128 components through the amplifiers on the B-TGU-B PCB. The Background Music signal from the external source is amplified in the BGM amplifier and sent out to all key stations. It is also sent to the Page amplifiers through the Page Matrix. Music on Hold, from the same or a separate source, is amplified and sent to each line circuit.

On-Board DC Regulation

3.27 The B-TGU-B pulls +24V and +5V from the KSU backplane. The +24V line is input into a regulator that produces +15V (DS2 and TP2), +12V (DS3 and TP3) and +5VA (DS1 and TP1). The +5V line is additionally conditioned by the +5V filter (DS4 and TP4).

Summary

3.28 One B-TGU-B PCB (B-TGU-B1) provides two DTMF generators, up to four DTMF receivers, system tones, Page link and music drivers (amplifiers) for the KSU and two sets of dry external relay contacts. The addition of the second B-TGU-B (B-TGU-B2) provides two more DTMF generators (system total of 4), up to four more DTMF receivers (system total of 8), system tones for the expansion cabinet, and Page link and music drivers (amplifiers) for the expansion cabinet.

B-AUX-A AUXILIARY PCB

3.29 The B-AUX-A Auxiliary PCB (Figure 8-11) is similar in many respects to the B-TGU-B PCB. It gives the system three additional DTMF generators; a DTMF Generator Matrix; a Page Matrix, Page amplifier, BGM amplifier and MOH amplifier for the expansion cabinet; and two sets of external dry relay contacts. The B-AUX-A PCB also has the rate table, controller and RAM for Least Cost Routing.

DTMF Generators and DTMF Generator Matrix

3.3Ø The three DTMF generators on the B-AUX-A PCB are identical to the generator circuits on the B-TGU-B PCB. The generators receive their input from the Z8Ø Data Bus, and present DTMF tones to the DTMF Generator Matrix. The 3 X 3Ø crosspoint matrix couples DTMF generators 3, 4 and 5 to the 1Ø links and the 2Ø direct access lines. Control signals for the matrix are sent by the Matrix Control, which is connected to the Z8Ø Data Bus.

Page Matrix and Page Amplifiers

3.31 The Page Matrix and page amplifiers Z5-Z8 are identical to those on the B-TGU-B; however, they are required to provide Page announcements to the expansion cabinet. Each B-AUX-A PCB page amplifier supports 16 key stations.

Background Music and Music on Hold Amplifiers

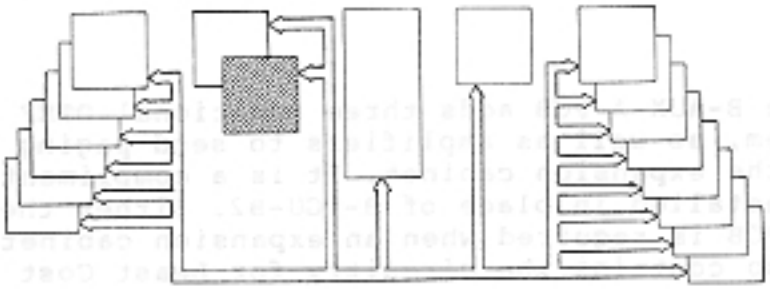
3.32 The Background Music and Music on Hold amplifiers receive input from the same external music source (s) as used by the B-TGU-B PCB. The amplified BGM signal is extended to the B-AUX-A Page Matrix and to the KSU backplane (and ultimately to the expansion cabinet). The amplified MOH signal is connected from the KSU backplane, to the expansion cabinet backplane and finally to the B-4COU-A PCBs for lines 25-3Ø.

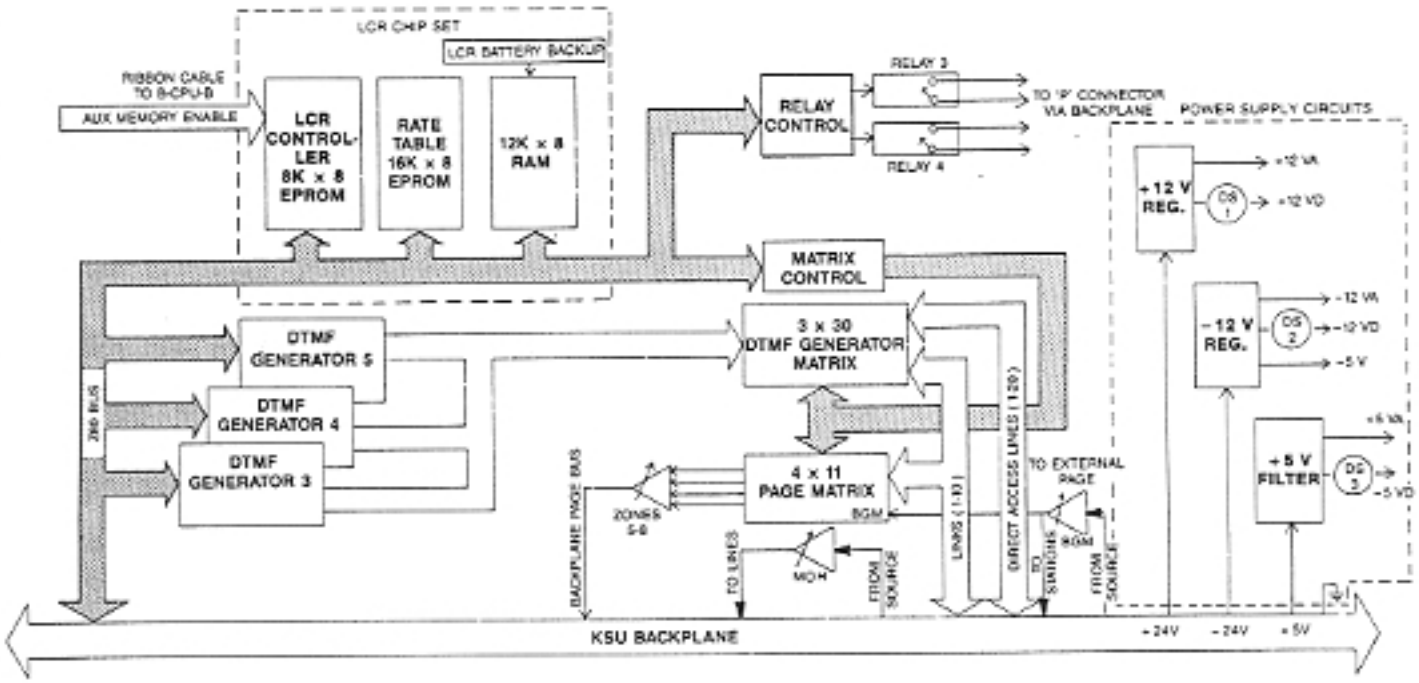
External Relays

3.33 The B-AUX-A PCB gives the system two more external relays: relays 3 and 4. Relays 3 and 4 are connected to the same 66M1-5Ø connecting block as relays 1 and 2. Relay control signals are sent by the Z8Ø through the Z8Ø data bus, as are relays 1 and 2.

Least Cost Routing

3.34 The Least Cost Routing (LCR) chip set consists of the 8K X 8 LCR Controller EPROM, the 16K X 8 LCR Rate Table EPROM and the 12K X 8 LCR RAM. The 12K LCR RAM is battery backed up to ensure that its contents will be retained if system power fails. Connection to the B-CPU-B PCB is through the Z8Ø Data Bus and the Auxiliary ribbon cable. This ribbon cable connects the Auxiliary memory enable circuits from the B-CPU-B to the B-AUX-A PCB.





NOTE: DATA PATHS SHOWN SCREENED.

Figure 8-11 B-AUX-A AUXILIARY PCB BLOCK DIAGRAM, TCX-128

On-Board DC Regulation

3.35 The +24V from the KSU backplane is input into the +12V regulator. The regulated output is +12VA and +12VD (DS1). The -24V from the backplane is fed into the -12V regulator. Output from this regulator is -12VA, -12VD (DS2) and -5V. The +5V from the backplane is filtered to provide +5VA and +5VD (DS3).

Summary

3.36 The B-AUX-A PCB adds three additional DTMF generators to the system, as well as amplifiers to send paging and music to the PCBs in the expansion cabinet. It is a compliment to the B-TGU-B and is installed in place of B-TGU-B2. Either the B-TGU-B2 or the B-AUX-A PCB is required when an expansion cabinet is used. The B-AUX-A also contains the circuitry for Least Cost Routing.

B-8SCU-C STATION CONTROL UNIT PCB

3.37 The B-8SCU-C PCB (Figure 8-12) is the control unit for eight multibutton and/or four button key stations. The heart of the B-8SCU-C PCB is the 6504 station processor. This processor works with the 6502 traffic controller in the B-CPU-B to monitor the data flow to and from the telephone, and connect the telephone audio path to the outside lines and other stations in the system.

6504 Station Processor Chip Set

3.38 The 6504 station processor is an eight bit microprocessor, with somewhat fewer capabilities than the 6502 traffic control microprocessor. It communicates with the B-CPU-B PCB through the station Common RAM, and with the key stations via the Data and Crosspoint PIOs. The 6504 is supported by 4K X 8 EPROM (containing the station processor operating program) and 2K X 8 RAM.

3.39 The 6504 has two "sides," the 6502 (CPU) side and the station side. The station Common RAM is on the 6502 side. If there is a change of state in the data from any of the eight telephones, the change is loaded into the station Common RAM by the 6504. A change of state flag is also set. The 6502, using its data bus, periodically polls the station Common RAM. When it sees the change of state flag set, it pulls the data from the Common RAM and works with the Z80 to process it. When data is to be sent to the telephone, the 6502 sends the Station Card Select interrupt to the station Common RAM and loads in the data. The next time the 6504 polls the Common RAM, it accepts the data and sends the change to the telephone.

3.40 The Data PIO and the Crosspoint PIO are on the station side of the 6504. The Crosspoint PIO accepts control data from the 6504 and generates, through its A channel, crosspoint select signals for the station crosspoint matrix. The Crosspoint PIO B channel controls the station status LEDs (DS1 through DS8). The Data PIO is configured for bidirectional operation. The Data PIO sends eight channels of station transmit data to the Voltage Modulator, and receives eight channels of station receive data from the Current Demodulator.

3.41 The 6504 is monitored by the Watchdog Timer. The watchdog receives input from the Crosspoint PIO and the system power-on reset signal. If the Crosspoint PIO stops sending data to the telephones, or a master reset command is received from the B-CPU-B PCB, the 6504 will be reset. If neither of these conditions occur, the watchdog will be continually refreshed.

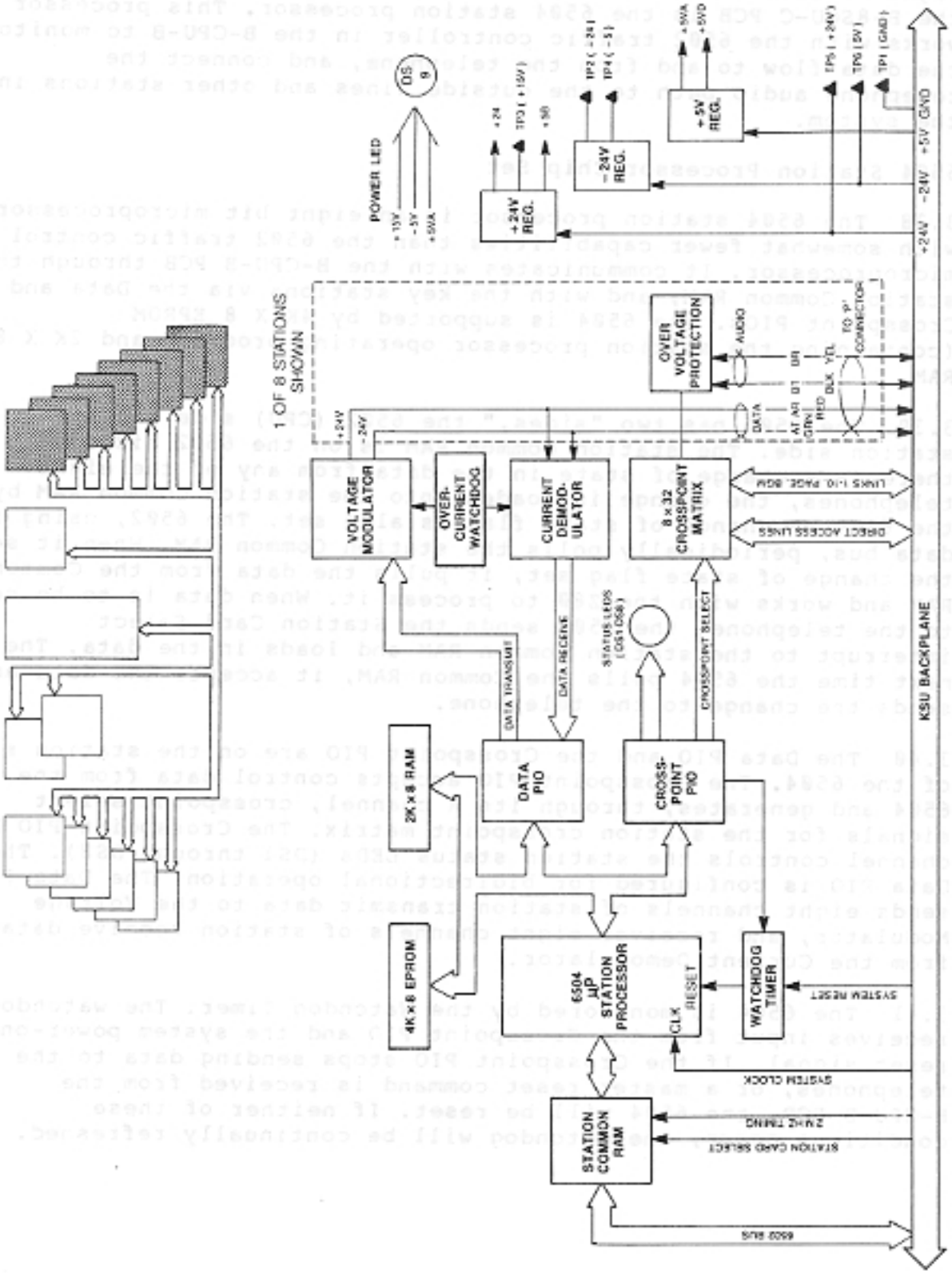


Figure 8-12 B-8SCU-C STATION CONTROL UNIT PCB BLOCK DIAGRAM, TCX-128

Data Receive and Transmit Circuits

3.42 The Data PIO sends and receives eight channels of telephone status data from eight discrete station data circuits. Each station data circuit consists of a Voltage Modulator and a Current Demodulator. Transmit data voltage (from the KSU to the telephone) is input into the Voltage Modulator circuit, which superimposes (simplexes) the data onto the station wire A pair carrying the DC power for the telephone. The green wire carries -24V and the red wire carries +24V. The amplitude of the transmitted data is slightly less than 1 volt (250-750mV). Data detectors in the telephone interpret the B-8SCU-C PCB transmit data.

3.43 Inbound data (current) is received on the green and red wires by the Current Demodulator. (Remember that OB data bits are voltage, and IB data bits are current.) The steady state current on the red and green wires is about 77mA. A set data bit will momentarily increase the current by 3-7mA. The receive data (i.e. a set data bit) is current detected by the demodulator and sent to the receive channel on the Data PIO, which in turn sends the data to the 6504. The Current Demodulator inputs a sample into the Over-Current Watchdog. If excessive current is detected, indicating a problem with the telephone, the Voltage Modulator for that telephone is shut down and the station is taken off line. Periodically the station is sampled for corrected current levels. If the problem has gone away, the station is brought back on line.

Station Crosspoint Matrix

3.44 The 8 X 32 Crosspoint Matrix switches audio from the eight telephones onto the 10 Intercom links, the Page link, the BGM link and the 20 Direct Access Lines. The matrix is controlled by the Crosspoint PIO. The telephone audio is on the two B pair station wires (black and yellow). The audio wire pair does not carry DC voltage. The B pair is connected to the Overvoltage Protection network before being going to the crosspoint matrix.

On-Board DC Regulation

3.45 The B-8SCU-C PCB contains on-board regulators for the +24V, -24V and +5V lines. The +24V line (TP5) from the backplane is input into the +24V regulator. This regulator generates +24V, +15V (TP3) and +5B. The -24V regulator outputs -24V (TP2) and -5 (TP4). The +5 (TP6) regulator produces +5VA and +5VD. Power LED DS9 senses +15V, -5V and +5VA. If these voltages are present, DS9 is on. If any of the voltages are incorrect, DS9 is out.

Summary

3.46 The B-8SCU-C PCB is structured around the 6504 station processor and supports eight key stations. The station Common RAM allows the 6504 to carry on its tasks efficiently, communicating with the 6502 traffic control processor only when a change of state is sent or received from the telephone. Data transmission between the KSU and telephone, made possible by the Voltage Modulator and Current Demodulator, is over the station A pair. Station audio, switched in the crosspoint matrix, is on the station B pair.

3.47 Stations communicate with the B-8SCU-C over four conductor station cable, with the wires defined as follows:

DESIGNATION	COLOR	FUNCTION
AT	GRN (green)	-24V and data
AR	RED (red)	+24V and data
BT	BLK (black)	Audio
BR	YEL (yellow)	Audio

B-8SLU-B SINGLE LINE UNIT PCB

3.48 The B-8SLU-B PCB (Figure 8-13) is installed in place of the B-8SCU-C PCB if single line (2500 type) telephones are to be used. The B-8SLU-B PCB uses the same 6504 station processor, PIOs, Common RAM and crosspoint matrix as the B-8SCU-C PCB. The single line interface replaces the data receive/transmit circuits used for the key telephones. The B-8SLU-B PCB supports eight single line (2500 type) telephones. Since the single line telephone is not a data telephone, there is no requirement for repetitive polling of the stations.

6504 Station Processor Chip Set

3.49 The 6504 station processor works with the station Common RAM and the 6502 traffic control processor to control the single line telephones. As in the B-8SCU-C PCB, interrupts from the 6502 tell the 6504 to change the status of the telephones. The 6504 in turn can set a status bit to indicate to the 6502 that the telephone user is placing a call. The Watchdog Timer, Station Card Select signal and the system clock serve the same functions as in the B-8SCU-C PCB. The operating software for the single line station processor is contained in the 4K X 8 EPROM.

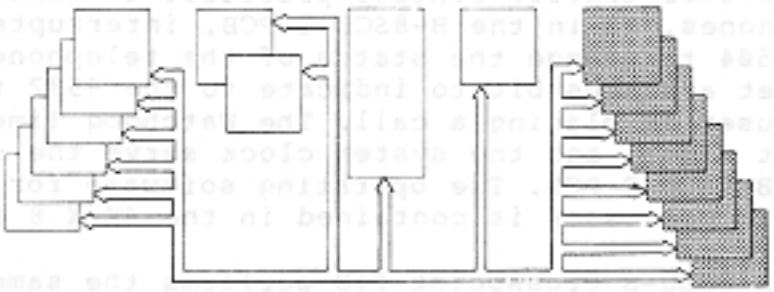
3.50 The B-8SLU-B Crosspoint PIO performs the same functions as the Crosspoint PIO in the B-8SCU-C PCB. It receives control data from the 6504 and provides crosspoint addresses to the 8 X 30 Crosspoint Matrix. The Crosspoint PIO also drives the station status LEDs (DS1-DS8), and refreshes the Watchdog Timer (along with system reset).

3.51 The Function PIO is required to monitor only three control signals for each telephone, not a constant stream of incoming and outgoing data as in the B-8SCU-C PCB. These signals are: off hook from the telephone, ring enable to the telephone ringer circuit, and mute to the telephone handset. The Single Line Interface circuits for each station connect the Function PIO to these signals.

Single Line Interface

3.52 The B-8SLU-B PCB contains a Single Line Interface circuit for each of the eight telephones it supports. The Single Line Interface provides the 48 VDC, necessary to power the single line telephone, that is normally provided by the telco Central Office battery. The green wire in the A pair sends +24VDC; the red wire sends -24VDC. The black wire in the B pair provides ground; the yellow wire provides a current limited +24V for certain special ringers.

3.53 When the single line (2500 type) telephone is idle, no significant current flows in the A pair. When the user lifts the handset, and the telephone hookswitch contacts close, off hook current flows in the A pair and is sensed by a current detector in the Single Line Interface. The detector sends an off hook digital signal to the Function PIO, which connects to the 6504.



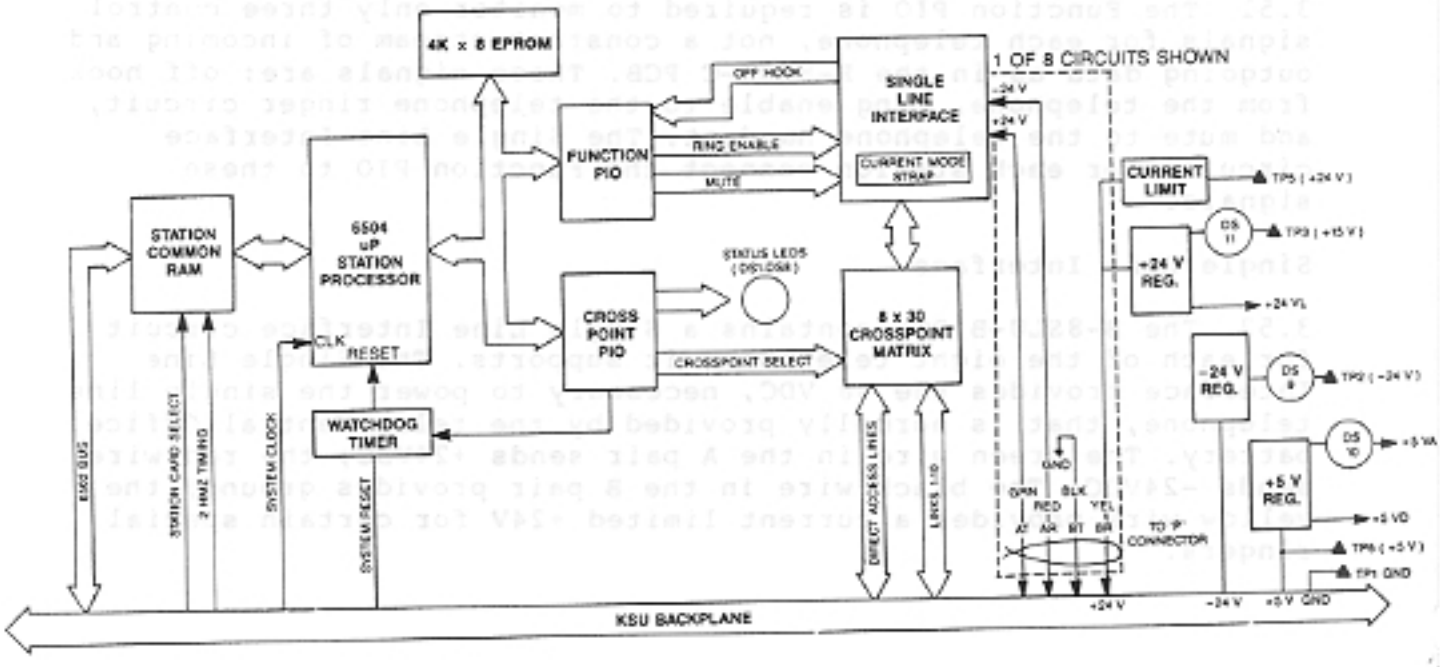


Figure 8-13 B-8SLU-B SINGLE LINE UNIT PCB BLOCK DIAGRAM, TCX-128

3.54 The command to ring a single line telephone comes from the 6502 traffic controller in the B-CPU-B. It is interpreted by the 6504 and is sent to the Single Line Interface by the Function PIO. The Single Line Interface then grounds the +24V line (the green wire in the A pair). This condition is monitored by the components on the Special Loud Ringer Board, which then excites the ringer in the telephone.

3.55 The third Function PIO control signal is for handset muting. During Speed Dialing, the mute circuit in the Single Line Interface is enabled so that the Speed Dial digits are muted in the telephone handset receiver.

3.56 The current mode strap in the Single Line Interface is used to match the current capacity of the A pair to the type of telephone used. The low current mode (strap E2 to E3) is used for the One Button Single Line Telephone and Off Premise Extensions. The high current mode (strap E1 to E2) is for standard 2500 type single line telephones.

Crosspoint Matrix

3.57 The B-8SLU-B switches telephone audio in the 8 X 30 crosspoint matrix. Audio from eight telephones can be connected to any of the 20 Direct Access Lines or the 10 Intercom links. The matrix does not use crosspoints for BGM and Page, since single line telephones do not have speakers to receive these signals. The outputs of the crosspoints are connected to the telephone through the A pair.

On-Board DC Regulation

3.58 On-board DC regulators use the +24V, -24V and +5V from the KSU backplane. The +24V regulator generates +24VL for the A pair green wire, +15V (DS11 and TP3), and +24V current limited (TP5) for the B pair yellow wire. The -24V outputs -24VL (DS9 and TP2) for the A pair red wire. The +5V line (TP6) is regulated to +5VA (DS10) and +5VD.

Summary

3.59 The B-8SLU-B PCB connects eight single line (2500 type) or one button telephones to the system. This PCB is similar in most respects to the B-8SCU-C PCB used for the key telephones, except that the Single Line Interface is used in place of the receive and transmit data circuits. The B-8SLU-B PCB provides each telephone with power (+/- 24VDC), off hook loop current detection, an audio path and circuits to excite the special ringers.

B-4COU-A CENTRAL OFFICE UNIT PCB

3.60 Each B-4COU-A PCB (Figure 8-14) contains the circuits to connect four Central Office or PBX lines to the system. This circuit board provides incoming ring detection, loop supervision, loop relay enable (line seize), Conference balancing, Music on Hold and audio amplifier circuits for each of the four lines. The B-4COU-A PCB is controlled by the 6502 traffic control processor, over the 6502 Data Bus.

Front End and Ring Detection

3.61 Tip (TP102) and Ring (TP101) are connected from the RJ21X connector, through the KSU backplane, to the input protection network in the B-4COU-A PCB. This network prevents excessively high input voltages (high voltage transients from lightning, etc.) from damaging the circuits on the PCB. Voltages in excess of 260VDC are shunted to the system cold water pipe ground.

3.62 An AC ring signal from the line, typically 90VAC, is detected in the supervision circuits. The ring signal is rectified (changed to DC) and converted to a digital line status signal by the Ring Pulse Stretcher. The line status signal from each of the four line circuits is presented to the Ring Detect Multiplexer. This multiplexer sends line status (ring detect) data to the B-CPU-B when addressed by the 6502.

3.63 When a line is to be seized for answering or placing a call, the seize command is sent by the 6502, down its data bus, to the Loop Relay Enable Decoder. The decoder then sends an enable signal to the loop relay for the line to be seized. When the line is seized, an LED (DS101 for line 1) is illuminated.

3.64 The Loop Relay and Supervision Circuits are also used when a line is on Hold and when Dial Pulse dialing is required. When a line is placed on Hold, the audio connection between the line and the system is dropped, while DC holding current is maintained in the loop relay. During Dial Pulse dialing, the 6502 sends pulsed enable signals to the line loop relay that correspond to the digits to be dialed. The supervision circuits are also used to detect a far-end disconnect pulse, which occurs when an outside party placed on Hold hangs up, if this facility is provided by the PBX or telco switching equipment that the TCX-128 is hooked up to.

Audio Circuits

3.65 Line audio is AC coupled from Tip and Ring to a bidirectional audio amplifier. This circuit is designed to ensure that the level of incoming audio is correctly balanced against the level of outgoing audio. For the first five B-4COU-A PCBs in the KSU (lines 1-20), audio is connected to the backplane as a Direct Access Line signal. For the last B-4COU-A PCB in the KSU and the two B-4COU-A PCBs in the expansion cabinet, audio is connected to the backplane as a Dial-Up Line Signal.

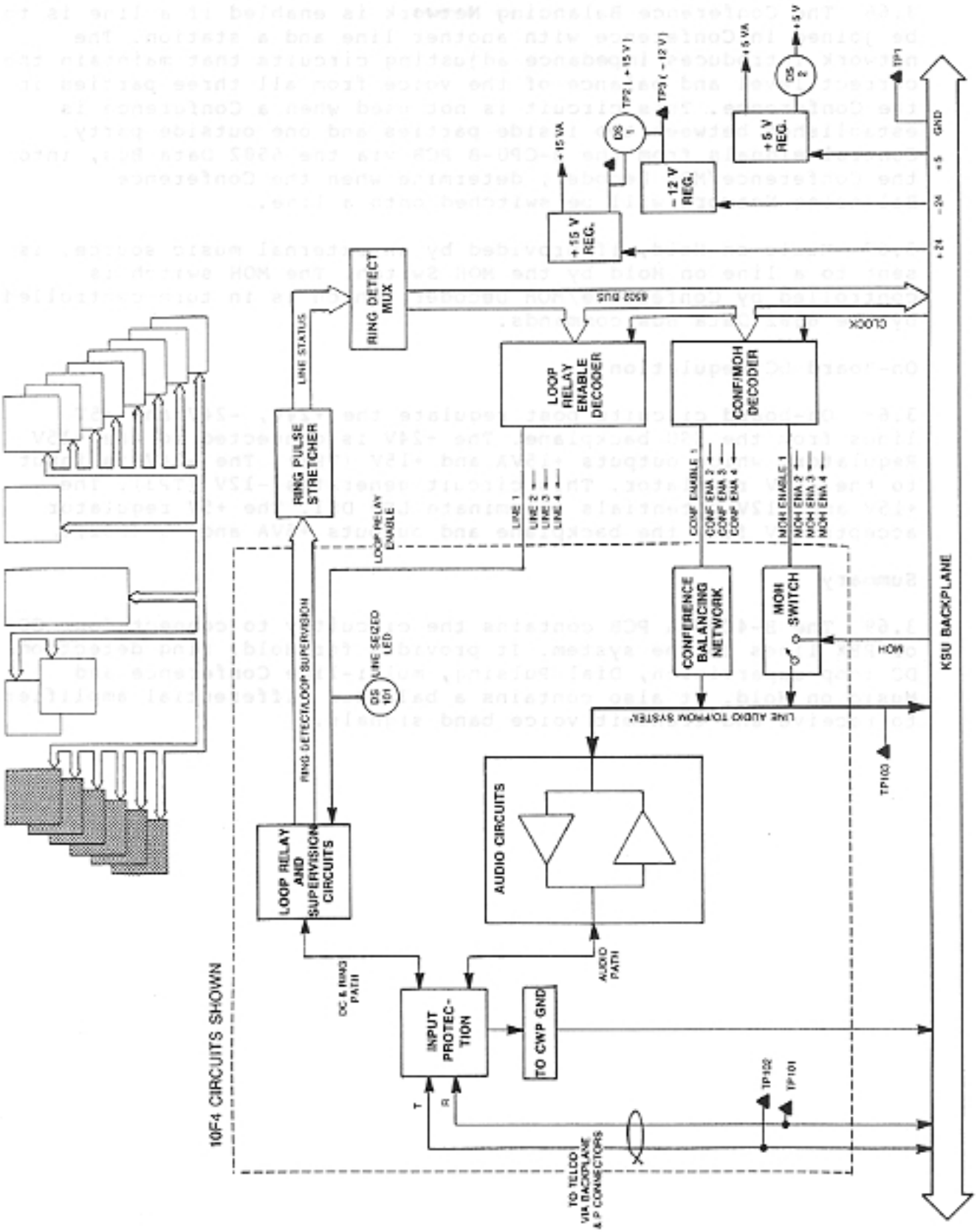


Figure 8-14 B-4COU-A CENTRAL OFFICE UNIT PCB BLOCK DIAGRAM, TCX-128

Conference and Music on Hold

3.66 The Conference Balancing Network is enabled if a line is to be joined in Conference with another line and a station. The network introduces impedance adjusting circuits that maintain the correct level and balance of the voice from all three parties in the Conference. This circuit is not used when a Conference is established between two inside parties and one outside party. Control signals from the B-CPU-B PCB via the 6502 Data Bus, into the Conference/MOH Decoder, determine when the Conference Balancing Network will be switched onto a line.

3.67 Music on Hold, if provided by an external music source, is sent to a line on Hold by the MOH Switch. The MOH switch is controlled by Conference/MOH Decoder, which is in turn controlled by the 6502 Data Bus commands.

On-Board DC Regulation

3.68 On-board circuits post regulate the +24V, -24V and +5V lines from the KSU backplane. The +24V is connected to the +15V Regulator, which outputs +15VA and +15V (TP2). The -24V is input to the -12V regulator. This circuit generates -12V (TP3). The +15V and -12V potentials illuminate LED DS1. The +5V regulator accepts +5V from the backplane and outputs +5VA and +5 (DS2).

Summary

3.69 The B-4COU-A PCB contains the circuitry to connect four CO or PBX lines to the system. It provides for Hold, ring detection, DC loop supervision, Dial Pulsing, multi-line Conference and Music on Hold. It also contains a balanced differential amplifier to receive and transmit voice band signals.

B-BUF-A BUFFER PCB

3.70 The B-BUF-A PCB (Figure 8-15), located in the expansion cabinet, functions as a buffer between the 6502 KSU Data Bus and the 6502 expansion cabinet Data Bus. If the expansion cabinet is not installed, the B-BUF-A PCB is not required.

3.71 All interconnection between the KSU and the expansion cabinet is through the two ribbon cables. The 6502 Data Bus passes through the B-BUF-A PCB before being extended to the expansion cabinet PCBs. The B-BUF-A PCB separately buffers the 6502 high order address signals, to obtain Station Card Select signals for stations 65-128, as well as the address and data signals that comprise the the 6502 Expansion Data Bus.

3.72 The links (Intercom, BGM and Page), Direct Access Lines and Dial-up Lines are connected unbuffered from the KSU backplane to the expansion cabinet backplane. The Z80 Data Bus is not used in the expansion cabinet.

3.73 The B-BUF-A PCB has on-board filters for the +5V line from the expansion cabinet backplane and power supply. LED DS1 will illuminate whenever +5V is present.

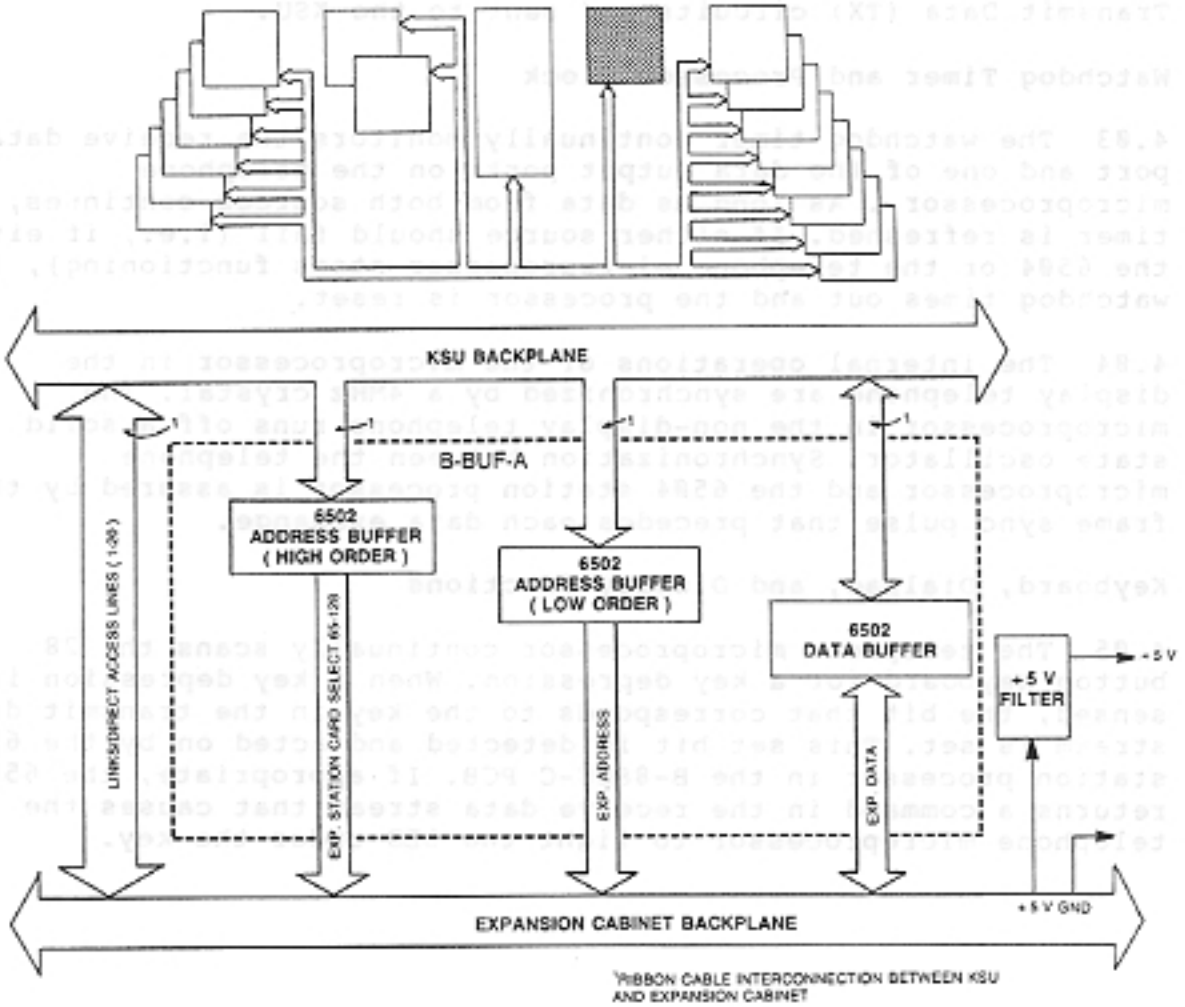


Figure 8-15 B-BUF-A BUFFER PCB BLOCK DIAGRAM, TCX-128

4. TELEPHONES

MULTIBUTTON KEY TELEPHONE

4.01 The Multibutton Key Telephone (Figure 8-16) is the most sophisticated station instrument in the TCX-128. It contains an internal microprocessor (with memory) that communicates with the 6504 microprocessor in the B-8SCU-C PCB. This provides for real time response to call activity. The telephone microprocessor also manages the keyboard, dialer, and display (optional), as well as the analog handset/speakerphone switching. The telephone is connected over four conductor cable to a dedicated port on its assigned B-8SCU-C PCB in the KSU.

Data and Power

4.02 Control data is simplexed over the DC voltages in the station A pair wires. The green wire carries -24V; the red wire carries +24V. The Voltage Network uses these two potentials to generate -12.4V, -6.8V, a ground reference, +7.5V and +15V for telephone circuit power. Receive data (voltage) from the KSU is detected in the Receive Data (RX) circuits and input into the telephone microprocessor (TP202). Transmit data (current) from the telephone microprocessor (TP203) is current amplified in the Transmit Data (TX) circuits and sent to the KSU.

Watchdog Timer and Processor Clock

4.03 The watchdog timer continually monitors the receive data port and one of the data output ports on the telephone microprocessor . As long as data from both sources continues, the timer is refreshed. If either source should fail (i.e., if either the 6504 or the telephone microprocessor stops functioning), the watchdog times out and the processor is reset.

4.04 The internal operations of the microprocessor in the display telephone are synchronized by a 4MHz crystal. The microprocessor in the non-display telephone runs off a solid state oscillator. Synchronization between the telephone microprocessor and the 6504 station processor is assured by the frame sync pulse that precedes each data exchange.

Keyboard, Dialpad, and Display Functions

4.05 The telephone microprocessor continually scans the 28 button keyboard for a key depression. When a key depression is sensed, the bit that corresponds to the key in the transmit data stream is set. This set bit is detected and acted on by the 6504 station processor in the B-8SCU-C PCB. If appropriate, the 6504 returns a command in the receive data stream that causes the telephone microprocessor to light the LED under the key.

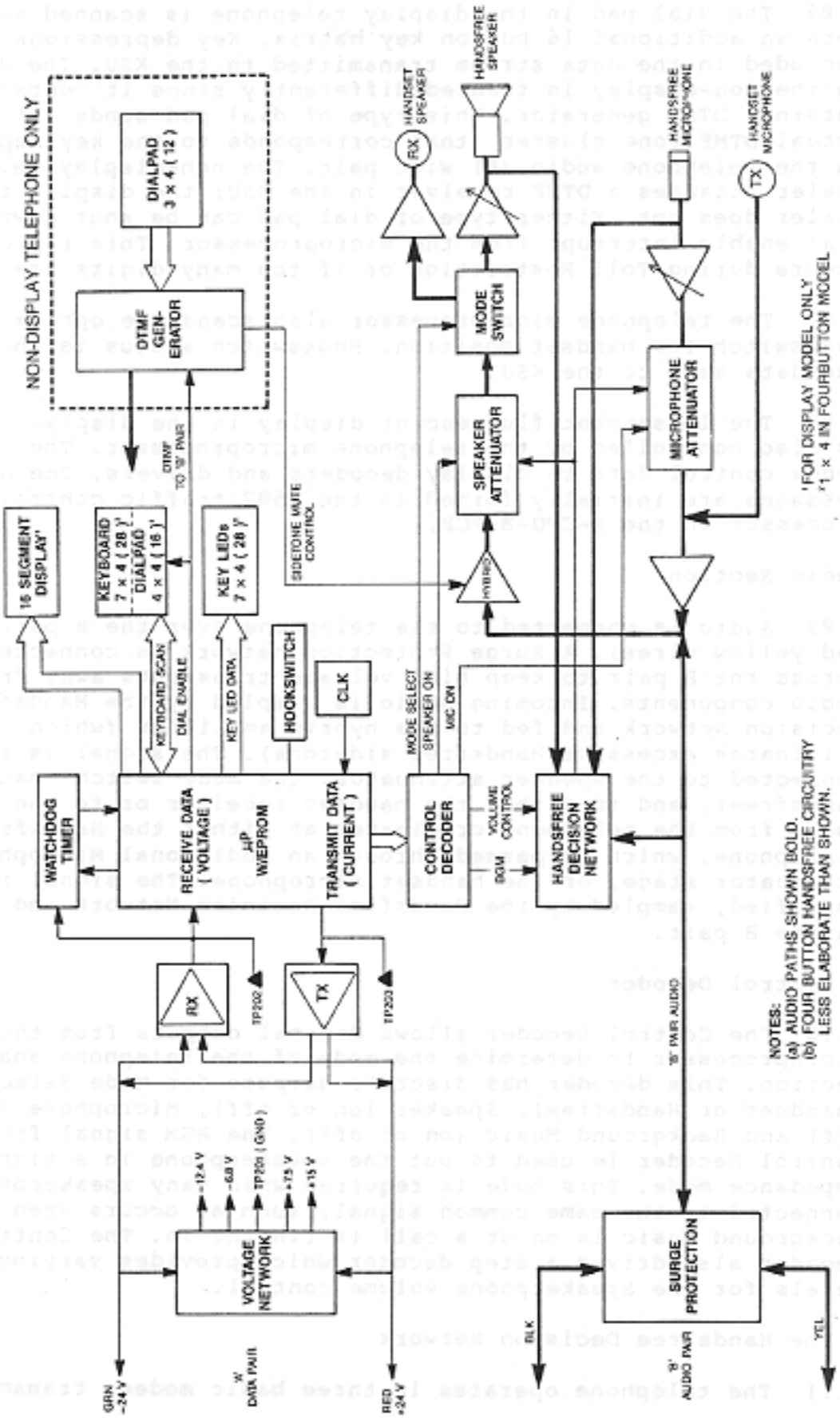


Figure 8-16 MULTIBUTTON KEY TELEPHONE BLOCK DIAGRAM, TCX-128

4.06 The dial pad in the display telephone is scanned as if it were an additional 16 button key matrix. Key depressions are included in the data stream transmitted to the KSU. The dial pad in the non-display is treated differently since it contains an internal DTMF generator. This type of dial pad sends out the actual DTMF tone cluster (that corresponds to the key depression) on the telephone audio (B) wire pair. The non-display telephone dialer attaches a DTMF receiver in the KSU; the display telephone dialer does not. Either type of dial pad can be shut down by the dial enable interrupt from the microprocessor. This typically occurs during Toll Restriction or if too many digits are dialed.

4.07 The telephone microprocessor also scans the optical hookswitch for handset position. Hookswitch status is included in the data sent to the KSU.

4.08 The 16 segment fluorescent display in the display telephone is also controlled by the telephone microprocessor. The processor sends control data to display decoders and drivers. The display messages are initially formed in the 6502 traffic control processor in the B-CPU-B PCB.

Audio Section

4.09 Audio is connected to the telephone over the B pair (black and yellow wires). A Surge Protection network is connected across the B pair to keep high voltage transients away from the audio components. Incoming audio is sampled by the Handsfree Decision Network and fed to the hybrid amplifier (which eliminates excessive Handsfree sidetone). The signal is then connected to the speaker attenuator, the mode switch (handset or Handsfree), and to either the handset receiver or to the speaker. Audio from the telephone originates at either the Handsfree microphone, which is passed through an additional Microphone Attenuator stage, or the handset microphone. The signal is then amplified, sampled by the Handsfree Decision Network and sent out on the B pair.

Control Decoder

4.10 The Control Decoder allows digital outputs from the microprocessor to determine the mode of the telephone analog section. This decoder has discrete outputs for Mode Select (handset or Handsfree), Speaker (on or off), Microphone (on or off) and Background Music (on or off). The BGM signal from the Control Decoder is used to put the speakerphone in a high impedance mode. This mode is required when many speakerphones are connected to the same common signal, such as occurs when Background Music is on or a call is ringing in. The Control Decoder also drives a step decoder which provides varying voltage levels for the Speakerphone volume control.

The Handsfree Decision Network

4.11 The telephone operates in three basic modes: transmit,

receive and idle. Transmit can be either with the handset or Handsfree (using the microphone). Receive can also be with the handset or Handsfree (using the speaker). When the telephone is neither transmitting or receiving, it is in the idle mode. The idle mode can automatically dampen background noise if the telephone is in an environment where that noise is at a consistent level (such as from a fan, etc).

4.12 The operation of the Handsfree speakerphone (speaker and microphone) is determined by a combination of signals from the Control Decoder, the B pair audio, the microphone and the speaker. As shown in the bottom half of Figure 8-16, the microphone and speaker signals loop back to the Handsfree Decision Network. This network compares the audio levels at the speaker to levels on the microphone and the B pair to determine if the telephone is transmitting or receiving.

4.13 As a result of this comparison, control voltages are sent by the Handsfree Decision Network to the Microphone and Speaker Attenuators. These attenuators are also controlled by the Control Decoder, which receives its input directly from the station microprocessor, independent of the audio levels present. What is happening in the telephone is determined on the one hand by the type of call, and on the other hand by the relative levels of transmit and receive. For example, if a call is transferred Handsfree, the control decoder turns both the Handsfree microphone and speaker on, the handset off, and the BGM high impedance mode off. Whether the telephone is transmitting to or receiving from the calling party is determined by how loud the incoming audio is, compared against how loud the outgoing reply is.

Summary

4.14 The Multibutton Key Telephone is a microprocessor based key telephone. It is connected to the B-8SCU-C PCB by four conductor station wire: two conductors carrying power and simplexed data, two conductors carrying the audio. The data exchange between the KSU and the telephone controls the telephone. The status of the audio section is also controlled by the handsfree decision network, working in conjunction with the microprocessor controller.

FOUR BUTTON KEY TELEPHONE

4.15 The Four Button Key Telephone is essentially the same telephone as the multibutton, except that:

- The Handsfree Decision and speakerphone circuitry is less elaborate than in Figure 8-16.
- All four button telephones use DTMF dialers (like the non-display multibutton telephones).
- The four button microprocessor only has to scan four keys and illuminate four key LEDs.
- Four button telephones do not have displays.

DIRECT STATION SELECTION (DSS) CONSOLE

4.16 The Direct Station Selection (DSS) Console (Figure 8-17) is comprised of a 64 button keyboard, with each key containing an LED. The microprocessor in the DSS, communicating with the 6504 station processor in the B-8SCU-C PCB, functions like the microprocessor in the multibutton telephone to scan the keys and light the LEDs. The DSS Console also contains a speaker for off hook signaling.

Keyboard Scan and Data Flow

4.17 Data is simplexed on the A pair wires. The green wire carries -24V from the B-8SCU-C PCB; the red wire carries +24V. These levels are connected to a voltage network that produces the -12.6V, -7.5V, a ground reference and +7.5V potentials used for circuit power. Data from the KSU (voltage) is detected in the Receive Data (RX) circuits and sent to the DSS microprocessor (at TP3). Data from the DSS microprocessor to the KSU (current) is sent out (at TP2) by the Transmit Data (TX) circuits.

4.18 The DSS microprocessor continually scans the 64 DSS keys. When a key depression is sensed, the data bit corresponding to that depression is sent in the TX data to the 6504 station processor. If appropriate, the Receive Data from the KSU will instruct the DSS processor to illuminate the LED under that key.

4.19 The Watchdog Timer is refreshed by the receive data from the B-8SCU-C PCB. If that PCB should stop sending data, the watchdog times out and resets the DSS microprocessor.

4.20 The internal operation of the DSS microprocessor is synchronized by the 4MHz crystal. Synchronization between the DSS and the B-8SCU-C PCB is ensured by the frame sync pulse transmitted from the 6504 station processor at the beginning of every data exchange.

Off Hook Signaling Speaker

4.21 The DSS Console B pair wires (black and yellow) carry incoming ring audible for attendant off hook signaling. The incoming ring passes through the Surge Protection Network and is sent sent to an audio amplifier. This amplifier drives the speaker in the console. The switching of the incoming ring is done in the KSU, not in the DSS console

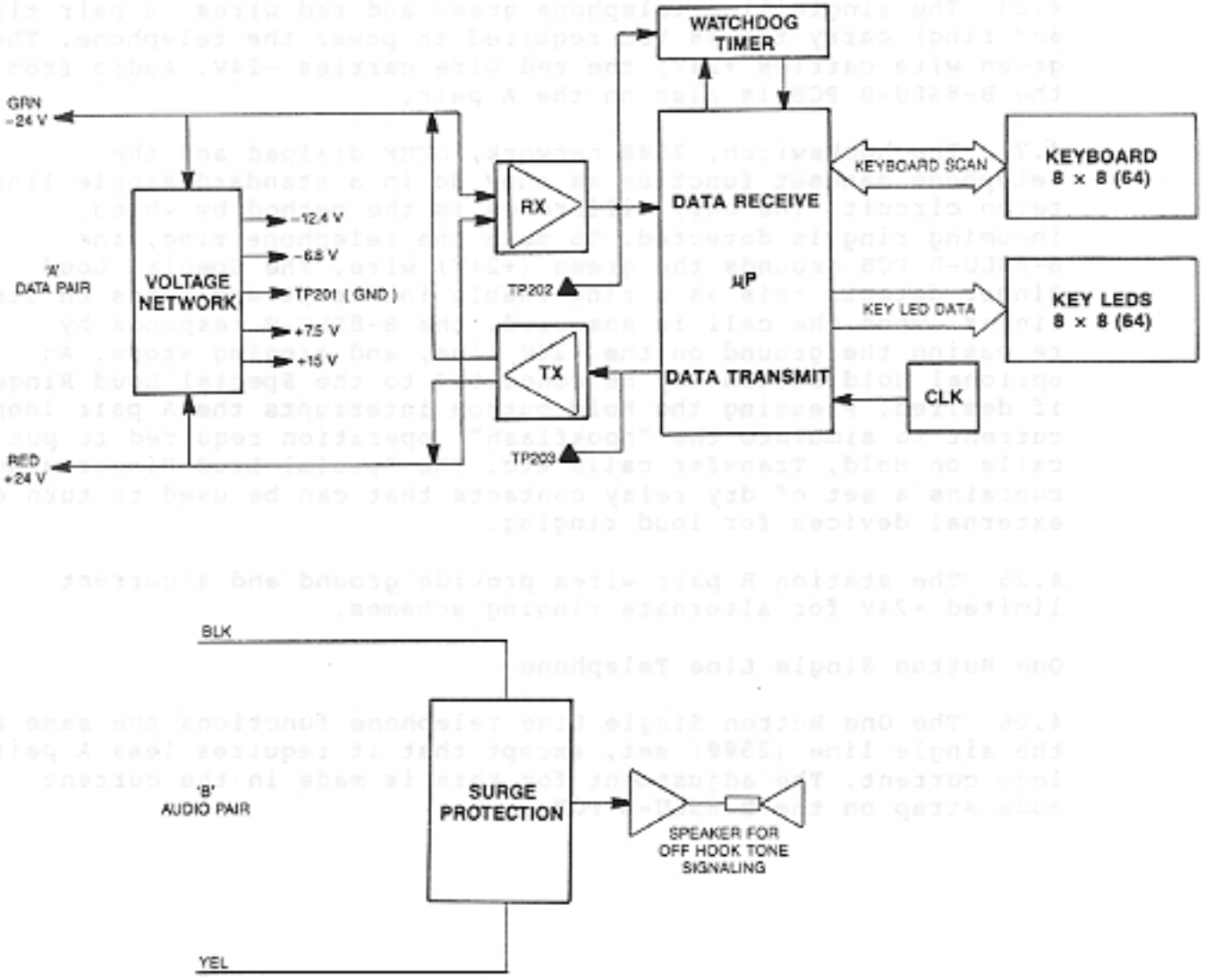


Figure 8-17 DIRECT STATION SELECTION (DSS) CONSOLE BLOCK DIAGRAM, TCX-128

SINGLE LINE 2500 TYPE AND ONE BUTTON TELEPHONES

Single Line (2500 Type) Telephone

4.22 Standard single line (2500 type) telephones (Figure 8-18) may be connected to the TCX-128. These telephones must be equipped with special ringers and must be connected to a port on a B-8SLU-B PCB in the KSU.

4.23 The single line telephone green and red wires (A pair tip and ring) carry the 48 VDC required to power the telephone. The green wire carries +24V; the red wire carries -24V. Audio from the B-8SLU-B PCB is also on the A pair.

4.24 The hookswitch, 2500 network, DTMF dialpad and the telephone handset function as they do in a standard single line telco circuit. The only difference is the method by which incoming ring is detected. To make the telephone ring, the B-8SLU-B PCB grounds the green (+24V) wire. The Special Loud Ringer detects this as a ring enable interrupt and turns on its ringer. When the call is answered, the B-8SLU-B responds by releasing the ground on the +24V line, and ringing stops. An optional Hold button may be connected to the Special Loud Ringer, if desired. Pressing the Hold button interrupts the A pair loop current to simulate the "hookflash" operation required to put calls on Hold, Transfer calls etc. The Special Loud Ringer also contains a set of dry relay contacts that can be used to turn on external devices for loud ringing.

4.25 The station B pair wires provide ground and a current limited +24V for alternate ringing schemes.

One Button Single Line Telephone

4.26 The One Button Single Line Telephone functions the same as the single line (2500) set, except that it requires less A pair loop current. The adjustment for this is made in the current mode strap on the B-8SLU-B PCB.

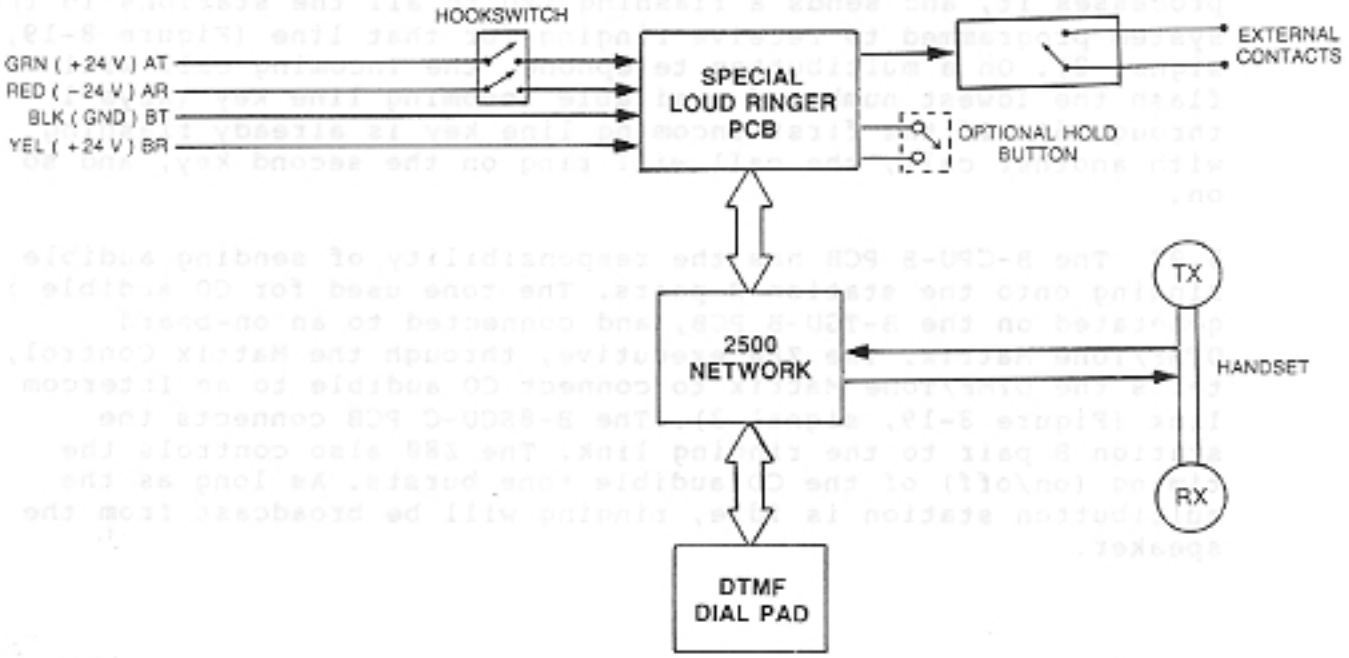


Figure 8-18 SINGLE LINE (2500 TYPE) TELEPHONE BLOCK DIAGRAM, TCX-128

5. ANALYSIS OF SIGNAL FLOW

RECEIVING AN OUTSIDE CALL

Detecting the Incoming Call

5.01 An incoming call from the Central Office or PBX will send ringing into the system. This ringing is detected in the B-4COU-A PCB to which the line is connected (Figure 8-19, signal 1). As the B-CPU-B polls the B-4COU-A PCBs, it sees the ring detect, processes it, and sends a flashing LED to all the stations in the system programmed to receive ringing for that line (Figure 8-19, signal 2). On a multibutton telephone, the incoming call will flash the lowest numbered available incoming line key (keys 1 through 5). If the first incoming line key is already flashing with another call, the call will ring on the second key, and so on.

5.02 The B-CPU-B PCB has the responsibility of sending audible ringing onto the station B pairs. The tone used for CO audible is generated on the B-TGU-B PCB, and connected to an on-board DTMF/Tone Matrix. The Z80 executive, through the Matrix Control, tells the DTMF/Tone Matrix to connect CO audible to an Intercom link (Figure 8-19, signal 3). The B-8SCU-C PCB connects the station B pair to the ringing link. The Z80 also controls the timing (on/off) of the CO audible tone bursts. As long as the multibutton station is idle, ringing will be broadcast from the speaker.

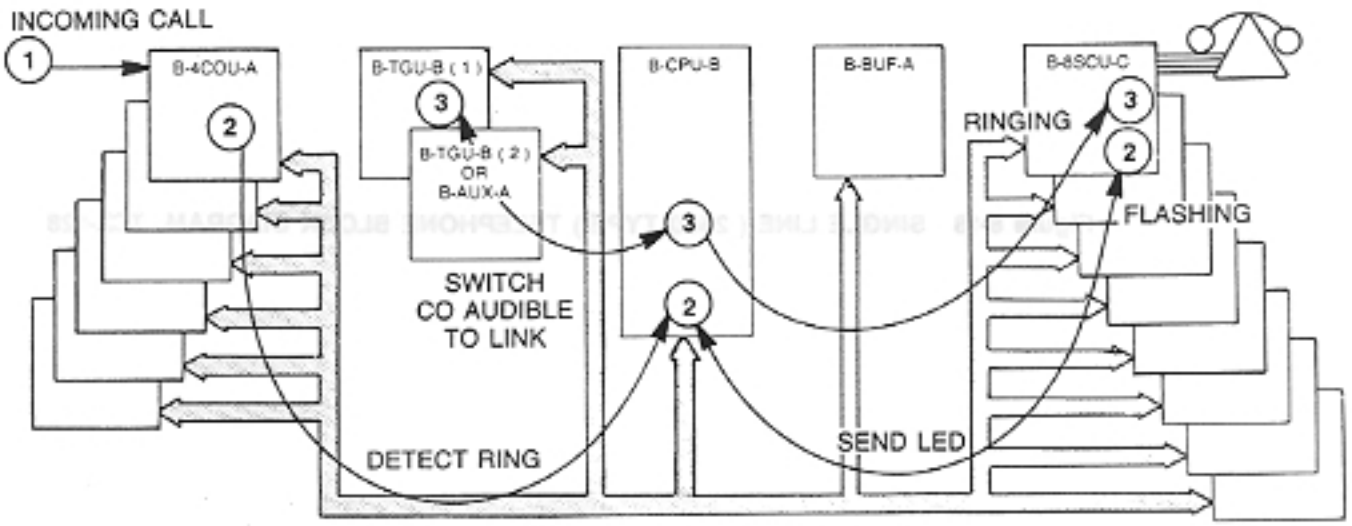


Figure 8-19 RECEIVING AN OUTSIDE CALL, TCX-128 (Page 1 of 2)

5.Ø3 On a four button telephone, ringing will occur in the telephone speaker unless another call is already ringing in. Only the first incoming call will ring. On a single line telephone, the B-8SLU-B PCB will enable the telephone ringer, provided another call was not previously ringing.

Answering the Incoming Call

5.Ø4 To answer the incoming call, the multibutton telephone user presses the flashing line key. The 65Ø4 station processor in the B-8SCU-C PCB picks up this key depression within 1ØØmS, and begins processing the request (Figure 8-19, signal 4). The line key on the telephone that answered the call will be steadily illuminated. The incoming line key on all other telephones will go out and be made available to another call.

5.Ø5 If the incoming call is on a Direct Access Line (lines 1-2Ø), the audio output from the B-4COU-A PCB is connected directly to the station B pair through a single crosspoint closure in the B-8SCU-C PCB (Figure 8-19, signal 5). If the incoming call is on a Dial-Up Line (lines 21-32), audio connection is from the telephone, through a link crosspoint closure in the B-8SCU-C, through another link crosspoint closure in the B-TGU-B PCB to the line audio circuit on the B-4COU-A PCB (Figure 8-19, signal 6).

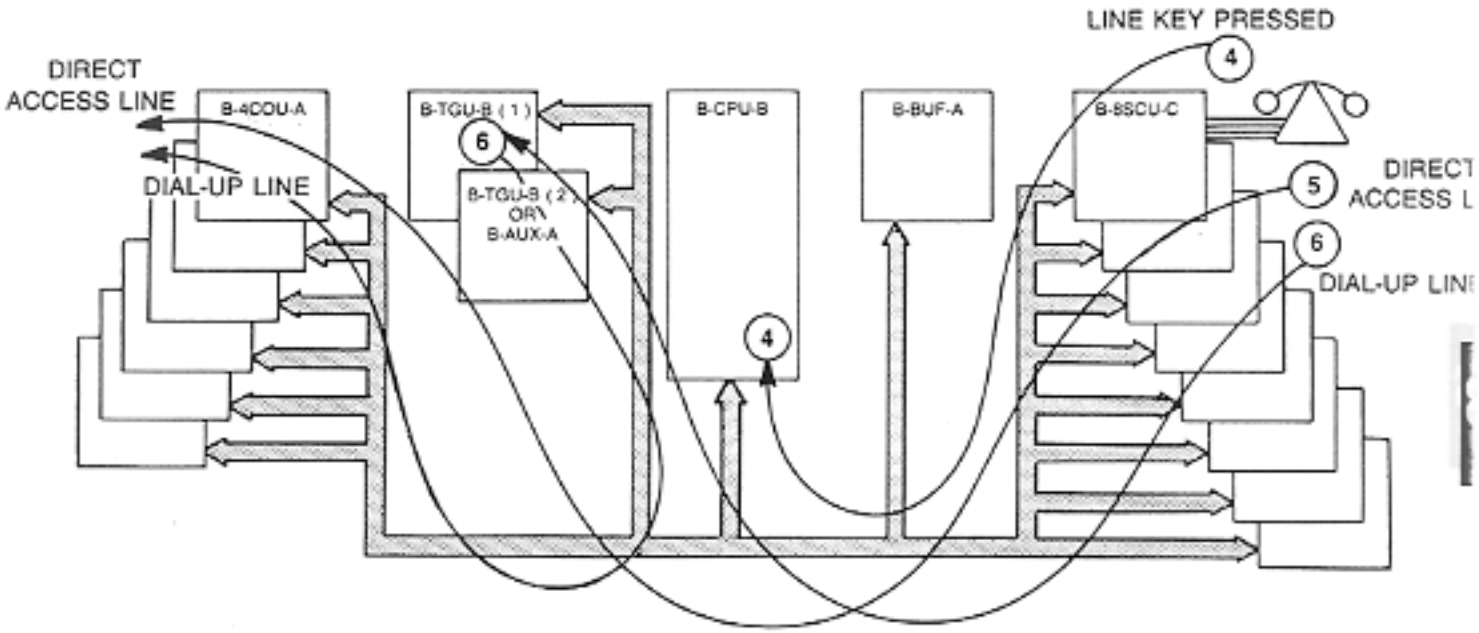


Figure 8-19 RECEIVING AN OUTSIDE CALL, TCX-128 (Page 2 of 2)

5.06 The B-CPU-B PCB sends a Loop Relay Enable signal to the line circuit on which the call rang in. When the loop relay is seized, a DC current path is established between the front end of the line circuit and the Central Office or PBX. This is required so the calling circuit knows the call has been answered. Both requirements for answering the call have been met: the DC path for holding the line, and the audio path for carrying the conversation.

5.07 To summarize how an incoming call is processed:

(1) The incoming ring is detected in the B-4COU-A PCB.
(2) Flashing LED and audible ring are sent to designated stations.
(3) Answering party presses flashing line key.
(4) Audio link between station and line is established.
(5) Loop relay is seized and DC loop current flows.

PLACING AN OUTSIDE CALL

Seizing the Line

5.08 The 6504 station processor in the B-8SCU-C PCB continually scans the key telephone for change of state. When the user lifts the handset and presses a line key, the change is sent in the data stream to the 6504, to the 6502 traffic controller in the B-CPU-B PCB, and to the Z80 for the processing decision (Figure 8-20, signal 1). The Z80 assigns a talkpath for the call and sends a Loop Relay Enable command to the line circuit being used to seize the line. If the call is being made on a Dial Pulse line, the Z80 attaches a tone generator to the talkpath to give dial tone to the party placing the call (Figure 8-20, signal 2). If the call is being placed on a DTMF line, dial tone is returned from the outside line. The data transmitted to the telephone lights the LED under the outgoing line key that was pressed. This key lights only at the station placing the call.

5.09 If the Z80 determines that the call should be placed on a Direct Access Line (lines 1-20), the audio connection is from the telephone, through a crosspoint on the B-8SCU-C PCB, to the Direct Access Line path in the KSU backplane, and finally to the audio circuit on the appropriate B-4COU-A PCB (Figure 8-20, signal 3). If the Z80 selects a Dial-Up Line to place the call (lines 21-32), connection is from the telephone, through a crosspoint on the B-8SCU-C PCB to an Intercom link, through an additional crosspoint on the B-TGU-B PCB, to the Dial-Up Line path in the KSU backplane, and finally to the audio circuit on the B-4COU-A PCB for the Dial-Up Line.

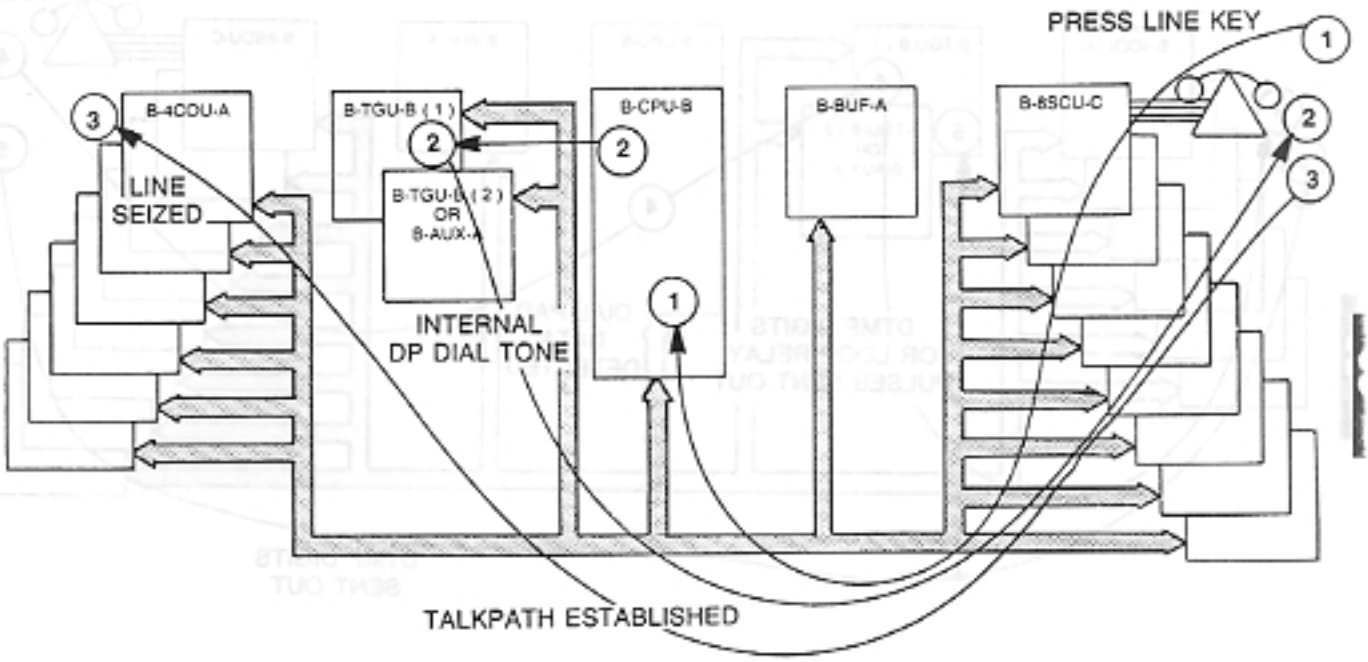


Figure 8-20 PLACING AN OUTSIDE CALL, TCX-128 (Page 1 of 2)

Dialing

5.1Ø Once the user hears dial tone, dialing can be begun. If the call is being made from a display telephone into a DTMF line, dial pad key depressions (dialed digits) are inserted into the data stream to the 65Ø4 station processor. The B-CPU-B PCB pulls the dial pad data out of the data stream and sends it to the time-shared DTMF generator that it has attached to the call talkpath (Figure 8-2Ø, signal 4). The DTMF generator sends the tones out to the line, and mirrors the tone bursts back to the telephone for dial confirmation. If the call is being placed into a Dial Pulse line, the B-CPU-B PCB receives the dial pad digits and pulses the line loop relay accordingly. In either case, Toll Restriction checks are made as the digits are dialed.

5.11 If the call is being placed from a non-display or four button telephone, the dial pad digits are not part of the A pair data stream. These telephones use dialers with integral DTMF generators, and place DTMF tone bursts onto the audio (B) pair Figure 8-2Ø, signal 5). These DTMF digits go out on tip and ring of the seized line. The Z8Ø attaches a DTMF receiver (on the B-TGU-B PCB) to the call talkpath to interpret the digits. This is done so that Toll Restriction checks and SMDR records can be made. The DTMF receiver is attached until dialing is completed. If the call is being placed on a Dial Pulse line, the DTMF receiver encodes the dialed digits for the Z8Ø, which then tells the 65Ø2 traffic controller to pulse the loop relay.

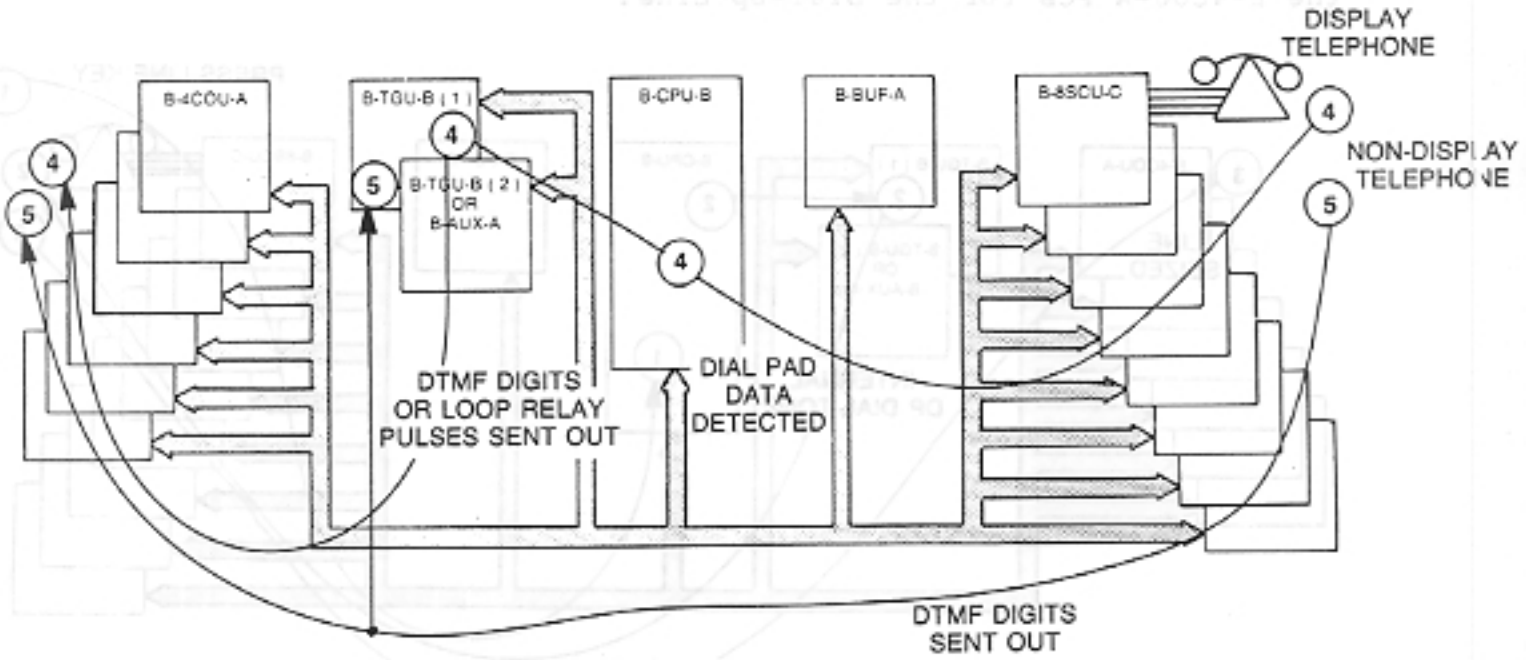


Figure 8-20 PLACING AN OUTSIDE CALL, TCX-128 (Page 2 of 2)

5.12 Four button telephones must dial codes to access outside lines. An Intercom link is connected as soon as the user lifts the handset. Once the access code is dialed over the link, the call is placed as it is for a non-display multibutton telephone. Single line (2500 type) and one button telephones also must use access codes; however, there is no data flow between the telephone and the KSU.

5.13 Since the front end of the B-4COU-A PCB is not current sensitive, answer detection is not required.

5.14 To summarize how an outgoing call is placed:

(1) Request for line is processed by B-CPU-B PCB.
(2) Line seized and talkpath established (Direct Access vs. Dial-Up).
(3) Dialed digits sent out by B-TGU-B PCB (display telephone) or on-board DTMF generator in dialer (non-display telephone).
(4) Dialed digits checked for Toll Restriction and SMDR.

PLACING AN INTERCOM CALL

Initiating the Call

5.15 When the multibutton telephone user lifts the handset and press the INT key, the change of state is sent in the data stream to the 6504 station processor. The 6502 traffic controller in the B-CPU-B PCB sees the change and sends it to the Z80 for processing (Figure 8-21, signal 1). The Z80 in the B-CPU-B PCB interprets the change and assigns an Intercom link to the station. It signals the B-TGU-B PCB to put Intercom dial tone on the selected link, and instructs the B-8SCU-C PCB to connect the link to the telephone audio (B) pair (Figure 8-21, signal 2). The system waits for digits to be dialed.

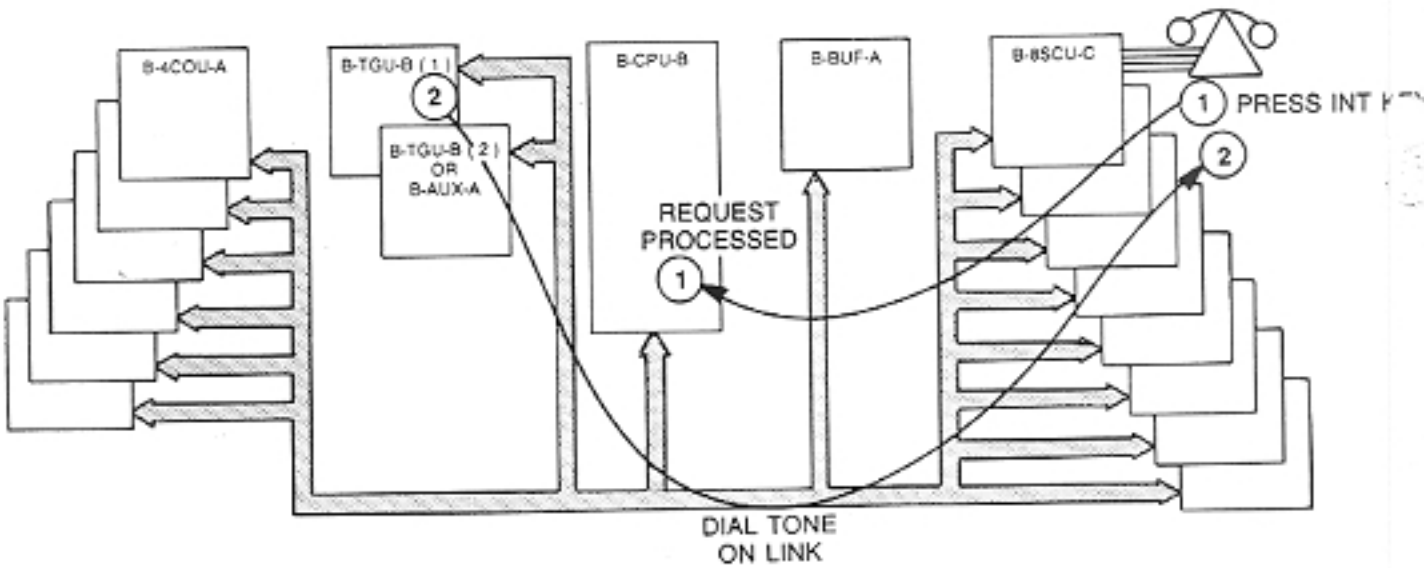


Figure 8-21 PLACING AN INTERCOM CALL, TCX-128 (Page 1 of 2)

Dialing the Intercom Call

5.16 Once Intercom dial tone is returned to the calling station, the user can dial the destination station (Figure 8-21, signal 3). If a display telephone is being used to place the call, the dial pad digits are included in the data exchange from the telephone to the B-8SCU-C PCB. The 6504 station processor reads the dialed digits and sends them to the B-CPU-B PCB. If the called extension is busy, the Z80 tells the B-TGU-B PCB to attach busy tone to the calling link. If the called station is idle (and Handsfree Answerback is enabled), the Z80 connects the B pair of the called station to the Intercom link and enables the called station's speakerphone (Figure 8-21, signal 4). The Z80 instructs the B-TGU-B PCB to send splash tones to the called station, indicating that a Intercom conversation has been established (Figure 8-21, signal 5).

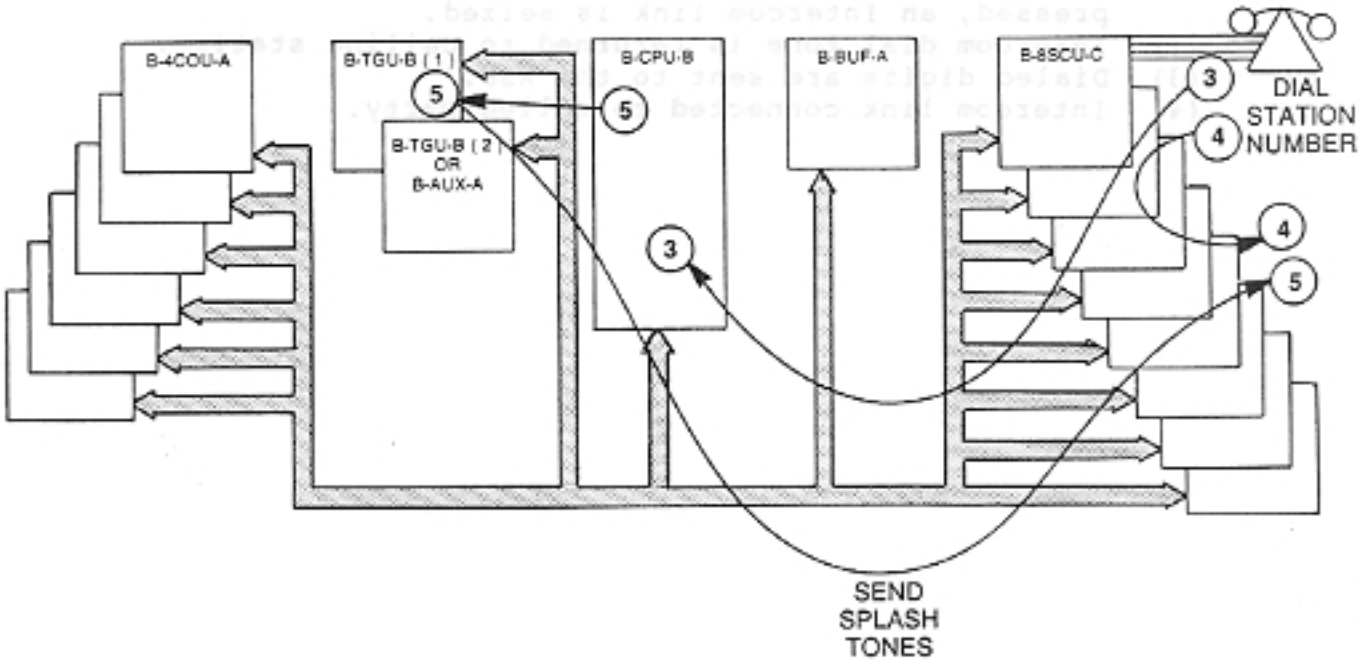


Figure 8-21 PLACING AN INTERCOM CALL, TCX-128 (Page 2 of 2)

5.17 If a non-display telephone is being used to place the call, the dial pad key closures are encoded into DTMF tone bursts in the telephone. These DTMF tones are sent down the station B pair (on the seized Intercom link) to the B-TGU-B PCB, where they must be decoded in a DTMF receiver. The Z80 looks at the output of the DTMF receiver to determine which station was called. All other functions are identical to the display telephone.

5.18 If Forced Intercom Ringing is enabled, the Z80 will command the B-TGU-B PCB to ring the called station. The Intercom link is connected between the two stations only when the called party lifts the handset.

5.19 Four button, single line (2500 type) and one button telephones are automatically connected to an Intercom link when the handset is lifted. Except for this difference, an Intercom call is processed exactly as it is for a non-display multibutton telephone.

5.20 To summarize how an Intercom call is placed:

(1) When the B-CPU-B PCB detects that the INT key has been pressed, an Intercom link is seized.
(2) Intercom dial tone is returned to calling station.
(3) Dialed digits are sent to the KSU.
(4) Intercom link connected to called party.

TCX-128
COMPUTERIZED BRANCH EXCHANGE
SECTION 9, MAINTENANCE

1. INTRODUCTION

1.01 The MAINTENANCE Section is used in conjunction with the TCX-128 THEORY OF OPERATION (Section 8). It allows service personnel to isolate and repair system troubles to the module (plug-replaceable unit) level. This section is divided into four parts: Troubleshooting (Part 2), Read Only Memory Check (Part 3), Display System Status Diagnostic (Part 4), and Least Cost Routing Diagnostic (Part 5).

1.02 Operational Specifications for each telephone are included in Appendices A through E of this manual. These specifications provide instructions on how to access each feature.

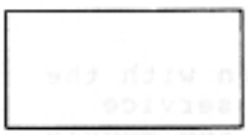
2. TROUBLESHOOTING

2.01 This part uses the System Troubleshooting Flowchart (Figure 9-1) to guide the technician in testing and fault location. The flowchart is supported by the Operational Test Procedure (Table 9-1), System Voltages (Table 9-2), the Replaceable Parts List (Table 9-3), and the illustrations on the various LEDs and testpoints (Figures 9-2, 9-3 and 9-4). A list of some common system faults, and their solutions, is provided in Table 9-4. Figure 9-5, How to Evaluate a System Problem, is a guide the technician can use when questioning a user about a system trouble.

TROUBLESHOOTING FLOWCHARTS

2.02 The System Troubleshooting Flowchart (Figure 9-1) provides service personnel with a logical framework for system checking and fault isolation. The flowchart is divided into six parts: System Check (Page 1 of 6), LED Check (Page 2 of 6), Power Supply/Service Check (Page 3 of 6), Voltage/PCB Check (Page 4 of 6), Cable Check (Page 5 of 6) and Features/Programming Check (Page 6 of 6). The System Check provides the outline for a correct installation, as well as a sequence for fault isolation and repair. The LED, Power Supply/Service, Voltage/PCB and Cable Checks allow the basic parameters of the system to be verified. The Features and Programming Check shows the interrelationsnip between feature operation and system programming.

: Denotes the beginning or end of the flowchart.



: Indicates an action to be carried out (event).

: Indicates that a decision must be made.

: Instructs the technician to go (branch) to the indicated area of the flowchart (i.e., B to B, C to C, etc.).

: Indicates the order in which events and decisions are executed.

CAUTION: THE PRINTED CIRCUIT BOARDS USED IN THE TCX-128 SYSTEM CONTAIN STATIC SENSITIVE CMOS COMPONENTS. AN ANTI-STATIC GROUND WRIST STRAP, TERMINATED AT EARTH GROUND, MUST BE WORN IF PCBS ARE TO BE HANDLED. PCBS MUST BE STORED IN THEIR VELOSTAT BAGS WHEN NOT PLUGGED INTO THE KSU.

CAUTION: A THERMAL PROTECTION DEVICE IS LOCATED ON THE KSU. WHEN THE MAXIMUM OPERATING TEMPERATURE FOR THE SYSTEM IS EXCEEDED, THE THERMAL PROTECTION DEVICE CAUSES THE RESET BUTTON ON THE FRONT FACE OF THE POWER SUPPLY TO POP UP, REVEALING A WHITE BAND. THIS BAND INDICATES THAT THE SYSTEM IS OPERATING AT DANGEROUSLY HIGH TEMPERATURES. THE THERMAL PROTECTION DEVICE WILL NOT SHUT DOWN THE POWER ON THE POWER SUPPLY.

OPERATIONAL TEST PROCEDURE

2.03 The Operational Test Procedure (Table 9-1) provides a checklist for evaluating the system features. The features are divided into three groups: Internal, External, and Optional. The table presents the features in the order they should be checked. The AVAILABLE column indicates the telephones that access the feature. The VERIFIED column is used to provide a checklist for feature status based on the Operational Specification. The PROGRAMMABLE column indicates if the feature is affected by system programming. If a feature does not operate correctly, the symptom is entered in the SYMPTOM column. The PROBABLE CAUSE column lists components that can cause failure. The components are presented in the order of the probability of failure.

NOTE: Since all features are accessed by the telephone, the telephone could cause any feature to fail. Before replacing a PCB, verify proper operation of the telephone at a known good station location, or at the Port 016 test location on the KSU (Figure 9-3).

OPERATING VOLTAGE CHECK

2.04 Operating voltages can be checked using Table 9-2. This table permits KSU and station voltages to be measured. The voltages are identified, the acceptable range stated, and the test condition defined. The testpoint location for each voltage is explained.

2.05 The LEDs and testpoints for the TCX-128 are shown in Figure 9-2. The KSU power supply fuses and test jack are shown in Figure 9-3. Figure 9-4 illustrates the power supply cable pin-out.

2.06 Two types of handset microphones are used with the key telephones in the TCX-128 system. A carbon microphone is used in multibutton key telephones with speakerphone (Handsfree). The Multibutton Display Key Telephone and the Multibutton Key Telephone without speakerphone (i.e., with Monitor) use an electret microphone that provides higher quality transmission and lower power consumption. These handsets will result in poor audio quality if they are connected to the wrong phone. The type of transmitter can be identified by looking into the holes of the handset. The carbon microphone is black and the electret microphone is silver.

REPLACEABLE PARTS LIST

2.07 Table 9-3 provides a replaceable parts list. Unless otherwise indicated, the items listed are available from:

TIE/communications, Inc.

Items not available from TIE/communications can be purchased from local telephone equipment supply houses.

TOOLS AND TEST EQUIPMENT

2.08 The following tools and test equipment items are recommended:

Standard punch down tool
Digital (high impedance) voltmeter
Continuity checker
Anti-static wrist strap
Spare bridging clips
Needle nose pliers
Small diagonal pliers
Medium size Philips-head screwdriver
Butt set (for checking CO lines)
Wire cutters
Wire strippers

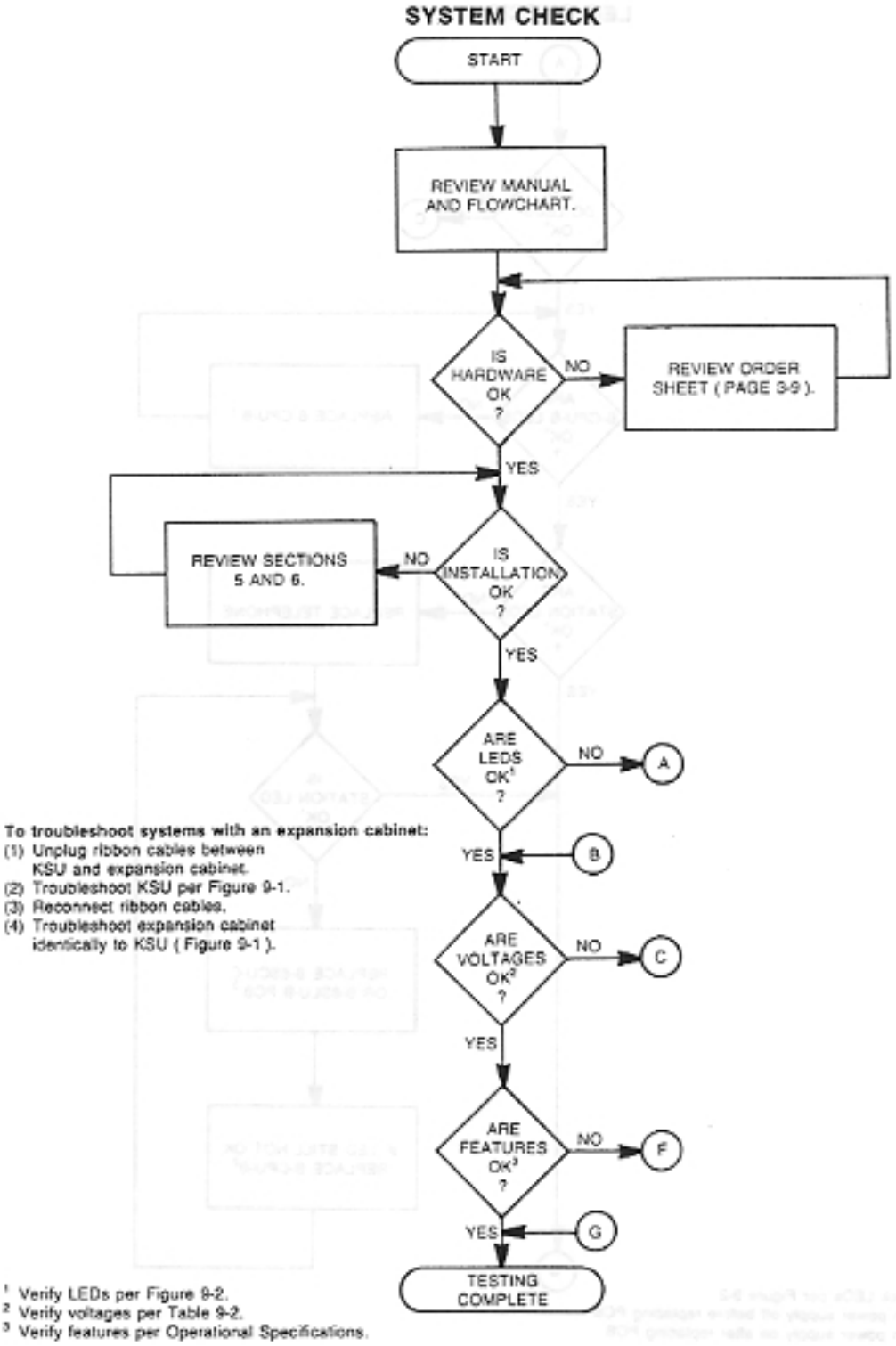
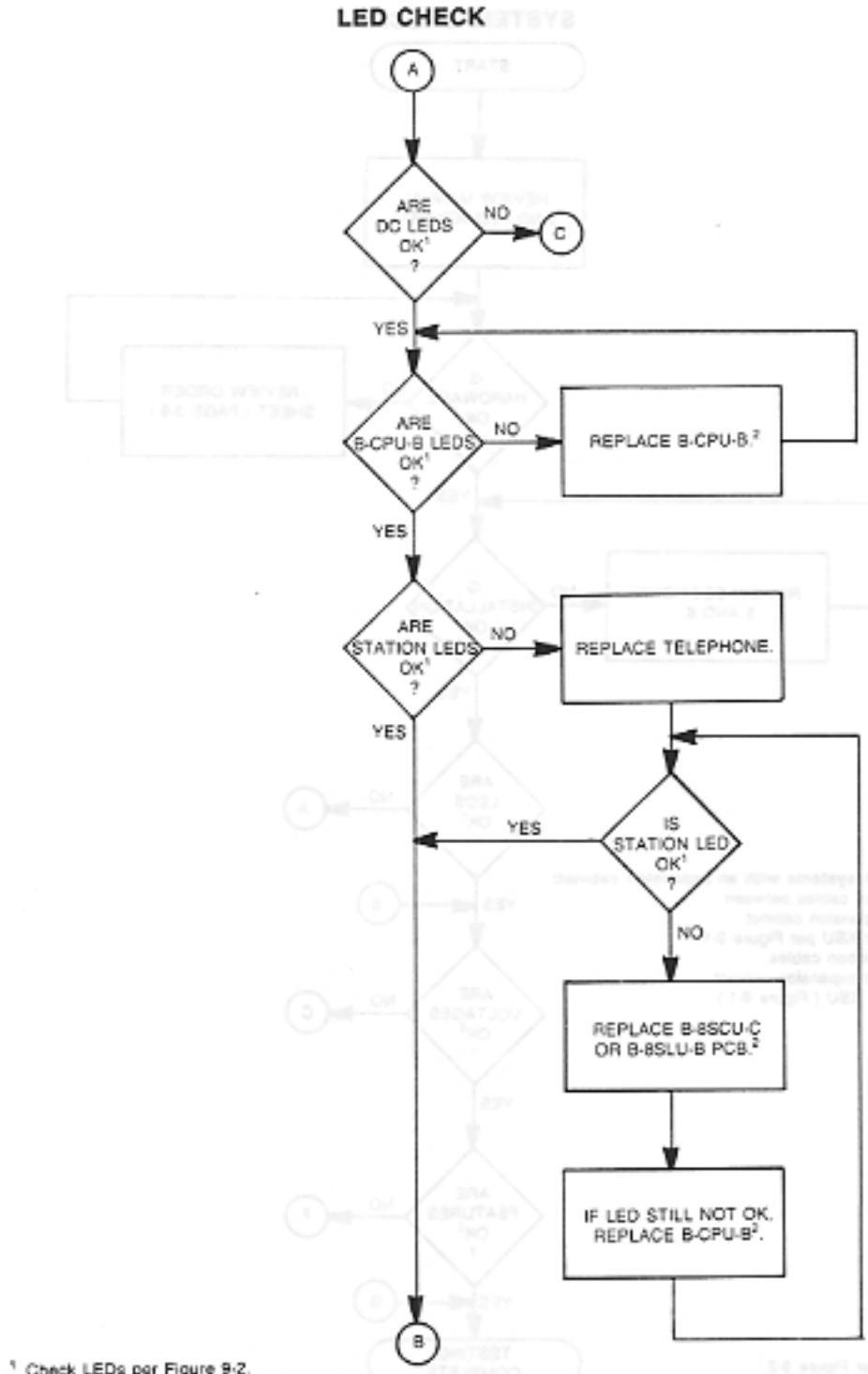


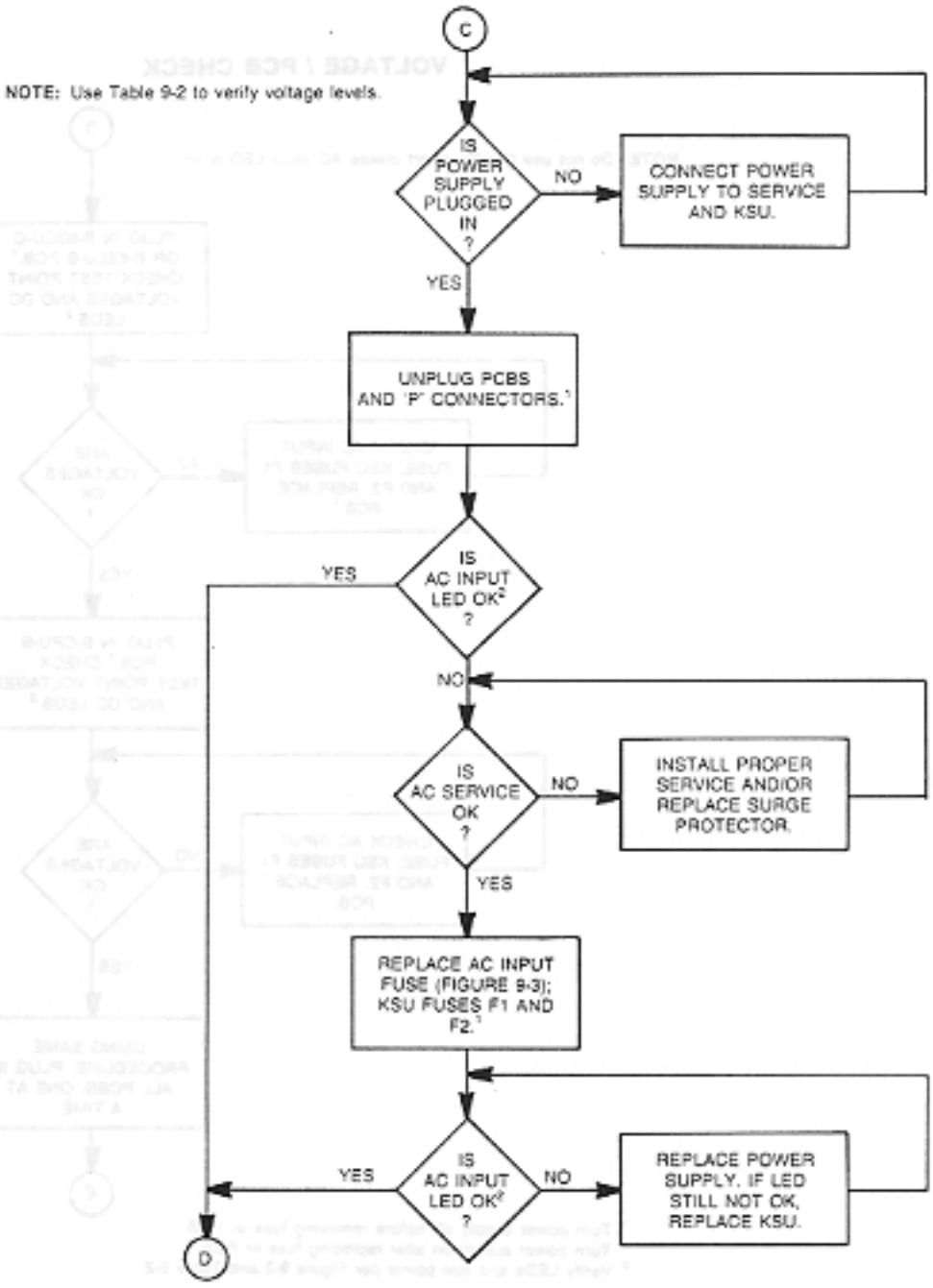
Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 1 of 6)



[1] Check LEDs per Figure 9-2.
[2] Turn power supply off before replacing PCB. Turn power supply on after replacing PCB.

Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 2 of 6)

POWER SUPPLY / SERVICE CHECK



[1] Turn power supply off before removing fuse or PCB. Turn power supply on after replacing fuse or PCB.
[2] AC input LED is inside power supply on / off switch.

Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 3 of 6)

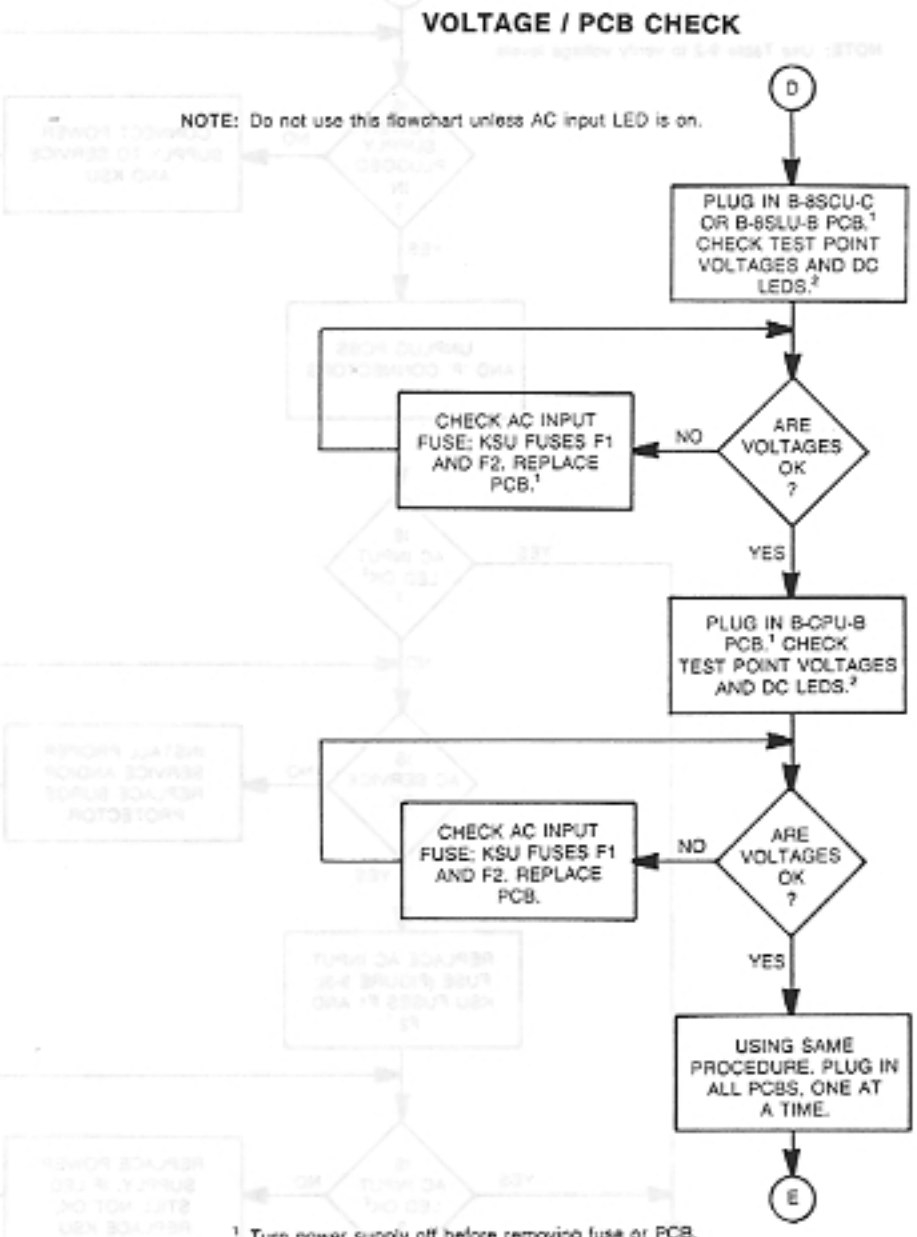
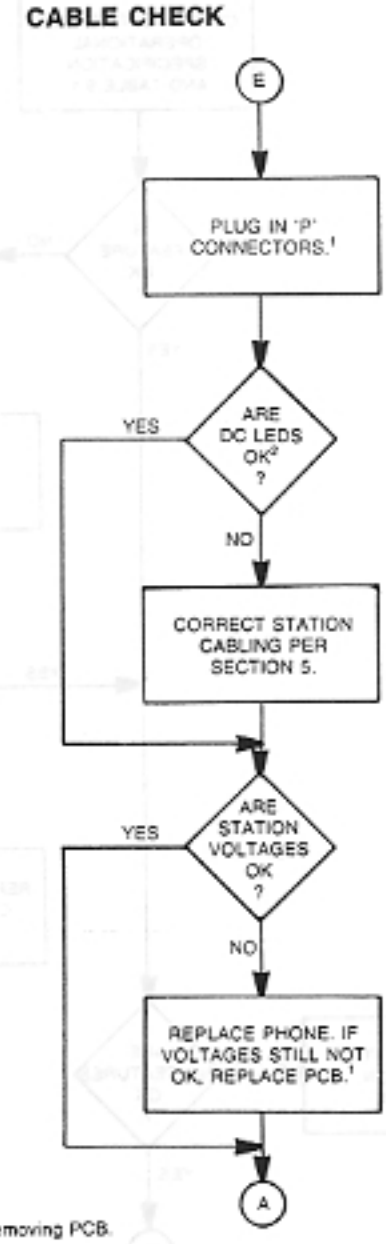


Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 4 of 6)



[1] Turn power supply off before plugging in 'P' connector or removing PCB. Turn power supply on after plugging in 'P' connector PCB.
[2] Verify LEDs and test points per Figure 9-2 and Table 9-2.

Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 5 of 6)

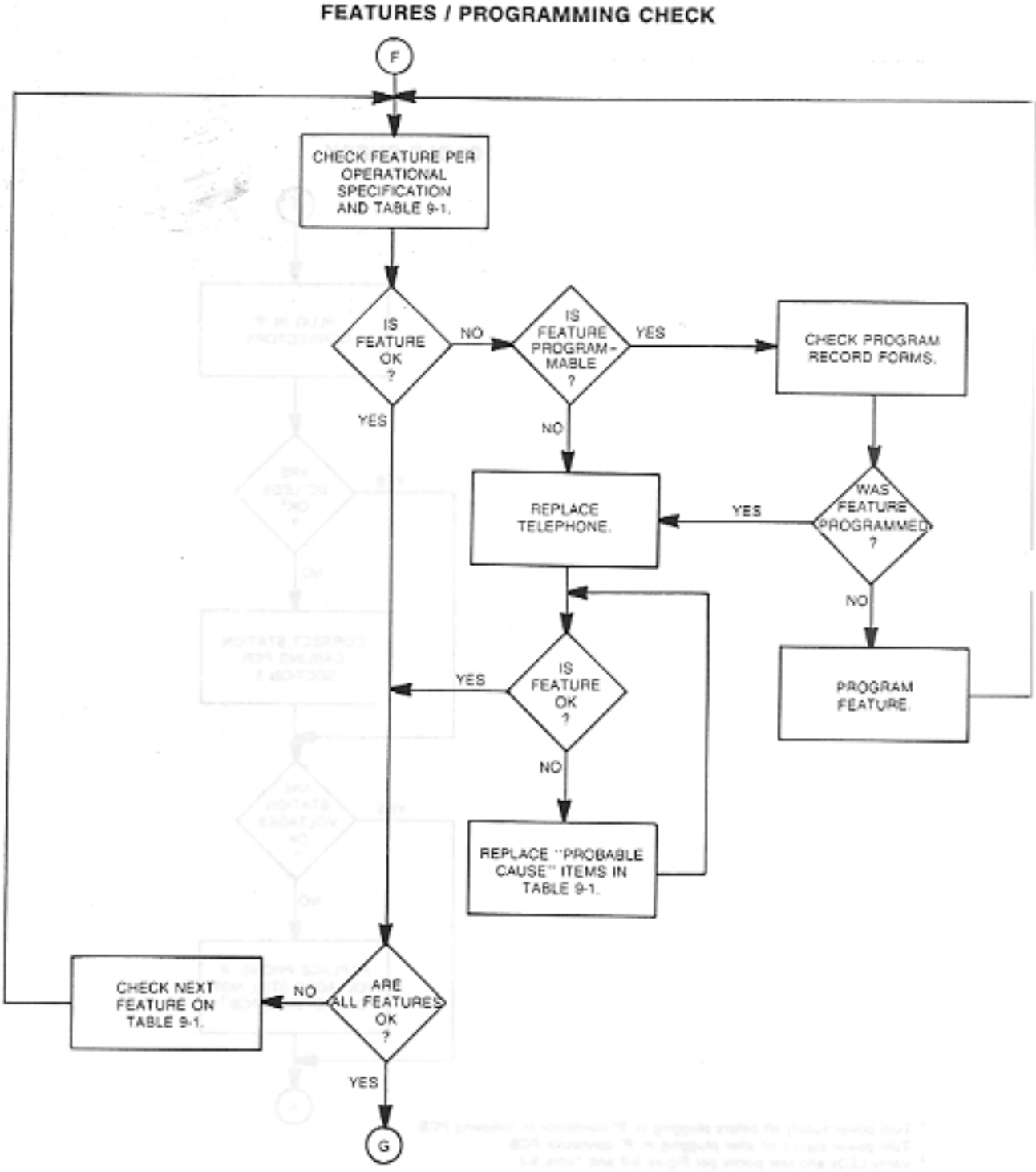
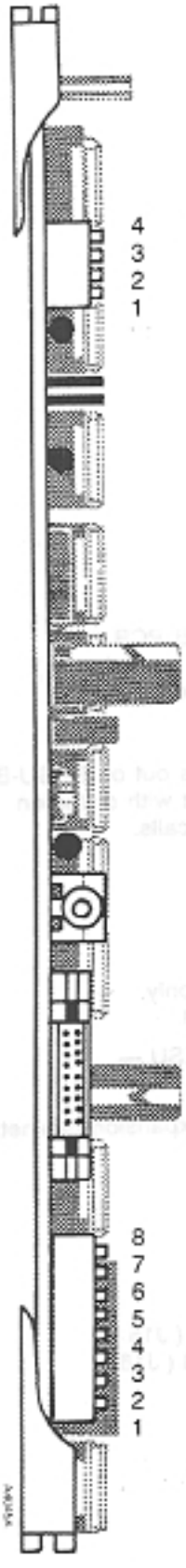


Figure 9-1 SYSTEM TROUBLESHOOTING FLOWCHART, TCX-128 (Page 6 of 6)

CENTRAL PROCESSING UNIT PCB B-CPU-B



4 3 2 1 — Switch S2 RS232C Port Baud Rate Selection

DS3 +5 V, +12 V & −12 V power. Normally on (RED).

TP2 GND
TP1 +5 V DC

DS2 6502 Processor running. Normally flashing (RED).

DS1 Clock (Z80 Processor Running). Normally Flashing (RED).

S1 Reset Switch

Connector for Ribbon Cable to B-AUX-A

8 7 6 5 4 3 2 1 — Switch S3 Output Data Format Selection

VIEW: Front edge of card

OPEN FUSE DATA*
CENTRAL PROCESSING UNIT B-CPU-B

F1 −24 V DC, 1A:

1. System Operational.
2. DS3 is out.
3. Cannot program system from CRT. Depressed CRT key causes system reset.

F2 +5 V DC, 1A:

1. System will be totally inoperative (i.e., constantly resetting).
2. BGM always ON, system noise available.
3. No LEDs lit on CPU PCB.
4. Single lines constantly ringing.

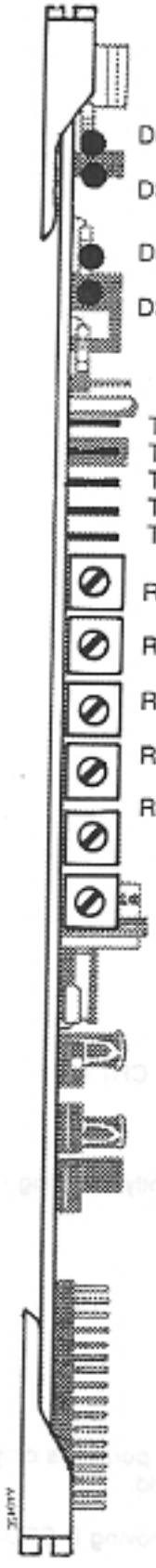
F3 +24 V DC, 1A:

1. DS1, DS3 out.
2. System must be reset.

* Open fuse data is provided for troubleshooting purposes only. Do not attempt to change PCB fuses in the field.

CAUTION: Turn off power before inserting or removing B-CPU-B PCB.

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 1 of 7)



TONE GENERATOR PCB B-TGU-B

DS4 +5 V DC power indicator
DS3 +12 V DC power indicator
DS2 +15 V DC power indicator
DS1 +5 V DC power indicator

Normally ON. (GREEN)

TP5 GND
TP4 +5 V DC
TP3 +12 V DC
TP2 +15 V DC
TP1 +5 V DC Analog

R45 Page volume-ports 49-64[2] (not used[3])
R38 Page volume-ports 33-48[2] (105-128[3])
R31 Page volume-ports 17-32[2] (81-104[3])
R24 Page volume-ports 1-16[2] (65-80[3])
R62 BGM volume
R59 MOH volume

NOTE: All voltages ±5%.

B-TGU-B

OPEN FUSE DATA[1]

F1 +5 V DC, 1.5A:
1. DS4 LED out on B-TGU-B PCB.
2. CO Lines not operable (no dial tone).
3. No dial tone for internal calls.

F2 +24 V DC, 1.5A:
1. DS1, DS2 and DS3 LEDs out on B-TGU-B PCB.
2. CO Lines operational but with distortion.
3. No dial tone for internal calls.
4. BGM volume low.

[1] Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

[2] Initialization ports (hardware Page zones) for KSU — PCB in slot J15.

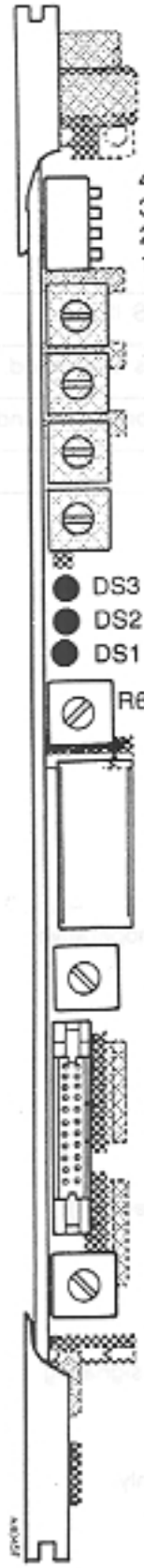
[3] Initialization ports (hardware Page zones) for expansion cabinet — PCB in slot J16.

B-TGU-B PCB STRAPPING

Tone Gen.#1 strap E1 to E2 (J15)
Tone Gen. #2 strap E1 to E3 (J16)

VIEW: Front edge of card

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 2 of 7)



B-AUX-A PCB

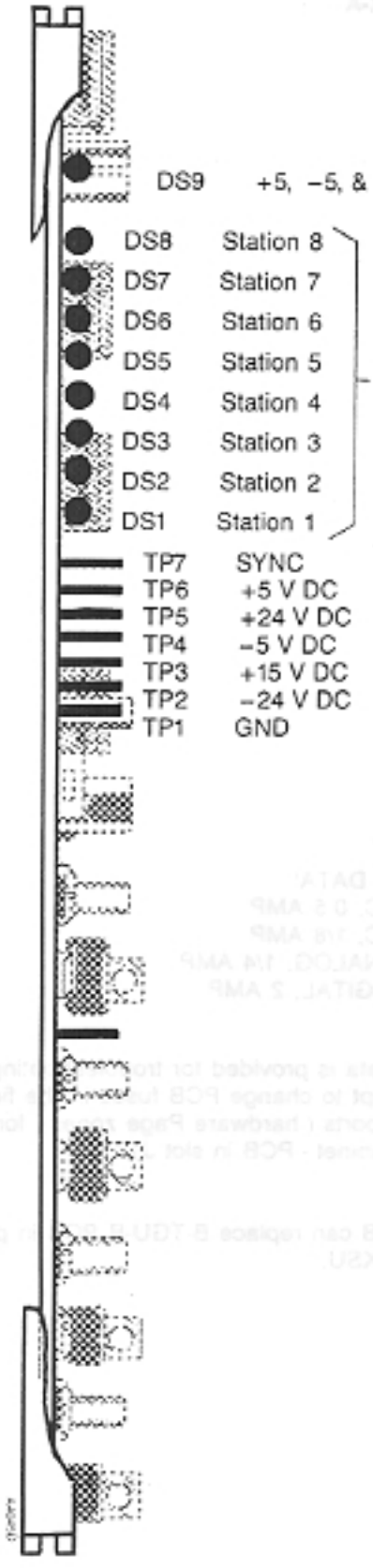
OPEN FUSE DATA¹
F1 +24 V DC, 0.5 AMP
F2 −24 V DC, 1/8 AMP
F3 + 5 V ANALOG, 1/4 AMP
F4 + 5 V DIGITAL, 2 AMP

¹ Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.
² Initialization ports (hardware Page zones) for expansion cabinet - PCB in slot J16.

(B-AUX-A PCB can replace B-TGU-B PCB in position 2 [slot J16] in KSU.)

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 3 of 7)

STATION PCB B-8SCU-C



VIEW: Front edge of card

IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected.
'ON STEADY'	- Telephone is connected and idle.
'FLASHING'	- Station is busy.

NOTE: All voltages ±5%.

B-8SCU-C PCB

OPEN FUSE DATA*

F1 +24 V DC, 3A:
1. DS9 LED out on Station PCB.
2. Telephones connected to PCB are completely inoperative.

F2 −24 V DC, 3A:
1. All LEDs lit on key telephones.
2. All phones squeal.
3. Operation station LEDs not lit.
4. DS9 LED out.
5. DS1-DS8 LEDs dim.

F3 +5 V DC, 3A (for digital circuit):
1. All LEDs lit on all key telephones (including operator).
2. All phones squeal.
3. DS9 LED dim.
4. DS1-DS8 LEDs out.

F4 +5 V DC, 3A (analog circuits):
1. Telephones connected to the PCB have normal signaling on internal but no CO dial tone.

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 4 of 7)

F

SINGLE LINE PCB B-8SLU-B

DS9 +5, −5, & +15 V DC power-indicator NORMALLY ON (GREEN)

DS8	Station 8	RED
DS7	Station 7	
DS6	Station 6	
DS5	Station 5	
DS4	Station 4	
DS3	Station 3	
DS2	Station 2	
DS1	Station 1	

TP6	+5 V DC
TP5	+24 V DC
TP4	−5 V DC
TP3	+15 V DC
TP2	−24 V DC
TP1	GND

IF LED IS:	STATION STATUS IS:
'OFF'	- No telephone is connected
'ON STEADY'	- Telephone is connected and idle
'FLASHING'	- Station is busy

NOTE: All voltages ±5%.

B-8SLU-B PCB

OPEN FUSE DATA

F1 +24 V DC, 3A:
1. DS9 LED out on SLU PCB.
2. Telephones connected to PCB are completely inoperative.

F2 −24 V DC, 3A:
1. Same as F1.

F3 +5 V DC, 3A:
1. Phones squeal when on-hook.
2. DS9 LED is out.

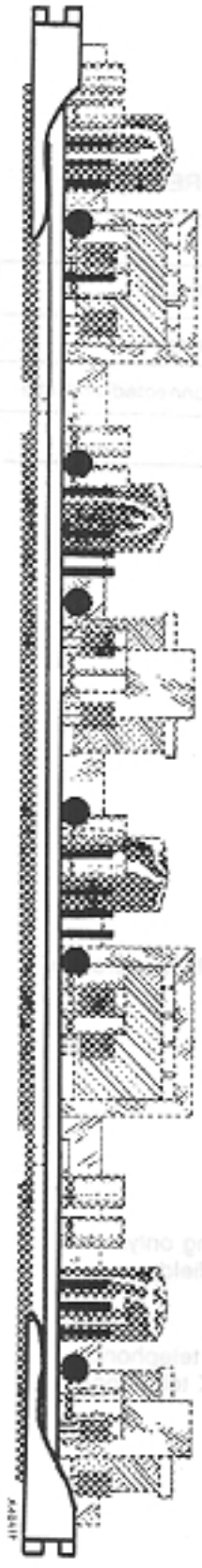
* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

Strap circuit E1 to E2 for single (2500 Type) telephone.
Strap circuit E2 to E3 for one button and OPX telephones.

VIEW: Front edge of card

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 5 of 7)

LINE PCB B-4COU-A



TP403 XPT Analog
TP402 Tip
TP401 Ring
DS401 Status (RED)

Line Ckt. #4

TP3 −12 V DC

Normal LED Status

DS1 and DS2 - ON

DS101 - 401:
OFF Line is idle
On Steady - Line is busy or busied out by program

DS1 +15 & −12 V DC (GREEN)
TP2 +15 V DC

TP303 XPT Analog
TP302 Tip
TP301 Ring
DS301 Status (RED)

Line Ckt. #3

NOTE: Lines 1-20 are Direct Access Lines.
Lines 21-32 are dial-up lines (i.e., require an Intercom link).

DS2 +5 V DC (GREEN)
TP1 GND

TP203 XPT Analog
TP202 Tip
TP201 Ring
DS201 Status (RED)

Line Ckt. #2

B-4COU-A PCB

OPEN FUSE DATA *
F1 +24 V DC, ¾A
1. DS1 dims to DS2 brightness.
2. Lines affected PCB "dead".

F2 −24 V DC, ¾A
1. DS1 dims to DS2 brightness.
2. Distorted MOH and audio on calls.

F3 +5 V DC
1. DS2 LED out.
2. Lines affected PCB "dead".

TP103 XPT Analog
TP102 Tip
TP101 Ring
DS101 Status (RED)

Line Ckt. #1

* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

VIEW: Front edge of card

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 6 of 7)

BUFFER PCB B-BUF-A

DS1 power-indicator NORMALLY ON

OPEN FUSE DATA
F1 +5 V DC, ¾ AMP

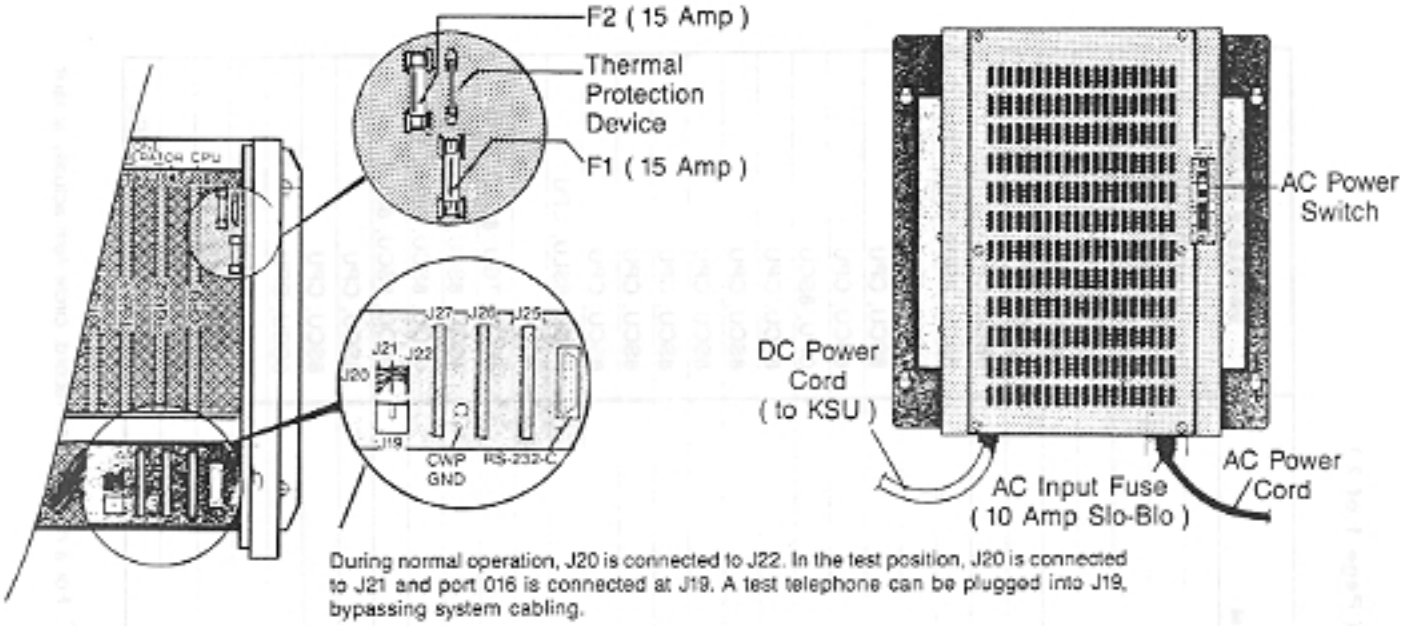
* Open fuse data is provided for troubleshooting only. Do not attempt to change PCB fuses in the field.

NOTE: The B-BUF-A PCB is only used if an expansion cabinet is installed.

VIEW: Front edge of card

Figure 9-2 LEDs AND TESTPOINTS, TCX-128 (Page 7 of 7)

FOR YOUR NOTES



During normal operation, J20 is connected to J22. In the test position, J20 is connected to J21 and port 016 is connected at J19. A test telephone can be plugged into J19, bypassing system cabling.

Figure 9-3 FUSE AND TEST CONNECTOR LOCATIONS, TCX-128


```
PIN  1 =    -24VDC
PIN  2 =    -24VDC
PIN  3 =    Remote Shutdown Control
PIN  4 =    +5VDC
PIN  5 =    +5VDC
PIN  6 =    +5VDC
PIN  7 =    Chassis Ground
PIN  8 =    +24VDC
PIN  9 =    +24VDC
PIN 10 =    + 5V RET
PIN 11 =    + 5V RET
PIN 12 =    +/-24VDC RET
```

NOTE: The P-PSU-B power supply uses remote sensing. The power supply voltages cannot be checked unless the power supply is plugged into the KSU and at least one B-8SCU-C PCB is installed.

Figure 9-4 POWER SUPPLY PIN-OUT DIAGRAM, TCX-128

Table 9-1 OPERATIONAL TEST PROCEDURE, TCX-128 (Page 1 of 2)

FEATURE	AVAILABLE[1]	VERIFIED[2] YES	VERIFIED[2] NO	PROGRAM-MABLE	SYMPTOM	PROBABLE CAUSE[3]
INTERNAL						
INTERCOM	ALL			N		8SCU, 8SLU, CPU
DATE AND TIME	AT,MB			Y		CPU
DIRECT STATION SELECTION	AT,MB			Y		8SCU, CPU
HOTLINE	MB			Y		8SCU, CPU
MICROPHONE CUTOFF/MUTE	MB			N		8SCU, CPU
HANDSFREE ANSWERBACK	AT,MB,FB			Y		8SCU, CPU
PAGING	ALL			Y		8SCU, 8SLU, TGU, CPU
CALL WAITING	ALL			Y		8SCU, 8SLU, CPU
CALLBACK	AT,MB			N		8SCU, CPU
CALL FORWARDING	AT,MB			N		8SCU, CPU
CALL FORWARDING CANCEL	AT			N		CPU, 8SCU
MESSAGE WAITING	AT,MB,FB			N		8SCU, CPU
DO NOT DISTURB	MB			N		8SCU, CPU
DO NOT DISTURB OVERRIDE	AT,MB			N		8SCU, CPU
BARGE IN	AT,MB			Y		8SCU, CPU
DATE AND TIME	AT,MB			Y		8SCU, CPU
ALT. ATTENDANT STATION	AT			Y		8SCU, CPU
VOLUME CONTROLS	AT,MB,FB,OB			N		8SCU, 8SLU, CPU
EXTERNAL						
DIRECT LINE ACCESS	AT			N		4COU, TGU, 8SCU, CPU
ANSWERING A CALL	ALL			Y		4COU, 8SCU, 8SLU, TGU
PLACING A CALL	ALL			Y		4COU, 8SCU, 8SLU, TGU
HOLD	ALL			Y		4COU, 8SCU, 8SLU
HANDSFREE	AT,MB			Y		8SCU, CPU
MONITOR	AT,MB,FB			Y		8SCU, CPU
FLASH	AT,MB			Y		8SCU, CPU
TRANSFER	ALL			N		8SCU, 8SLU, CPU
LAST NUMBER REDIAL	ALL			N		8SCU, 8SLU, CPU
SAVE	AT,MB			N		8SCU, 8SLU, CPU
DIRECT INWARD LINES	ALL			Y		4COU, 8SCU, 8SLU, CPU

[1] AT = Attendant Multibutton
MB = Multibutton
FB = Four Button
OB = One Button
SL = Single Line

[2] Verify according to Operational Specification.

[3] For a maintenance record, circle item actually at fault.

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January 1985

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Table 9-1 OPERATIONAL TEST PROCEDURE, TCX-128 (Page 2 of 2)

FEATURE	AVAILABLE[1]	VERIFIED[2] YES	VERIFIED[2] NO	PROGRAM-MABLE	SYMPTOM	PROBABLE CAUSE[3]
EXTERNAL (cont'd)						
SPLIT	ALL			N		4COU, 8SCU, 8SLU
CONFERENCE	AT,MB,FB			N		4COU, 8SCU, CPU
LINE QUEUING	AT,MB,FB			N		8SCU, 4COU
SPEED DIAL	ALL			Y		8SCU, 8SLU, 4COU
SPLIT RINGING	ALL			Y		8SCU, 8SLU, 4COU
NIGHT SERVICE (UNA & ANA)	ALL			Y		8SCU, 8SLU, CPU, 4COU
RELEASE	AT			N		8SCU, 8SLU, 4COU
BUSY OUT LINES	AT			N		8SCU, 8SLU, 4COU
CALL PICKUP, DIRECTED	ALL			N		8SCU, CPU, COU
CALL PICKUP, GROUP	ALL			Y		8SCU, CPU, COU
PARK	ALL			N		8SCU, CPU, COU
PRIVATE LINE	AT,MB			Y		4COU, 8SCU, TGU, CPU
TOLL RESTRICTION	ALL			Y		CPU
OPTIONAL						
MUSIC ON HOLD	ALL			Y		TGU, 8SLU, 8SCU, 4COU
BACKGROUND MUSIC	AT,MB,FB			Y		TGU, 8SLU, 8SCU
SMDR	ALL/PRINTER			Y		CPU
ACCOUNT CODE	ALL/PRINTER			Y		CPU

AT = Attendant Multibutton
MB = Multibutton
FB = Four Button
OB = One Button
SL = Single Line

[2] Verify according to Operational Specification.

[3] For a maintenance record, circle item actually at fault.

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Table 9-2 SYSTEM VOLTAGES, TCX-128

DANGER: DIRECT CONTACT WITH POWER SUPPLY INPUT AND OUTPUT VOLTAGES MAY BE HARMFUL OR LETHAL. ONLY QUALIFIED PERSONNEL SHOULD ATTEMPT TO TAKE THE VOLTAGE READINGS OUTLINED IN THE CHART BELOW.

DESCRIPTION	READING[1]	TEST CONDITION	TEST POINT LOCATION
AC Input	95 to 130 VAC	No load (i.e., no PCBs installed) and full load (i.e., all PCBs installed).	Measure service outlet or use power line monitor.
Power Supply			
+24 V DC	+24.0 V DC to +25.0	No load.	Measure between F2 (+) and GND (–) lug.
– 24 V DC	– 24.0 V DC to – 25.0 V DC	No load.	Measure between F1 (+) and GND (–) lug.
PCB Voltages			
+5V DC	+4.75 V DC to +5.25 V DC	Full load.	Measure between TP6 (+) and TP1 (–) on left most SLU/SCU PCB.
+5 V DC	+4.75 V DC to +5.25 V DC	Full load.	Measure between TP6 (+) and TP1 (–) on any right most SLU/SCU PCB.
– 5 V DC	– 4.75 V DC to – 5.25 V DC	Full load.	Measure between TP4 (+) and TP1 (–) on any SLU/SCU PCB.
+ 15 V DC	+ 14.25 V DC to + 15.75 V DC	Full load.	Measure between TP3 (+) and TP1 (–) on any SLU/SCU PCB.
+ 24 V DC	+ 22.8 V DC to + 25.2 V DC	Full load.	Measure between TP5 (+) and TP1 (–) on any SLU/SCU PCB.
– 24 V DC	– 22.8 V DC to – 25.2 V DC	Full load.	Measure between TP2 (+) and TP1 (–) on any SLU/SCU PCB.
Sta. Voltages			
Multibutton, Four Button Data Power	+ 38 V DC to + 48 V DC	Telephone installed.	Open cover on 625 jack. Measure between RED (+) and GRN (–) lugs.
Single Line, One Button			
+ 24 V DC	+ 22.8 V DC to + 25.2 V DC	Telephone installed.	Open cover on 625 jack. Measure between GRN (+) and BLK (–) lugs, and YEL (+) and BLK (–) lugs.
– 24 V DC	– 22.8 V DC to – 25.2 V DC	Telephone installed. (on hook)	Open cover on 625 jack. Measure between RED (+) and BLK (–) lugs.

Readings should be made with a digital voltmeter with a known accuracy of ± 1% or better.

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Table 9-3 REPLACEABLE PARTS, TCX-128

ITEM	PART NUMBER	DESCRIPTION	WHERE USED
KSU	86003[1]	Key Service Unit	KSU/EXP
B-EXP-A	86016[1]	Expansion Cabinet	EXP
B-PSU-B	86007[1]	Power Supply	KSU/EXP
B-CPU-B	86037[1]	Central Processing Unit PCB	KSU
B-8SCU-C	86023[1]	Station Card Unit PCB	KSU/EXP
B-8SLU-B	86027/A[1]	Single Line Instrument Unit PCB	KSU/EXP
B-4COU-A	86010[1]	CO Line Unit PCB	KSU/EXP
B-TGU-B	86033[1]	Tone Generator Unit PCB	KSU
B-AUX-A	86047	Auxiliary PCB (with rate chips)	KSU
B-AUX-A	86048	Auxiliary PCB (without rate chips)	KSU
B-BUF-A	86017[1]	Buffer PCB	EXP
—	86015[1]	DTMF Receiver Daughter Board	TGU
—	86185[1]	Special Loud Ringing Tone Board	S/L TEL.
—	86187[1]	TIE Electronic Ringer	S/L TEL.
B-OPX-A	86043[1]	OPX Adaptor PCB	OPX
—	86073[1]	MERITOR/DELPHI Display Multibutton Key Tel.	Station
—	86070[1]	MERITOR/DELPHI Multibutton Key Tel. (Handsfree)	Station
—	86072[1]	MERITOR/DELPHI Multibutton Key Tel. (Monitor)	Station
—	86071[1]	MERITOR/DELPHI Four Button Key Tel.	Station
—	86075[1]	MERITOR/DELPHI DSS Console	Attendant
—	86057[1]	MERITOR/DELPHI One Button Tel.	Station
—	86076[1]	MERITOR/DELPHI Multibutton Wall Mounting Kit	Station
—	86077[1]	MERITOR/DELPHI Four Button/One Button Wall Mounting Kit	Station
—	86063[1]	ULTRACOM Display Multibutton Key Tel.	Station
—	86080[1]	ULTRACOM Multibutton Key Tel. (Handsfree)	Station
—	86082[1]	ULTRACOM Multibutton Key Tel. (Monitor)	Station
—	86061[1]	ULTRACOM Four Button Key Tel.	Station
—	86064[1]	ULTRACOM DSS Console	Attendant
—	86067[1]	ULTRACOM One Button Tel.	Station
—	86066[1]	ULTRACOM Multibutton Wall Mounting Kit	Station
—	86062[1]	ULTRACOM Four Button/One Button Wall Mounting Kit	Station
F1,F2	—[2]	KSU Fuse, 15 Amp (312/AGC)	KSU/EXP
—	—[2]	AC Input Fuse, 10 Amp (313/MDL)	Power Supply
—	TBD	ULTRACOM Handset (Carbon)	Station
—	TBD	ULTRACOM Handset (Electret)	Station
—	TBD	MERITOR/DELPHI Handset (Carbon)	Station
—	TBD	MERITOR/DELPHI Handset (Electret)	Station
—	TBD	ULTRACOM Handset Coil Cord	Station
—	TBD	ULTRACOM Line Cord	Station
—	TBD	MERITOR/DELPHI Handset Coil Cord	Station
—	TBD	MERITOR/DELPHI Line Cord	Station
—	—[2]	Station Cable	Station
—	—[2]	66M1-50 Connection Blocks (w/clips)	KSU/EXP
—	—[2]	625A4 Modular Station Jack	Station
—	—[2]	625F4 Modular Station Jack	Station
—	—[2]	Plug-In Power Line Surge Protector	Power Supply
—	—[2]	Anti-Static Wrist Ground Strap	KSU/EXP
—	TBD[1]	Key Cap Kit	Station
—	01300 IMG[1]	TCX-128 Installation & Maintenance Manual	—
—	01300 AC[1]	TCX-128 Attendant User Guide	—
—	01300 MB[1]	TCX-128 Multibutton User Guide	—
—	01300 FB[1]	TCX-128 Four Button User Guide	—
—	01300 OB[1]	TCX-128 One Button User Guide	—
—	01300 SL[1]	TCX-128 Single Line User Guide	—

[1] Parts available from TIE/communications, Inc., unless otherwise indicated.
[2] Parts available from Telephone equipment supply houses.

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April 1985

Printed in U.S.A.

Table 9-4 COMMON SYSTEM FAULTS, TCX-128

	FAULT	SOLUTION
(1)	Cannot program system.	Check B-CPU-B PCB LEDs and fuses. Check B-CPU-B PCB switches S2 and S3 for correct settings. Troubleshoot system per Figure 9-1.
(2)	Constant ringing on all telephones.	Check B-CPU-B PCB LEDs and fuses. Troubleshoot system per Figure 9-1.
(3)	No audible tones.	Check B-TGU-B PCB LEDs and fuses, replace PCB. Troubleshoot system per Figure 9-1.
(4)	Excessive crosstalk on outside calls, Intercom calls and Page.	Systems with an expansion cabinet must use a B-TGU-B or B-AUX-A PCB in TONE GEN slot 2. Replace B-TGU-B PCB. Troubleshoot system per Figure 9-1.
(5)	Switch S1 on B-CPU-B PCB does not reset system.	If B-CPU-B PCB LEDs are OK, replace PCB. If an individual B-8SCU-C or B-8SLU-B PCB cannot be reset, check LEDs, then replace PCB. Troubleshoot system per Figure 9-1.
(6)	SMDR prints alpha characters instead of numbers.	Replace B-CPU-B PCB.
(7)	Low Page volume.	Adjust potentiometers (per Figure 9-2) on B-TGU-B and / or B-AUX-A PCB. If Alternate Audio Ports are not used, verify that 'E'-> EXTERNAL OUTPUTS programming has been left at the default value (20).
(8)	Various LEDs on key telephones flash and stations do not work. All stations may be ringing constantly.	Check B-8SCU-C PCB LEDs and fuses, replace PCB.
(9)	Telephone dead.	Check B-8SCU-C / B-8SLU-B LEDs and fuses, replace PCB. Troubleshoot system per Figure 9-1.
(10)	Intermittent or delayed dial tone.	All DTMF receivers and / or links busy due to heavy traffic. Add additional DTMF receivers, if possible.
(11)	Constant ringing on all single line telephones.	Check B-8SLU-B LEDs and fuses, replace PCB.
(12)	Cannot program Station Speed Dial numbers.	Stations 51-128 do not have memory programming. Replace B-CPU-B PCB, then B-TGU-B PCB.
(13)	Fluctuating display telephone brightness.	Wrong handset installed. Display telephone and multibutton telephone (without speakerphone) handset transmitters are "silver metalic" (electret). All other transmitters are black (carbon).
(14)	Outside line cannot be used (i.e., no dial tone or audio).	Check programming. Check B-4COU-A PCB LEDs and fuses, replace PCB.
(15)	From attendant's station, cannot seize line using Direct Line Access.	Check B-4COU-A PCB LEDs and fuses, replace PCB.
(16)	Expansion cabinet cannot be used.	Check B-BUF-A PCB. Check ribbon cable connections.

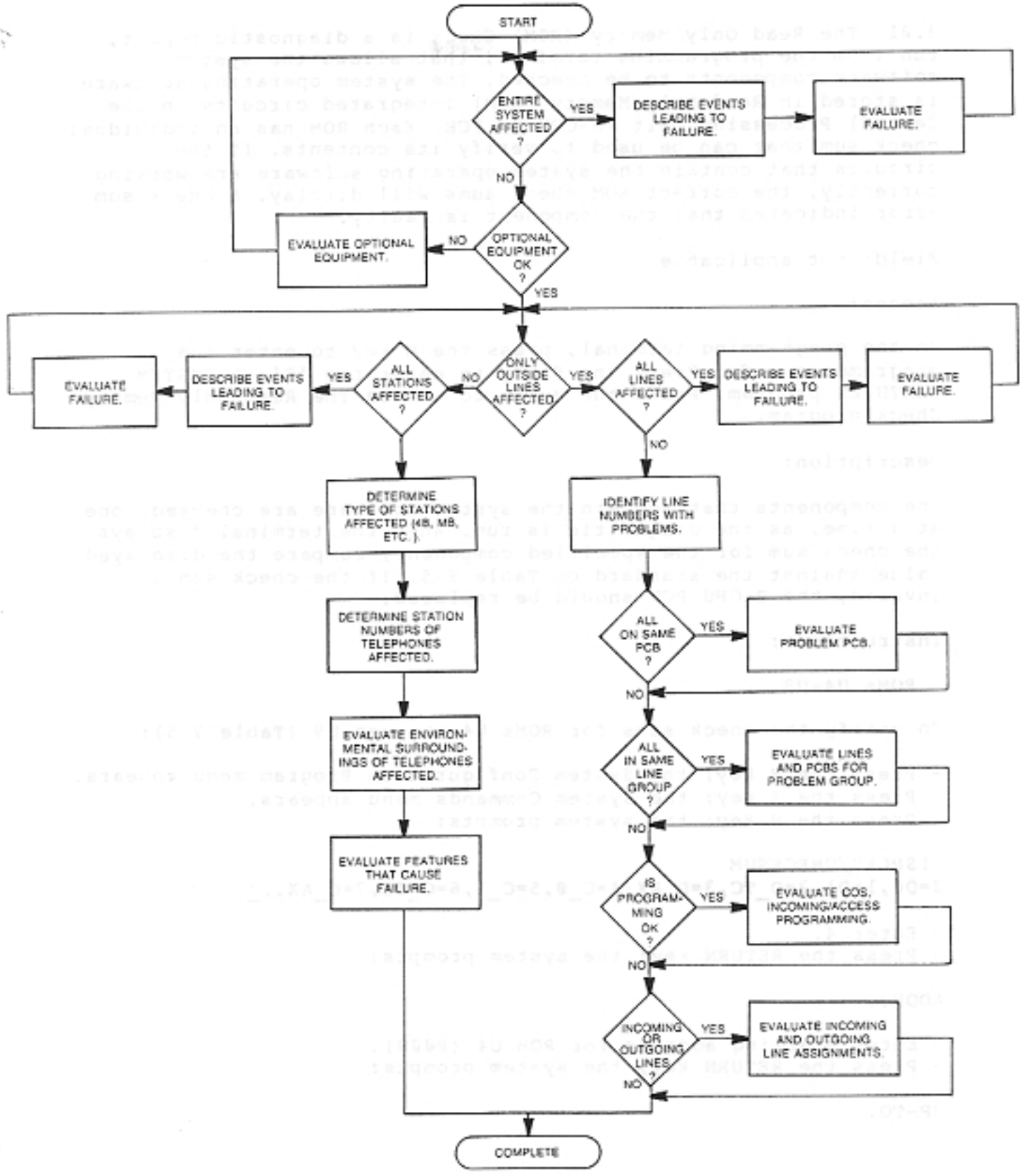

Figure 9-5 HOW TO EVALUATE A SYSTEM PROBLEM, TCX-128

3. READ ONLY MEMORY CHECK

3.01 The Read Only Memory (ROM) Check is a diagnostic report, run from the programming terminal, that allows the system software components to be checked. The system operating software is stored in Read Only Memory (ROM) integrated circuits on the Central Processing Unit (B-CPU-B) PCB. Each ROM has an individual check sum that can be used to verify its contents. If the circuits that contain the system operating software are working correctly, the correct ROM check sums will display. A check sum error indicates that the component is faulty.

Field: not applicable

Access:

On the programming terminal, press the M key to enter the programming mode. Press the S key to enter the 'S'--> SYSTEM FEATURES program. Press the H key to access The Read Only Memory Check program.

Description:

The components that contain the system software are checked, one at a time, as the diagnostic is run. When the terminal displays the check sum for the specified component, compare the displayed value against the standard on Table 9-5. If the check sum is invalid, the B-CPU PCB should be replaced.

Instructions:

ROMs U4-U9

To verify the check sums for ROMs U4 through U9 (Table 9-5):

- Press the M key; the System Configuration Program menu appears.
- Press the S key; the System Commands menu appears.
- Press the H key; the system prompts:

```
DISPLAY/CHECKSUM
0=D0,1=D1,2=D_TC,3=D_AX,4=C_0,5=C_1,6=C_TC,7=C_AX.._
```

- Enter 4.
- Press the RETURN key; the system prompts:

```
ADDR..
```

- Enter starting address for ROM U4 (0000).
- Press the RETURN key; the system prompts:

```
UP-TO.
```

- Enter ending address for ROM U4 (1FFF).
- Press the RETURN key. The check sum for the ROM prints in approximately one minute.
- Press the Y key and the RETURN key to display each subsequent check sum for ROMs U5 through U9.

ROMs U10-U11

To verify the check sums for ROMS U10 through U11:

- Press the Q key to exit ROM check U4 through U9.
- Press the H key; the system prompts:

```
0=D0,1=D1,2=D_TC,3=D_AX,4=C_0,5=C_1,6=C_TC,7=C_AX..
```

- Enter 5.
- Press the RETURN key; the system prompts:

```
ADDR..
```

- Enter beginning address for ROM U10 (2000).
- Press the RETURN key; the system prompts:

```
UP-TO.
```

- Enter ending address for ROM U10 (3FFF).
- Press the RETURN key; the check sum for ROM U10 prints in approximately one minute.
- Press the Y key and the RETURN key. The check sum for ROM U11 will display in approximately one minute.

Table 9-5 ROM CHECK SUMS (BT-15 X10), TCX-128

ROM	PROM	CHECK SUM	BEGINNING ADDRESS	ENDING ADDRESS
U4	#1	4736	0000	1FFF
U5	#2	85F9	2000	3FFF
U6	#3	49A4	4000	5FFF
U7	#4	504D	6000	7FFF
U8	#5	B038	8000	9FFF
U9	#6	E034	4000	BFFF
U10	#7	C9D5	2000	3FFF
U11	#8	A194	4000	5FFF
U23	#9	73B9	C000	CFFF

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ROM U23

To verify the check sum for ROMs U23:

- Press the Q key to exit ROM check U10 and U11.
- Press the H key; the system promts:

```
0=D0,1=D1,2=D_TC,3=D_AX,4=C_0,5=C_1,6=C_TC,7=C_AX.._
```

- Enter 4.
- Press the RETURN key; the system prompts:

```
ADDR..
```

- Enter beginning address for ROM U23 (C000).
- Press the RETURN key; the system prompts:

```
UP-TO.
```

- Enter ending address for ROM U23 (CFFF).
- Press the RETURN key. The check sum for ROM U23 prints in approximately one minute.

Example: not applicable

Default Value: not applicable

Conditions:

Table 9-5 shows the check sums for software version BT15X10 only. These values do not apply to other revisions.

This report is run from the programming terminal.

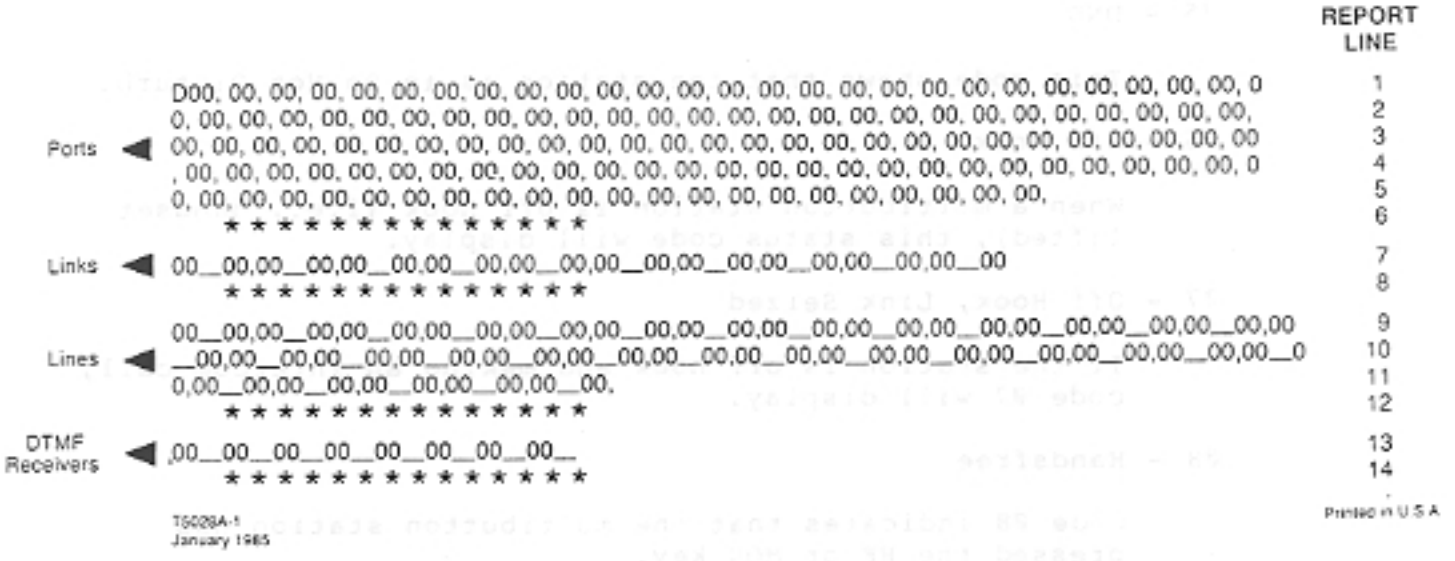
Related Programming: not applicable

Feature Reference: not applicable

4. DISPLAY SYSTEM STATUS DIAGNOSTIC

4.Ø1 The 'D' --> DISPLAY SYSTEM STATUS report is a diagnostic program that displays the status of all station ports, links, CO lines and DTMF receivers in the system. The diagnostic is run from the programming terminal, and shows the system status at the moment the report is run.

4.Ø2 The report (shown below) is formatted into 14 lines. Lines 1 through 5 display station port status. Line 7 is for link status; lines 9 through 11 are for line status. The state of the system DTMF receivers is shown in Line 13.



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STATION PORT STATUS

4.Ø3 The first five lines of the report show the status of each station in the system, referenced to the port assignment. There are 128 2-bit fields; one field for each port. The first field is for port Ø1; the last for port 128. When the report is run, the system checks the status of each station port and assigns a status code to each of the 128 station port fields.

4.Ø4 The Station Port Status Codes are defined as follows:

ØØ - Not Installed

If a port does not have a station installed, or the installed station is not functioning, status code ØØ will be displayed.

Ø1 - Idle

If a port has a station installed that is functioning, but not in use, the status code Ø1 will be displayed.

02 - Not Used

03 - Page Receive

Code 03 indicates that a station is receiving a Zone or All Call Page.

04 - Incoming CO Audible

If a station is programmed to receive CO Audible for a line (in E --> STATIONS FEATURES, CO AUDIBLE [NN..NN] IS..), this code will display as the call is ringing in.

05 - DND

This code shows that the station is in Do Not Disturb.

06 - Off Hook

When a multibutton station is off nook (i.e., handset lifted), this status code will display.

07 - Off Hook, Link Seized

If the station is off hook and making an Intercom call, code 07 will display.

08 - Handsfree

Code 08 indicates that the multibutton station has pressed the HF or MON key.

09 - Handsfree, Link Seized

If a station uses the Handsfree or Monitor mode to place an Intercom call, status code 09 will display.

0A - Handsfree Answerback

Multibutton and four button telephones can use Handsfree Answerback to answer Intercom calls without touching the handset. If the report is run while a station is in the Handsfree Answerback mode, code 0A will display.

0B - Handsfree, Off Hook

Status code 0B indicates that a multibutton station is off hook and the HF (or MON) key has been pressed. This condition would occur if the station user switches from the handset mode to the Handsfree mode, before placing a call, and does not hang up the handset.

0C - Handsfree, Off Hook, and Link Seized

If a multibutton station has the handset off hook, and the HF (or MON) and INT keys pressed, status code 0C will display. This code will also display if a four button station is off hook and the MON key has been pressed. This condition would occur if the station user places an Intercom call using the handset and switches to the Handsfree (or Monitor) mode without hanging up the handset.

0D - Off Hook, Line Seized

Status code 0D indicates that the station is busy on an outside call.

0E - Handsfree, Line Seized

If a key station is busy on a Handsfree or Monitored outside call, status code 0E will display.

0F - Handsfree, Off Hook, and Line Seized

If a key station has the handset off hook, the HF (or MON) key pressed and a line seized, status code 0F will display. A line can be seized only if it is allowed by 'E' --> STATIONS FEATURES, CO ACCESS (NN..NN) IS.. programming. Status code 0F would display if the handset was used to place an outside call, and the station user switched to the Handsfree or Monitor mode without hanging up the handset.

10 - Speed Dial Being Programmed

Status code 10 indicates that a multibutton station is entering Speed Dial numbers.

4.05 For example, the sample report below indicates that:

- Port 001 is making a Handsfree CO call.
- Ports 002, 003, 004, 006, 007 and 009 are installed but idle.
- Ports 008, 010, and 12 through 128 are not installed.
- The station installed at port 005 is in Do Not Disturb.
- Port 011 has a multibutton station installed that is entering Speed Dial numbers.

Port 001 Port 005 Port 011

0E,01,01,01,05,01,01,00,01,00,10,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,0
0,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00
00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,0
0,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,

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LINK STATUS

4.06 The seventh line of the 'D' --> DISPLAY SYSTEM STATUS report indicates the status of the 10 system links. This section of the report uses 10 4-bit fields to show link status (bits 1 and 2), and the station port which is using the link (bits 3 and 4). The port is represented by its hexadecimal equivalent, offset by one (Table 9-6). Bits 2 and 3 of each field are separated by an underscore. Each field is separated from the next by a comma. The first field in the Link Status line is for link 1; the last field is for link 10.

Table 9-6 PORT NUMBER TO HEXADECIMAL CONVERSION, TCX-128

PORT	HEX	PORT	HEX	PORT	HEX	PORT	HEX
001	00	033	20	065	40	097	60
002	01	034	21	066	41	098	61
003	02	035	22	067	42	099	62
004	03	036	23	068	43	100	63
005	04	037	24	069	44	101	64
006	05	038	25	070	45	102	65
007	06	039	26	071	46	103	66
008	07	040	27	072	47	104	67
009	08	041	28	073	48	105	68
010	09	042	29	074	49	106	69
011	0A	043	2A	075	4A	107	6A
012	0B	044	2B	076	4B	108	6B
013	0C	045	2C	077	4C	109	6C
014	0D	046	2D	078	4D	110	6D
015	0E	047	2E	079	4E	111	6E
016	0F	048	2F	080	4F	112	6F
017	10	049	30	081	50	113	70
018	11	050	31	082	51	114	71
019	12	051	32	083	52	115	72
020	13	052	33	084	53	116	73
021	14	053	34	085	54	117	74
022	15	054	35	086	55	118	75
023	16	055	36	087	56	119	76
024	17	056	37	088	57	120	77
025	18	057	38	089	58	121	78
026	19	058	39	090	59	122	79
027	1A	059	3A	091	5A	123	7A
028	1B	060	3B	092	5B	124	7B
029	1C	061	3C	093	5C	125	7C
030	1D	062	3D	094	5D	126	7D
031	1E	063	3E	095	5E	127	7E
032	1F	064	3F	096	5F	128	7F

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4.07 The Link Status bits (bits 1 and 2) are defined as follows:

ØØ - Link Idle

Any link that is not being used when the report is run will be given status ØØ. If a link is idle, any random port assignment that may appear in bits 3 and 4 is not meaningful.

Ø1 - Link Initialized

Information to be provided.

Ø2 - Link, Dial Tone

If a link has been seized by a station, and dial tone has been switched onto that link, code Ø2 displays. This code is valid only while dial tone is present (i.e., before timeout occurs).

Ø3 - Link Ringing

CO Audible from incoming calls is derived from tones on the B-TGU-B PCB. These tones are connected to the ringing stations through a link. When a link is switched for ringing, it is assigned status code Ø3. The port number designation (bits 3 and 4) is not meaningful for this code.

Ø4 - Link, Talk

Status code Ø4 indicates that the station has seized an Intercom link and established a talk path with another station.

Ø5 - Destination Busy

When a station seizes a link and places an Intercom call to a busy extension, status code Ø5 is displayed. The Display System Status report must be run while the calling station is receiving a busy tone.

Ø6 - Reorder Tone

Reorder tone is sent to a station when a link is seized and an invalid dial command is attempted or link timeout occurs. If a link is receiving a reorder tone, the status code Ø6 will be displayed.

07-0C - Splash Tones

When placing an Intercom call, splash tones are sent to a key telephone before a Handsfree Answerback talkpath is established. If the diagnostic is run as the splash tones are being sent to the receiving station (before the talkpath is established), status codes 07, 08, 09, ØA, ØB or ØC will display.

ØD - Lines 21-32 are termed dial-up lines, and are connected to a station through an Intercom link. If a call has been established using a dial-up line, status code ØD will display for the link used. The port number designation is not meaningful.

ØE-12 - Attendant or Hotline Partner Call Waiting

If the attendant calls a busy station, or a station calls its busy Hotline partner, Call Waiting tones are sent to the busy station. The calling station link is camped-on to the busy station. Codes ØE, ØF, 10 and 12 indicate that the link camped-on condition exists.

13 - Link Paging

Status code 13 indicates that a station is Paging (All Call or Zone).

14 - Not Used

15 - Link, Beep

Information to be provided.

16 - Link, Splash Tone

Information to be provided.

17 - Forced Intercom Ringing Enabled

If an Intercom call is placed to a key telephone that is programmed to ring, the link seized by the calling party will display status code 17. Forced Intercom Ringing can be enabled on a system wide or station wide basis.

18-1A - No Dial Tone (Waiting)

Information to be provided.

1B - Page Tone

When a station initiates a Page, a Page tone is sent out over the link it has seized. If the Display System Status diagnostic is run at the instant the Page tones are on the link, status code 1B will display.

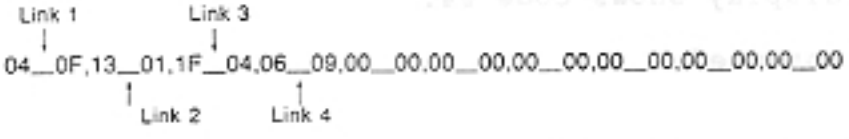
1C - Not Used

1F - Barge In

Status code 1F indicates that a station has seized a link and used Barge In to connect to an existing call.

4.08 For example, the sample report below indicates that:

- Port 016 is on an Intercom call over link 1.
- Port 002 is making a Page announcement over link 2.
- Port 005 has used link 3 to Barge In to an existing conversation.
- Port 010 has attempted an illegal command and is receiving reorder tone.



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LINE STATUS

4.09 Lines 9 through 11 of the 'D' --> DISPLAY SYSTEM STATUS report shows the status of the 32 incoming lines. This field uses 32 4-bit fields (one field for each line) to show line status (bits 1 and 2) and the station port which is using the line (bits 3 and 4). Bits 2 and 3 of each field are separated by an underscore. Each field is separated from the next by a comma. The first field is for line 1; the last field is for line 32. The port (bits 3 and 4) is represented by its hexadecimal equivalent, offset by one (Table 9-6).

4.10 The Line Status codes are defined as follows:

00 - Line Idle

If a line is installed and not being used, status code 00 will display. The port assignments for lines with status 00 are not meaningful.

01 - Line Ring

Status code 01 will be displayed for each line that has a call ringing in. The port designation is not meaningful.

02 - Hold

Status code 02 will be displayed for all lines on Hold.

03 - Hold Recall/Transfer

If a call is left on Hold longer than the programmed recall period, it will recall the station that placed it on Hold. Status code 03 will be displayed if the diagnostic is run while the line is recalling. This code is also used to indicate which station a call has been transferred to.

04 - Flash

If the Display System Status diagnostic is run while a line is being flashed (loop current interruption), the display shows code 04.

05 - Not used

06 - Line Conference

A Line Conference is a Conference between one internal party and two outside lines. When a station establishes a Line Conference, status code 06 (and the port assignment) displays for both lines.

07 - Dial Tone Timeout

If a line is waiting for dial tone (i.e., the DIAL TONE TIME-OUT.(SEC). interval has not been exceeded), status code 07 will display. This code is valid only for toll restricted telephones.

08 - Last Number Redial

When a user initiates a Last Number Redial, status code 08 will display (for the line seized) as the number dials out.

Ø9 - Line Seized

Status code Ø9 will display if a station has seized a line to make an outside call.

ØA - Last Number Redial (Flash)

When a multibutton telephone user presses the L# key while a line is seized, the Last Number Redial facility flashes the line and sends the last number dialed. If the diagnostic is run as the flash is occurring, status code ØA will display.

ØB - Not Used

ØC - CO Transfer

Status code ØC indicates that the line has been transferred to the executive station in a Hotline pair.

ØD - CO Callback

Multibutton telephone users can leave Callback (Line Queuing) requests on a line if all lines in that line's group are busy. The first available line will call the station that left the Callback. Status code ØD will display if the diagnostic is run as the Callback is occurring.

ØE - Not Used

ØF - CO Orbit

All lines placed in a General Park orbit will be displayed as status code ØF. Any port assignment that may display for this code is not meaningful.

1Ø - Add-on Conference

Add-on Conference joins two internal stations to an outside line. If a line is part of an Add-on Conference, status code 1Ø will display. The port assignment will be for the added station, not the station that initiated the Conference.

11 - Wait DTMF

Information to be provided.

12 - Not Used

4.11 For example, the sample report below indicates that:

- Line 1 is idle.
- Calls are ringing in on lines 2 and 3.
- Line 4 is being flashed by port 002.
- Line 5 is sending a Callback ring to port 004.
- Line 6 has been placed in a General Park orbit.

```
Line 1  Line 2  Line 3  Line 4  Line 5  Line 6
  ↓       ↓       ↓       ↓       ↓       ↓
00__00,01__00,01__00,04__01,0D__03,0F__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00
__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__00,00__0
0,00__00,00__00,00__00,00__00,00__00,
```

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DTMF RECEIVER STATUS

4.12 The thirteenth line of the Display System Status diagnostic displays the status of the DTMF receivers in the system. The eight receivers are displayed in the following order (from left to right):

- DTMF Receiver 1 (B-TGU-B1)
- DTMF Receiver 2 (B-TGU-B1)
- DTMF Receiver 3 (Daughter Board 1, B-TGU-B1)
- DTMF Receiver 4 (Daughter Board 2, B-TGU-B1)
- DTMF Receiver 5 (B-TGU-B2)
- DTMF Receiver 6 (B-TGU-B2)
- DTMF Receiver 7 (Daughter Board 1, B-TGU-B2)
- DTMF Receiver 8 (Daughter Board 2, B-TGU-B2)

Each status field is separated from the next by an underscore.

4.13 The DTMF Receiver status bits are:

00 - Idle

The DTMF Receiver is installed but not in use.

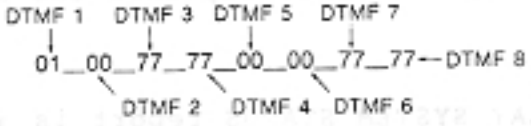
01 - In Use

The DTMF Receiver is processing digits.

77 - Not Installed

4.14 For example, the sample report below indicates that:

- DTMF Receiver 1 is busy.
- DTMF Receiver 2 is installed and idle.
- DTMF Receivers 3, 4, 7 and 8 (daughter boards) are not installed.
- DTMF Receivers 5 and 6 (B-TGU-B2) are installed but idle.



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DISPLAY SYSTEM STATUS SUMMARY

Field: 'D' --> DISPLAY SYSTEM STATUS

Access:

On the programming terminal, press the M key to turn off the SMDR and enter the programming mode. Once the System Configuration Program menu displays, press the D key. The Display System Status diagnostic will run in its entirety once the D key is pressed.

Description:

The 'D' --> DISPLAY SYSTEM STATUS report is a diagnostic that shows the status of all station ports, Intercom links, lines and DTMF receivers in the system. The display is valid at the instant the report is run.

Instructions:

The entire 'D' --> DISPLAY SYSTEM STATUS diagnostic will run when the D key is pressed.

Example:

Refer to examples on the preceding pages.

Default Value: not applicable

Conditions:

The report is run from the programming terminal.

Related Programming:

The system programmable options will affect the way all stations function. Thus, the content of the report is in large part determined by system programming.

Feature Reference: not applicable

5. LEAST COST ROUTING DIAGNOSTIC

5.01 The Least Cost Routing (LCR) diagnostic consists of two reports, run from the programming terminal, that provide the servicing technician with data on how LCR is routing a call. These reports are the Rate Structure Report (paragraph 5.02) and the Conflict Code Report (paragraph 5.12).

RATE STRUCTURE REPORT

5.02 The Rate Structure Report allows the routing and cost of an actual call to be compared to the rate structures outlined in the Least Cost Routing Questionnaire. If the rate structure software is programmed correctly and LCR is properly installed, the diagnostic and the questionnaire should not conflict. Any discrepancies should be carefully analyzed, and, if necessary, reported to the system sales or service representitive.

5.03 This diagnostic report shows:

(a) The first eight digits of the number dialed (i.e., the call being routed).

(b) The routes that are available to the call, listed in order of their relative cost.

(c) The cost (in four minute increments) of each available route.

(d) The rate structure for each route.

5.04 A sample report is shown below. The line and byte assignments are not part of the report, but are provided to make the explanation easier to understand.

		Byte Assignment														
		00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Line 1	<FDE9>	12	A3	92	62	00	00	00	00	00	00	00	00	00	00	00	FF
Line 2	<FDF9>	03	00	94	02	00	9C	01	00	B7	99	99	99	99	99	99	99
Line 3	<FE09>	99	99	99	99	99	99	99	99	99	99	99	99	99	99	00	00
Line 4	<FE19>	11	06	00	00	41	00	11	05	10	00	35	00	11	03	70	00
Line 5	<FE29>	37	00	99	99	99	99	99	99	99	99	99	99	99	99	99	99
Line 6	<FE39>	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
Line 7	<FE49>	99	99	99	99	99	99	99	99	99	99	99	99	00	00	00	00

Line 1 - Number Dialed

<FDE9> 12 A3 92 62 00 00 00 00 00 00 00 00 00 00 00 FF

5.05 Line 1 of the report displays the first eight digits of the number dialed (bytes 00-03). In the sample, the first eight digits of the number dialed are 12039262 (where A=0). The report indicates that LCR is routing a toll call to area code 203, exchange 926. Bytes 04-0F are not used.

Lines 2 and 3 - Service Choice and Cost

```
<FDF9> 03 00 94 02 00 9C 01 00 B7 99 99 99 99 99 99 99
<FE09> 99 99 99 99 99 99 99 99 99 99 99 99 99 99 00 00
```

5.06 Lines 2 and 3 show the services available to the call being placed (in order of preference), and list the cost of a four minute call on each service. Line 2-byte 00 displays the line service number for the least expensive route for the call. Line 2-bytes 01 and 02 show the cost of a four minute call on that service (in hexadecimal). In the sample, line service 03 is the preferred route, and the cost of a four minute call on this service is $1.48.

5.07 Report line 2-bytes 03, 04 and 05 show that service 02 is next preferred, and a four minute call costs $1.56. Line 2-bytes 06, 07 and 08 display service 01 as the third cheapest service. A four minute call on service 01 costs $1.83. The remaining bytes, which are unused in the sample, are assigned as follows:

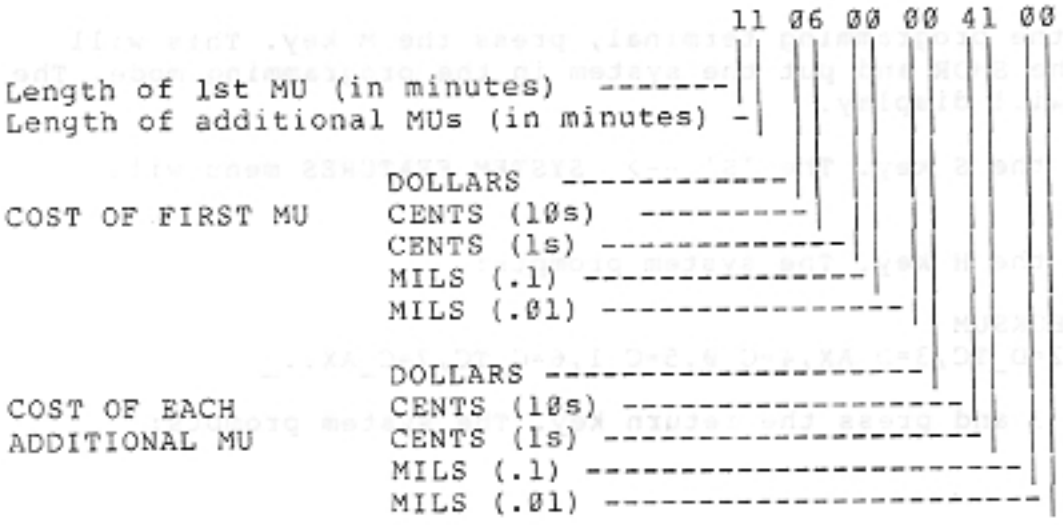
Line 2-bytes 09, 0A and 0B - Fourth preferred service
Line 2-bytes 0C, 0D and 0E - Fifth preferred service
Line 2-byte 0F and line 3-bytes 00 and 01 - Sixth preferred service
Line 3-bytes 02, 03 and 04 - Seventh preferred service
Line 3-bytes 05, 06 and 07 - Eighth preferred service
Line 3-bytes 08, 09 and 0A - Ninth preferred service
Line 3-bytes 0B, 0C and 0D - Tenth preferred service

Lines 4 through 7 - Rate Structure for Each Service

```
<FE19> 11 06 00 00 41 00 11 05 10 00 35 00 11 03 70 00
<FE29> 37 00 99 99 99 99 99 99 99 99 99 99 99 99 99 99
<FE39> 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
<FE49> 99 99 99 99 99 99 99 99 99 99 99 99 00 00 00 00
```

5.08 Diagnostic lines 4 through 7 display the rate structure for each line service programmed into the LCR rate chips. Each rate structure is defined by twelve bits (six bytes). The first six bytes represent the rate structure for line service 01, the next six bytes represent the rate structure for line service 02, and so on. In the sample, only services 01, 02 and 03 are available.

5.09 For example, bytes 00 through 05 display the rate structure for line service 01 as follows (where MU corresponds to Message Units):



In this example, the first message unit is one minute and costs $.60 ($0.6000). Each additional message unit is also one minute, and costs $.41 ($0.4100). This corresponds to the cost of the third preferred route presented in paragraph 5.07, where the cost of a four minute call was $1.83.

5.10 The rate structure data for the 10 line services can be located using the following chart.

RATE STRUCTURES

LINE SERVICE #	LOCATION OF RATE STRUCTURE BYTES
Line service 01	Line 4, bytes 00-05
Line service 02	Line 4, bytes 06-0B
Line service 03	Line 4, bytes 0C-0F; line 5, bytes 00 & 01
Line service 04	Line 5, bytes 02-07
Line service 05	Line 5, bytes 08-0D
Line service 06	Line 5, bytes 0E & 0F, line 6, bytes 00-03
Line service 07	Line 6, bytes 04-09
Line service 08	Line 6, bytes 0A-0F
Line service 09	Line 7, bytes 00-05
Line service 10	Line 7, bytes 06-0B

How to Run the Rate Structure Report

5.11 The Rate Structure Report is run only after the system is installed and programmed. Least Cost Routing must also be installed and programmed. Review all the steps in the following sequence before attempting to run the report.

(1) From the programming terminal, press the M key. This will turn off the SMDR and put the system in the programming mode. The main menu will display.

(2) Press the S key. The 'S' --> SYSTEM FEATURES menu will display.

(3) Press the H key. The system prompts:

```
DISPLAY/CHECKSUM
Ø=DØ,1=D1,2=D_TC,3=D_AX,4=C_Ø,5=C_1,6=C_TC,7=C_AX.._
```

(4) Enter 3 and press the return key. The system prompts:

```
ADDR.._
```

(5) Enter FDE9 and press the return key. The system prompts:

```
UP-TO._
```

(6) Enter FE49 BUT DO NOT PRESS THE RETURN KEY.

(7) Using LCR, dial the number to be routed.

(8) Press the return key on the programming terminal as soon AS SOON AS YOU ARE DONE DIALING, but before LCR redials the number. The Rate Structure Report will display.

CONFLICT CODE REPORT

5.12 The Conflict Code Report displays the line services that have the capability to interpret conflict codes (i.e., three-digit codes that can be either area codes or local exchanges). If the dialing area in which the system is installed has conflict codes, the LCR rate chip software should be configured to recognize these codes. If the conflict code is dialed with a leading 1 (1 + NPX + NNX + nnnn), LCR should route the call as a toll call. If the conflict code is dialed without the leading 1 (NNX + nnnn), the call should be recognized as a non-toll call and placed on a Direct Distance Dialing line.

5.13 A sample report is shown below. The line and byte assignments are not part of the report, but are provided to make the explanation easier to understand.

		Byte Assignment														
		00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Line 1	<408F>	01	05	0C	00	00	00	00	00	00	00	00	00	00	00	00	00
Line 2	<40A2>	00	00	00	00	32	39	2D	41	75	67	2D	38	34	2C	33	37

Line 1-bytes 00 to 09 identify the line service types, and are disregarded for the Conflict Code Report. (Refer to page 4-24 for an explanation of this section of the report.) The next consecutive 10 bytes are reserved to identify the services that can interpret conflict codes. If a service can identify one of these codes, its byte is 01. If a service cannot identify a conflict code, its byte is 00. The conflict code bytes are located by using the chart below.

LINE SERVICE #	LOCATION OF CONFLICT CODE BYTES
Line service 01	Line 1-byte 0A
Line service 02	Line 1-byte 0B
Line service 03	Line 1-byte 0C
Line service 04	Line 1-byte 0D
Line service 05	Line 1-byte 0E
Line service 06	Line 1-byte 0F
Line service 07	Line 2-byte 00
Line service 08	Line 2-byte 01
Line service 09	Line 2-byte 02
Line service 10	Line 2-byte 03

Line 2-bytes 04 to 0F are disregarded for this report.

5.14 In the sample report provided, no conflict codes are recognized. If the dialing area where the system is installed has conflict codes, the sales or service representitive must be notified so the rate chip software can be corrected.

How to Run the Conflict Code Report

5.14 To run the Conflict Code Report:

(1) From the programming terminal, press the M key. This will turn off the SMDR and put the system in the programming mode. The main menu will display.

(2) Press the S key. The 'S' --> SYSTEM FEATURES menu will display.

(3) Press the H key. The system prompts:

```
DISPLAY/CHECKSUM
0=D0,1=D1,2=D_TC,3=D_AX,4=C_0,5=C_1,6=C_TC,7=C_AX.._
```

(4) Enter 3 and press the return key. The system prompts:

```
ADDR.._
```

(5) Enter 408F and press the return key. The system prompts:

```
UP-TO._
```

(6) Enter 40A2 and press the return key. The Conflict Code Report will display.

APPENDIX A
OPERATIONAL SPECIFICATION
FOR
TCX-128 ATTENDANT MULTIBUTTON KEY TELEPHONE

TABLE OF CONTENTS

NOTES:

(a) If your telephone is equipped with a MON key, it does not have a speakerphone. Intercom calls can be received Handsfree (Handsfree Answerback) and outside calls may be monitored (Monitor). Handsfree CO calls are not permitted.

(b) Wherever these instructions tell you to lift the handset, you may press the HF (or MON) key instead. Refer to the Handsfree (Speakerphone) and Monitor features.

ACCOUNT CODE CAPABILITY

Attendant Key Telephones can enter Account Code numbers of up to nine digits.

To assign an account code as you place a call:
- Lift handset.
- Place outside call.
- Dial # (within three seconds).
- Dial Account Code.

Calls are processed in the normal manner and recorded in chronological order at the SMDR printer.

ALTERNATE ATTENDANT STATION

As the attendant, you can redirect all your calls to the alternate attendant station which was specified during installation.

To send your calls to the alternate:
- Press ALT key. Key flashes.

To return your calls to you:
- Press ALT key again. ALT key extinguishes.

ANSWERING A CALL

To answer a call:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

Display: | LINE XX |

To answer a second call:
- Press flashing line key.

Display: | LINE XX |

The first call is automatically placed on Hold. Any number of calls can be answered and placed on Hold in this manner.

BACKGROUND MUSIC

The telephone speaker may be used to broadcast Background Music.

To turn Background Music on or off:
- Press HOLD key.

To regulate the volume of Background Music for non-display telephones:
- Turn left volume control clockwise to decrease volume.
- Turn left volume control counterclockwise to increase volume.

To regulate the volume of Background Music for display telephones:
- Do not lift handset.
- Press VOL UP key to increase volume.
- Press VOL DN key to decrease volume.

BARGE IN

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

Your station may be permitted to Barge In (intrude into) conversations in progress.

To initiate Barge In:
- Lift handset.
- Press TRF/VOICE key and dial station number (receive busy tone).

OR

- Press DSS key (receive busy tone).

Display:

YYY BUSY

- Press BRG/IN key. You will hear three short tones as you join the conversation.

In addition, your calls might be interrupted by certain stations authorized to Barge In. You will hear three short tone bursts as a Barge In occurs. Your station can be programmed during installation to block Barge In.

BUSY OUT LINES

As the attendant, you can remove problem lines from service. Lines that are busied out cannot be accessed by any station in the system.

To Busy Out a line:
- Lift handset.
- Press TRF/VOICE key.
- Press *.
- Dial number of line to be Busied Out (Ø1-12).

An acknowledgment tone is heard and the appropriate line is removed from service.

To return the line to service:
- Repeat procedure.

CALL FORWARDING CANCEL

As the attendant, you can cancel all Call Forwarding conditions throughout the system.

To cancel all Call Forwarding:
- Lift handset.
- Press TRF/VOICE key.
- Dial # #.
- Hang up.

CALL PICKUP, DIRECTED

To answer an outside call you hear ringing at a nearby station:
- Lift handset.
- Press PARK key.
- Dial number of station that is ringing.

Display: | PICK-UP FROM YYY |

The ringing call can be answered only if it was transferred from another station in the system.

CALL PICKUP, GROUP

To answer a call that rings into your pickup group:
- Lift handset.
- Press flashing PKUP key.

Display: | PICK-UP FROM YYY |

Normally, you will receive ringing for all calls transferred to you, in addition to all calls programmed to ring at your station. You may also enable your telephone to ring for calls to other stations in your pickup group which do not normally ring on your telephone.

To receive ringing in the Pickup Group:
- Lift handset.
- Press TRF/VOICE key.
- Dial 1803.

To prevent ringing in the Pickup Group:
- Lift handset.
- Press TRF/VOICE key.
- Dial 1802.

CALL WAITING

Call Waiting, CO Call

When busy on another call, you may receive a signal that an outside (CO) call is waiting to be answered. This call may be a call ringing in to your station, or a call transferred from another station. The CO Call Waiting indication is a double beep.

To answer a CO Call Waiting signal:
- Press flashing line key.

If the initial call is a CO call, it will be put on Hold. If an Intercom call, it will be dropped.

As the system attendant, a Call Waiting signal is automatically transmitted when you call a busy station. The busy station may choose whether or not to answer this signal.

Call Waiting, Hotline Partner

You may be assigned as the Hotline partner for another station in the system. When busy on another call, you may receive a signal that an Intercom call from your Hotline partner is waiting to be answered. The Hotline Partner Call Waiting signal is a double beep.

To answer a Hotline Partner Call Waiting signal:
- Hang up or put initial call on Hold (if CO call).
- Press HL key.

NOTE: If you receive a double beep and a flashing incoming line key, you have a CO call waiting to be answered. Refer to Call Waiting, CO Call.

CALLBACK

If you are busy on a call, a multibutton or four button station user can leave a Callback request on your telephone. When you hang up, the station which left the Callback will be signaled. If that station answers the signal, an Intercom call will be automatically placed to your station.

CONFERENCE

Conference permits a three-way telephone conversation. There are two types of conference features: Add-On Conference and Line Conference.

Add-On Conference

To add a second internal party to an outside call:
- Press TRF/VOICE key.
- Dial station number to be added to Conference (or press DSS key). Outside call automatically placed on Hold.

Display: | EXTENSION YYY |

- Announce Conference.
- Press CONF key. Outside call reconnected.

To join an Add-On Conference, when announced:
- Lift handset.
- Press flashing incoming line key.

If two multibutton telephones are joined in an Add-On Conference, the CONF key at both stations is steadily illuminated.

NOTE: If the invited party does not join the Conference within 10 seconds, then the request for a Conference is canceled.

Line Conference

To establish a Conference call with two external lines:
- Place first call on Hold (press HOLD key).
- Establish second call on another line.

Display: | LINE XX |

- Press CONF key to be connected to both external calls.

Do not answer another incoming call while a Conference is being established. As the most recent call, this call would be included in the Conference instead of the intended call.

Your system may be set up so that each outgoing line key (keys 8-13) has been assigned to a different line group. To place and join in Conference two calls in the same line group (using the same outgoing line key:
- Place first call.
- Press CONF key. Call will move up to first available incoming line key.
- Press HOLD key.
- Place second call, using the same outgoing key as for first call.
- Press CONF key. Conference is established.

DATE AND TIME

As the attendant, you can set the Date and Time for the system. Date and Time is used for SMDR and display telephone presentations.

To enter Date and Time:
- Lift handset.
- Press TRF/VOICE key.
- Press 7.
- Enter hour (2 digits, 24 hour clock, e.g. 1 PM = 13).+
- Enter minutes past the hour (2 digits, ØØ-59).
- Enter month (2 digits, January = Ø1; December = 12).
- Enter day of the month (2 digits).
- Enter year (2 digits, 1983 = 83).

You will hear an acknowledgment tone after the last entry is made.

+ Each entry must be made within six seconds of the last, or you will have to start procedure again.

If you have a display telephone, it will show you the day of the week, month, date and time in the display window. This information displays continuously when the telephone is idle.

DIRECT INWARD LINES

Certain outside lines may ring directly into designated stations, without having to be transferred by you (as the attendant). These Direct Inward Lines ring identically to transferred calls. Consult with your communications manager to find out which lines ring at which stations.

DIRECT LINE ACCESS

Direct Line Access allows you to select a specific line to place a call, rather than a line group.

To select a line:
- Lift handset.
- Press TRF/VOICE key.
- Dial #.
- Dial line number (Ø1-32).

Display: | LINE XX |

NOTE: The attendant can override Least Cost Routing using Direct Line Access.

DIRECT STATION SELECTION

The DSS console provides one button intercom access to every station in the system (except for stations 464 and 465).

To place an Intercom call using the DSS console:
- Lift handset (or press HF key).
- Press DSS key for station being called.

Display: | EXTENSION YYY |

- DSS key LED will flash fast.

The DSS console normally provides access to stations 3Ø1-363. To access stations 4Ø1-463, press the SHIFT key.

The DSS console also serves as a Busy Lamp Field (BLF) for the system. When a station is idle, the appropriate DSS console LED is off. When a station is off-hook, the LED is on. When a station is in Do Not Disturb, the LED flashes slowly.

If a single line or one button telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call Handsfree unless programmed otherwise.

If your station does not have a DSS console, the first 14 buttons on your telephone can be used as Direct Station Selection (DSS) keys for one button access to selected stations. After your telephone is installed, you must select the station which corresponds to each DSS key. If you do not program the DSS keys, they will be assigned automatically to the first 14 stations.

NOTE: When assigning DSS numbers, do not allow more than six seconds to elapse between steps. If you do, you must begin the procedure again. Also, do not program more than one DSS key for the same station.

To program your 14 DSS keys:
- Do not lift handset or press HF key.
- Press OUT/MEM key. Key flashes.

Display: | PROGRAM MEMORY |

- Press DSS key (1-14). Key flashes.

Display: | NUMBER TO BIN WW |

- Dial *.
- Dial station number that will be assigned to the DSS key being programmed.
- Press bin key again (1-14).

Display: | PROGRAM COMPLETE |

To use your 14 Direct Station Selection (DSS) keys:
- Lift handset.
- Press TRF/VOICE key.
- Press DSS key (within six seconds) for station you wish to call.

Display: | EXTENSION YYY |

DISTINCTIVE RINGING

You can always differentiate between Intercom ringing and outside call ringing. Intercom ringing consists of a 1.5 second ring burst followed by a 2.5 second pause. Outside (and transferred) calls always ring with two short bursts followed by a pause. Intercom calls will ring only if Forced Intercom Ringing is enabled.

DO NOT DISTURB OVERRIDE

You may override a station's Do Not Disturb. You will be connected to the called station Handsfree, unless programming requires that your call will ring.

To initiate DND Override:
- Lift handset.
- Press flashing DSS key.

Display: | YYY DND |

- Make announcement.

FLASH

Flash allows you to obtain a new dial tone without losing control of your line.

To Flash the line:
- Do not hang up.
- Press line key presently in use.

FORCED INTERCOM RINGING

Forced Intercom Ringing causes all Intercom calls to ring multibutton and four button telephones, rather than be received in the Handsfree Answerback mode. Forced Intercom Ringing may be enabled throughout the entire system (by system programming), individually by the multibutton or four button station user, or as you place an Intercom call.

To force Intercom calls to multibutton and four button stations to ring (as you place the call):
- Lift handset.
- Press TRF/VOICE key.
- Dial 1, then station number.

To force all Intercom calls to your station to ring (i.e., enable Forced Intercom Ringing):
- Lift handset.
- Press TRF/VOICE key.
- Dial 1801.
- Hang up.

To cancel Forced Intercom Ringing (if you have enabled it):
- Lift handset.
- Press TRF/VOICE.
- Dial 1800.
- Hang up.

HANDSFREE (SPEAKERPHONE)

Handsfree (Speakerphone) operation allows the speaker and microphone inside the telephone to be used for all calls, instead of the handset. If your telephone has an HF button, Handsfree operation is permitted.

To initiate Handsfree mode:
- Press HF key. HF key lights.

To return to handset operation:
- Lift handset. HF key extinguishes.

HANDSFREE ANSWERBACK

Handsfree Answerback allows Intercom calls to be answered using the speaker and microphone in the telephone, instead of the handset. Intercom calls to your station are normally received in the Handsfree Answerback mode. Handsfree Answerback cannot occur if Forced Intercom Ringing is enabled for the system, or if the call was placed using a leading 1.

HOLD

There are two types of Hold for outside calls: **Automatic Hold** and **Exclusive Hold.**

Automatic Hold

As the attendant, you can place a call on Exclusive Hold and answer a second call without using the HOLD key. The first call is put on Exclusive Hold automatically when the second call is answered. If you don't have a console you can't use this feature.

To answer second call:
- Press flashing line key.

Exclusive Hold

The Exclusive Hold feature provides a Hold indication only at the telephone where the call was placed on Hold. The line does not appear on any other station in the system, and can be retrieved only at the station where the call was placed on Hold.

To place a call on Exclusive Hold:
- Press HOLD key.

To return to a call on Exclusive Hold:
- Press flashing line key.

NOTE: If a call is left on Exclusive Hold longer than the programmed period, it will re-ring at your station. Calls left on Exclusive Hold at other stations, if unanswered, will ring your station.

HOTLINE

Hotline allows two stations to be directly connected for fast, efficient communication and call transfer. If you have a DSS console, this feature is generally not used since the console provides you with one button access and a Busy Lamp Field for every station in the system. If you do not have a DSS console, a Hotline partnership may be useful.

To call your Hotline partner:
- Lift handset.
- Press HL key.

To transfer an outside call to your Hotline partner:
- Press HL key.
- Announce call.

Display: | EXTENSION YYY |

If your Hotline partner would like the call in the Handsfree mode:
- Press HL key again.

If your Hotline partner does not want to take the call:
- Do not hang up.
- Press flashing line key to return to call.

NOTES:

(a) If your Hotline partner is in Do Not Disturb or busy on a call, your HL key will be steadily illuminated. You can override your partner's Do Not Disturb by pressing the HL key.

(b) If you are the secretary in an executive/secretary Hotline partnership, a call transferred to you will indicate on your telephone as an Off Fluttering incoming line key. A call transferred to the executive will indicate on your telephone as an On Fluttering incoming line key.

Your system may be installed so that you are part of a Hotline group, rather than having a single Hotline partner. If you are the person in your group assigned as the secretary/receptionist, your station number will be the highest number. Any calls transferred from any other station in your group, using just the HL key, will ring your telephone. When any of the partners in the group press the HL key, they will be connected to you. The station that your reach by pressing your HL key is determined during installation.

INTERCOM

To place an Intercom call:
- Lift handset.
- Press TRF/VOICE key and dial station number.

OR

- Lift handset.
- Press appropriate DSS key (1-363, 401-463).

Display: | EXTENSION YYY |

If a single line or one button telephone telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call Handsfree unless programmed otherwise.

When an Intercom call is placed to your station, the display will show the station number of the calling party:

Display: | EXT YYY CALLING |

LAST NUMBER REDIAL

To use Last Number Redial:
- Press L# key. Handsfree mode is automatically selected.

Display: | LINE XX |

Display: | DIGITS |

- Lift handset if privacy is desired.

LEAST COST ROUTING

Least Cost Routing (LCR) automatically places your outgoing call on the least expensive available route. Check with your communications manager to see if you are required to use Least Cost Routing to place outgoing calls.

To place a call using Least Cost Routing:
- Lift handset.
- Press outgoing line key 12 or 13 (key flashes).
- Dial number.

Display:	DIGITS
Display:	LINE XX
Display:	DIGITS

NOTE: Do not allow more than six seconds to elapse between the digits you dial, or you will have to start the sequence over again.

LEAST COST ROUTING BYPASS

The Least Cost Routing (LCR) package installed in your system reflects the rate structure (i.e., cost of placing calls in your area) at the time the system was installed. If a station user must dial an office or area code that was not included in the original package, LCR automatically places the call on a Direct Distance Dialing (DDD) line. All Speed Dial calls to the new code will also be placed on the DDD line. The system will record the cost of these calls at $9.99 per minute.

In addition, any multibutton station user can bypass LCR by placing a call using outgoing line keys 8-11. These stations may also be able to bypass LCR by accessing line groups not represented by the outgoing line keys (refer to Placing a Call). All Toll Restrictions remain in force.

As the attendant, you may also bypass LCR by using Direct Line Access.

MESSAGE WAITING

A Message Waiting indication can be left at a called four button or multibutton station that does not answer.

To leave a Message Waiting:
- Press M.WAIT key.
- Hang up.

The called station will have a flashing M.WAIT key. In addition, the station at which the message is left will broadcast a tone every 2 minutes indicating that a message is waiting. Every time the tone is broadcast the following message is briefly displayed:

Display: | MSG FROM EXT YYY |

To respond to a Message Waiting indication:
- Lift handset.
- Press M.WAIT key.

Display: | EXTENSION YYY |

The station which placed the Message Waiting indication is automatically signaled.

To cancel a Message Waiting signal left at your telephone:
- Do not lift handset.
- Press M.WAIT key. LED extinguishes.

Since more than one message can be left at your station, canceling the first Message Waiting signal may not extinguish the LED. Continue to press the M.WAIT key until all messages have been canceled.

MONITOR

Monitor allows you to dial and listen to the progress of a call without lifting the handset. This feature is also useful to listen to your call if it has been placed on Hold by the outside party. Monitor requires that you lift the handset to speak.

NOTE: If your telephone has a MON key (instead of a HF key), you have the Monitor feature.

To activate Monitor:
- Press MON key.

NIGHT SERVICE

To put the system in the night mode:
- Do not lift handset.
- Press NIGHT key. Key flashes.

To return the system to normal operation:
- Do not lift handset.
- Press NIGHT key. Key extinguishes.

If another attendant puts the system in the night mode, your NIGHT key will steadily illuminate. Pressing your NIGHT key returns the system to normal operation.

Assigned Night Answer

When you put the system in the night mode, Assigned Night Answer (ANA) automatically transfers ringing for incoming calls to specified stations. Your communications manager can tell you which stations are assigned to receive night mode ringing.

To answer a night mode call ringing at your telephone:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

Universal Night Answer

Universal Night Answer (UNA) allows you to answer calls that you hear ringing over the Paging system or external alerting device. UNA is activated when you (as the attendant) put the system in the night mode.

To answer a night mode call ringing over the Paging system or external alerting device:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

OR

- Lift handset.
- Press INT key.
- Dial 69.

PAGING

You can page the entire system (All Call) or just selected areas (Zone Page).

All Call Page

To initiate All Call Page:
- Lift handset.
- Press PAGE key.
- Make announcement.
- Hang up.

Zone Page

To initiate Zone Page:
- Lift handset.
- Press TRF/VOICE key.
- Dial desired zone (61-68).
- Make announcement.
- Hang up.

PARK

You can place an outside call in a parking orbit, page a third person and have that person pick up the parked call from any station in the system. There are two types of parking orbits: General Park and Personal Park. An unanswered parked call will re-ring the station which initially parked the call. If the returned call is unanswered, it will ring the attendant.

General Park Orbit

To place a call into a General Park Orbit:
- Press TRF/VOICE key. Call automatically placed on Hold.
- Dial General Park Orbit code (50-59). Acknowledgment tone audible.

Display: | CO TO ORBIT ZZ |

NOTE: If an acknowledgment tone is not heard, that parking orbit is busy. Dial a different parking orbit code.

- Use Paging to announce call and orbit code (50-59).
- Hang up.

To retrieve a call from General Park Orbit:
- Lift handset.
- Press PARK key.
- Dial announced General Park Orbit number (50-59).

Display: | CO FROM ORBIT ZZ |

Personal Park Orbit

Personal Park Orbit provides access to calls that are parked at a particular station. These calls may be answered from any other station by dialing the number of the station where the call is parked.

To Park a call at a station:
- Press TRF/VOICE key.
- Dial number of station where call is to be Parked.

OR

- Press DSS key for station where call is to be Parked.
- Press PAGE key (for All Call Page) or use Zone Page to announce call and station number.
- Hang up.

To retrieve a call from Personal Park Orbit:
- Lift handset.
- Press PARK key.
- Dial the number of the station to which the call was transferred.

Display: PICK-UP FROM YYY

NOTE: If a call is left in a parking orbit longer than the programmed time, it will ring at your station.

PLACING A CALL

To place an outside call:
- Lift handset.
- Press outgoing line key (keys 8-13).

Display: LINE XX

- Dial telephone number.

Display: DIGITS

Display: COST $VV.VV

You may be permitted to access outgoing lines that are not normally available using your outgoing line keys (keys 8-13).

To access lines not available on your outgoing line keys:
- Lift handset.
- Press TRF/VOICE key.
- Dial line group (90-99).

Display: LINE XX

NOTE: Dialing 91-99 accesses line groups 1 through 9. Dialing 90 accesses line group 10.

PRIVATE LINE

A Private Line is a line reserved exclusively for your use when placing a call. Other stations in the system cannot use this line for outgoing calls. In addition, your Private Line may be programmed to ring only at your telephone.

To place or answer a call using your Private Line:
- Lift handset.
- Press incoming line key 5.

Display: | LINE XX |

NOTE: When the system is in the night mode, your Private Line will not ring over the external speakers or external alerting device.

SAVE

The Save feature stores a frequently called number for automatic dialing at a later time.

To Save a number:
- Lift handset.
- Select outgoing line key.

Display: | LINE XX |

- Dial number.

Display: | DIGITS |

- Press SAVE key after digits are dialed or while engaged on call.
- Hang up.

To redial a Saved number:
- Press SAVE key. Handsfree mode is automatically selected.
- Lift handset if privacy is desired.

The call will go out on the highest numbered line in the line group where the call was initially placed.

SPEED DIAL

The system utilizes two types of memory dialing: Station Speed Dial and System Speed Dial.

Station Speed Dial

The first 5Ø stations in the system can be programmed for individual speed dialing by using the first 14 keys as bin storage locations. Each bin can store one telephone number, with a maximum of 16 digits. Pauses count as a digit and are stored by dialing #.

To store Station Speed Dial numbers:
- Press OUT/MEM key. Key flashes.+

Display: | PROGRAM MEMORY |

- Press bin (1-14) where number is to be stored. Key flashes.

Display: | NUMBER TO BIN WW |

- Dial number to be stored.
- Press bin key again. Key stops flashing.

Display: | PROGRAM COMPLETE |

+ The system normally uses line group 1 to place all Station Speed Dial calls. If you want to preselect a special line group to be used whenever the bin is accessed, press a line key in the desired group before pressing the OUT/MEM key. If LCR is installed, the line will be selected for you.

To dial Station Speed Dial numbers:
- Lift handset.
- Press OUT/MEM key.
- Press bin (1-14) where number was stored.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

System Speed Dial

As the attendant, you can store up to 100 frequently-dialed numbers that are available to every station. Each bin can store one telephone number, with a maximum of 16 digits. Pauses count as a digit and are stored by dialing #.

To dial the stored System Speed Dial numbers:
- Lift handset.
- Press TRF/VOICE key.
- Dial code (800-899) for desired System Speed Dial number.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

To store or change numbers (up to 16 digits long):
- Press OUT/MEM key. Key illuminates and dial tone is audible.

Display: PROGRAM MEMORY

- Select and press a bin key (1-14). The key illuminates.

Display: | NUMBER TO BIN WW |

- Dial #.
- Enter one location code (ØØ-99).

Display: | DIGITS |

- Dial number to be stored, including options as required.

Display: | DIGITS |

- Press illuminated bin key (1-14) again. Number is now stored and key will extinguish.

Display: | PROGRAM COMPLETE |

SPEED DIAL, CHAINING BINS

Speed Dial bins may be chained to allow dialing of numbers longer than 16 digits.

Manually Chaining Station Speed Dial Bins

To manually chain Station Speed Dial bins:
- Lift handset.
- Press OUT/MEM key.
- Sequentially press bins to be chained (within six seconds).

A maximum of two bins may be chained.

Chaining a Station Speed Dial Bin to a Manually Dialed Number

To use a manually dialed number with a Station Speed Dial bin:
- Lift handset.
- Press OUT/MEM key.
- Press appropriate bin key. Let number dial out.
- Manually dial second number.

NOTE: This can be done only from unrestricted telephones (Class of Service 0).

Chaining System Speed Dial Bins

You can select up to four System Speed Dial bins to be chained, in any order.

To chain System Speed Dial bins:
- Lift handset.
- Press TRF/VOICE key.
- Dial 8*.
- Dial System Speed Dial bins to be chained (00-99).
- Dial * to end sequence.

Chaining System and Station Speed Dial Bins

Up to three Station Speed Dial bins can be automatically chained to a System Speed Dial bin.

To chain a System Speed Dial bin to Station Speed Dial bins:
- Lift handset.
- Press TRF/VOICE key.
- Dial 8 *.
- Dial bin (00-99) for desired System Speed Dial number.
- Dial #.
- Dial desired bin (01-14). (Do not press bin key.)
- If another station bin is to be chained, press # between the bin numbers.
- Dial * to end sequence.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

Chaining a System Speed Dial Bin to a Manually Dialed Number

You may be able to manually dial a number after a System Speed Dial number:
- Dial System Speed Dial number.
- When system bin has dialed out, manually dial number (within six seconds).

Chaining a *2* System Speed Dial Bin to a Station Speed Dial Bin

Certain System Speed Dial bins may be programmed with the System Speed Dial Directive *2*. This directive allows System and Station Speed Dial bins to be chained more easily.

To chain a station bin to a *2* system bin:
- Lift handset.
- Press TRF/VOICE key.
- Dial code (800-899) for System Speed Dial number.

Display: LINE XX

Display: DIGITS

- Let System Speed Dial number dial out. OUT/MEM key illuminates.
- Press Station Speed Dial bin key (within six seconds).

Display: DIGITS

Display: COST $VV.VV

SYSTEM SPEED DIAL OPTIONS

Speed Dial Options can be entered into Speed Dial bins to increase the flexibility of Speed Dialing.

Pause Option

The # key allows a pause to be entered into a System or Station Speed Dial bin. The duration of the pause is programmed during system installation. More than one pause can be programmed into a bin and each # counts as a digit.

Pauses are typically entered into Speed Dial bins when the system is installed behind a PBX. For example, if the PBX access code for an outside line is 9, and the number to be Speed Dialed on the outside line is 12039262000, the bin would be programmed as 9#12039262000.

Automatic Chaining Option

The command *1 allows System Speed Dial bins to be automatically chained. A system bin ending in *1 will automatically be chained to the next consecutive system bin. This is useful if an OCC access or security code is longer than 16 digits. The *1 counts as two digits. More than one bin may be automatically chained using the *1 directive.

For example, if the OCC access and security code 213444858512129999 is to be programmed into System Speed bins Ø1 and Ø2, enter 213444*1 into bin Ø1 and 858512129999 into bin Ø2. The bins will consecutively dial out when 8Ø1 is dialed.

Simplified Manual Chaining Option

The directive *2* simplifies the way a Station Speed Dial bin is chained to a System Speed Dial bin. If *2* is entered at the end of the system bin, the multibutton telephone user only has to press the Station Speed Dial bin key to chain the system bin to the station bin. The *2* command counts as three digits.

Bypass Toll Restriction Option

When entered at the beginning of a System Speed Dial bin, the *3 command prevents the number stored in the bin from displaying at display telephones and printing on the SMDR. This is used to prevent unauthorized use of OCC access and security codes. For example, if a System Speed Dial bin is programmed with *38882ØØ, the SMDR and display will suppress 8882ØØ, but the digits will still be dialed.

If *3 is entered at the beginning of a bin that uses *1 to automatically chain, none of the digits in the chained sequence will print. If *3 is entered in a *2* manually chained bin, the station bin will print; the system bin will not.

The command *3 also is used to bypass Toll Restriction. Any station can use a bin in which *3 was used to turn off the SMDR and display. For example, if a System Speed Dial bin containing 12039262000 should be accessible to every Class of Service, program a system bin with 1*32039262000. The digits 2039262000 will also be suppressed on the displays and the SMDR. When used to bypass Toll Restriction, the directive *3 cannot be the first entry in the system bin.

Station Toll Restriction On Option

The *4 command, entered at the beginning or end of a System Speed Dial bin, restricts the call according to the Class of Service (COS) of the station which is using the bin. For example, if *5 was used at the beginning of the system bin to turn Toll Restriction off, *4 could be entered at the end of the bin to turn Toll Restriction back on. This would allow a normally restricted station to access the bin but would prevent unauthorized manual dialing or chaining after the bin dialed out. The *4 command counts as two digits.

Station Toll Restriction Off Option

The *5 command, entered at the beginning or end of a System Speed Dial bin, assures that all stations in the system can use the bin. For example, the *5 directive allows a telephone with Class of Service 4 to dial a leading 1 10-digit call which would normally be prevented. The *5 directive counts as two digits.

The *5 command can also be used to enable Toll Restricted stations to manually dial after a System Speed Dial bin has dialed out. For example, assume that COS 1 is allowed to dial area code 203, and that System Speed Dial bin 50 is programmed with an OCC access number of 12039262000. When a station with COS 1 accesses bin 50 (dials 850), OCC dial tone is returned but the station cannot dial into the service. If the command *5 is entered at the beginning or the end of the bin (*512039262000), the station can manually dial into the service after the OCC dial tone is returned.

Supressing the Leading 1 Option

When placed at the end of a System Speed Dial bin, the *6 command will automatically remove the leading 1 from any succeeding chained Speed Dial bin. This option is helpful if a system bin contains the access and security code for an OCC located in a non-leading 1 dialing area, and the bin to be chained to this system bin contains a leading 1. If the *6 option is implemented, the leading 1 from any chained bin is ignored. If the *6 option was not used in this situation, the chained bins could be incompatible with the non-leading 1 dialing service.

For example, if System Speed Dial bin 50 contains 1203888200*6 and System Speed Dial bin 51 contains 15551212, bin 51 will dial out as 5551212 if it is chained to bin 50.

TERMINATING A CALL

As the attendant, you may terminate a CO or Intercom call without replacing the handset.

To terminate a call:
- Press RLS key.

TRANSFER

You can transfer a call to someone else by one of two methods: Screened (Announced) or Unscreened (Unannounced).

Screened (Announced) Transfer

To Transfer a screened call:
- Press TRF/VOICE key.
- Dial number (or press DSS key) of station to receive transfer.

Display: | EXTENSION YYY |

- Announce call and wait for reply.
- If party accepts the transfer, hang up.

If the party does not take the call, do not hang up. You must press the flashing line key to return to the call.

If you make a Screened Transfer and the party wishes to accept the call Handsfree:
- Press HF/TRF key.
- Hang up.

Unscreened (Unannounced) Transfer

To Transfer an unscreened call:
- Press DSS key for station to receive transfer. (Call Waiting tones will not be sent.)

OR

- Press TRF/VOICE key.
- Dial number (or press DSS key) of station to receive transfer.
- Wait two seconds to send Call Waiting tones.

Display: | EXTENSION YYY |

- Hang up.

If the party does not take the call, the call will be returned to you.

Display: RECALL FROM YYY

VOLUME CONTROL

Two volume control thumbwheels are located on the front edge of the telephone. The left thumbwheel is used to adjust the volume of the Page Receive, Splash Tone, Ring Tone and Background Music (BGM). The right thumbwheel controls the volume of incoming Handsfree Answerback and Handsfree conversations. To increase volume, turn the thumbwheels counterclockwise. On display telephones, volume is controlled by the VOL UP and VOL DN keys.

APPENDIX B
OPERATIONAL SPECIFICATION
FOR
TCX-128 MULTIBUTTON KEY TELEPHONE

TABLE OF CONTENTS

NOTES:

(a) If your telephone is equipped with a MON key, it does not have a speakerphone. Intercom calls can be received Handsfree (Handsfree Answerback) and outside calls may be monitored (Monitor). Handsfree CO calls are not permitted.

(b) Wherever these instructions tell you to lift handset, you may press the HF (or MON) key instead. Refer to the Handsfree (Speakerphone) and Monitor features.

ACCOUNT CODE CAPABILITY

Multibutton Key Telephones can enter Account Code numbers of up to nine digits.

To assign an Account Code as you place a call:
- Lift handset.
- Place outside call.
- Dial # (within three seconds).
- Dial Account Code.

Calls are processed in the normal manner and recorded in chronological order at the SMDR printer.

ANSWERING A CALL

To answer a call:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

Display: LINE XX

BACKGROUND MUSIC

The telephone speaker may be used to broadcast Background Music.

To turn Background Music on or off:
- Press HOLD key.

To regulate the volume of Background Music for non-display telephones:
- Turn left volume control clockwise to decrease volume.
- Turn left volume control counterclockwise to increase volume.

To regulate the volume of Background Music for display telephones:
- Do not lift handset.
- Press VOL UP key to increase volume.
- Press VOL DN key to decrease volume.

BARGE IN

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

Your station may be permitted to Barge In (intrude into) conversations in progress. To initiate Barge In:
- Lift handset.
- Press INT key.
- Dial number for station (receive busy tone).

Display:

YYY BUSY

- Press DND/M.MUTE key. You will hear three short tones as you join the conversation.

In addition, your calls might be interrupted by certain stations authorized to Barge In. You will hear three short tone bursts as a Barge In occurs. Your station can be programmed during installation to block Barge In.

CALL FORWARDING

You can have all your calls automatically transferred to another station in the system.

To forward your calls to another station:
- Lift handset.
- Press C.FWD key.
- Dial number for destination station. Listen for acknowledgment tone.
- Hang up. C.FWD key will flash.

While in the Call Forwarding mode, your telephone will broadcast a short tone every two minutes. The following message is briefly displayed every time the tone occurs:

Display: | FORWARD TO YYY |

To cancel Call Forwarding:
- At your own telephone, press C.FWD key.

CALL PICKUP, DIRECTED

To answer an outside call you hear ringing at a nearby station:
- Lift handset.
- Press PARK key.
- Dial number of station that is ringing.

Display: | PICK-UP FROM YYY |

The ringing call can be answered only if it was transferred from another station in the system.

CALL PICKUP, GROUP

To answer a call that rings into your pickup group:
- Lift handset.
- Press flashing PKUP key.

Display: | PICK-UP FROM XXX |

Normally, you will receive ringing for all calls transferred to you, in addition to all calls programmed to ring at your station. You may also enable your telephone to ring for calls to other stations in your pickup group which do not normally ring on your telephone.

To receive ringing in the Pickup Group:
- Lift handset.
- Press INT key.
- Dial 1 plus 803.

To prevent ringing in the Pickup Group:
- Lift handset.
- Press INT key.
- Dial 1 plus 802.

CALL WAITING

Call Waiting, Attendant/Hotline Partner

When busy on another call, you may receive a signal that an Intercom call from the attendant or your Hotline partner is waiting to be answered. The Attendant/Hotline Partner Call Waiting signal is a double beep.

To answer an Attendant/Hotline Partner Call Waiting signal:
- Press the SPLIT key. Initial call put on Hold (if CO call).

To alternate between the call on Hold and the attendant/Hotline partner:
- Press the SPLIT key.

NOTE: If you are not automatically connected to the attendant or to your Hotline partner, you have a CO call waiting to be answered. Refer to Call Waiting, CO Call.

Call Waiting, CO Call

When busy on another call, you may receive a signal that an outside (CO) call is waiting to be answered. This call may be a call ringing in to your station, or a call transferred from another station. The CO Call Waiting indication is a double beep.

To answer a CO Call Waiting signal:
- Press flashing incoming Line key (keys 1-5). Initial call terminated.

OR

- If busy on CO call, press HOLD key. Initial call put on Hold.
- Press flashing Line key to answer waiting call.

NOTE: To alternate between two CO calls, use the Split feature.

CALLBACK

If you make an Intercom call to a busy station, you can automatically be alerted when that station becomes free.

To leave a Callback request:
- Press C.BACK key. Key is steadily illuminated.
- Hang up.

When the busy party becomes available, your telephone will ring and the C.BACK key will flash (slow flash).

Display: `CALL BACK ST YYY`

To answer the Callback:
- Lift handset.

To cancel the Callback:
- Press illuminated C.BACK key.

If you are busy on a call, a multibutton or four button station user can leave a Callback request on your telephone. You see this request as a flashing (fast) C.BACK key. When you hang up, the station which left the Callback will be signaled. If that station answers the signal, an Intercom call will be automatically placed to your station.

CONFERENCE

Conference permits a three-way telephone conversation. There are two types of conference features: **Add-On Conference** and **Line Conference.**

Add-On Conference

To add a second internal party to an outside call:
- Press INT key. Outside call automatically placed on Hold.
- Dial station number to be added to conference or press DSS key.

Display: `EXTENSION YYY`

- Announce conference.
- Press CONF key. Outside call reconnected.

To join an Add-On Conference, when announced:
- Lift handset.
- Press flashing line key.

If two multibutton telephones are joined in an Add-On Conference, the CONF key at both stations is steadily illuminated.

NOTE: If the invited party does not join the conference within 10 seconds, then the request for a conference is canceled.

Line Conference

To establish a conference call with two external lines:
- Place first call on Hold (press Hold key).
- Establish second call on another line.

Display: | LINE XX |

- Press CONF key to be connected to both external calls.

Your system may be set up so that each outgoing line key (keys 8-13) has been assigned to a different line group. To place and join in Conference two calls in the same line group (using the same outgoing line key):
- Place first call.
- Press CONF key. Call will move up to first available incoming line key.
- Press HOLD key.
- Place second call, using same outgoing key as for first call.
- Press CONF key. Conference is established.

DATE AND TIME

If you have a display telephone, it will show you the day of the week, month, date and time in the display window. This information displays continuously when the telephone is idle.

DIRECT INWARD LINES

Certain outside lines may ring directly into your station, without having to be transferred by the attendant. These Direct Inward Lines ring identically to transferred calls. Consult with the system attendant to find out which lines ring your station directly.

DIRECT STATION SELECTION

The first 14 buttons on your telephone can be used as Direct Station Selection (DSS) keys for one button access to selected stations. After your telephone is installed, you may select the station which corresponds to each DSS key. The DSS keys are initially assigned to stations 3Ø1-314.

NOTE: When assigning DSS numbers, do not allow more than six seconds to elapse between steps. If you do, you must begin the procedure again. Also, do not program more than one DSS key for the same station.

To program your 14 DSS keys:
- Do not lift handset or press HF key.
- Press OUT/MEM key. Key flashes.

Display: PROGRAM MEMORY

- Press DSS key (1-14). Key flashes.

Display: NUMBER TO BIN WW

- Dial *.
- Dial station number (3Ø1-363, 4Ø1-465) that will be assigned to the DSS key being programmed.
- Press bin key again (1-14).

Display: PROGRAM COMPLETE

To use your 14 Direct Station Selection (DSS) keys:
- Lift handset.
- Press INT key.
- Press DSS key (within six seconds) for station you wish to call.

Display: EXTENSION YYY

DISTINCTIVE RINGING

You can always differentiate between Intercom ringing and outside call ringing. Intercom ringing consists of a 1.5 second ring burst followed by a 2.5 second pause. Outside (and transferred) calls always ring with two short bursts followed by a pause. Intercom calls will ring only if Forced Intercom Ringing is enabled.

DO NOT DISTURB

Do Not Disturb allows you to block incoming calls. Only the attendant can override Do Not Disturb. While in the Do Not Disturb mode, you can still use your telephone to place and answer calls.

To enable DND:
- Press DND/M.MUTE key twice. Key flashes slowly.

To disable DND:
- Press DND/M.MUTE key. DND/M.MUTE key extinguishes.

If you call a station which is in the DND mode, the following display appears:

Display:

YYY DND

NOTE: Calls transferred from the attendant to an executive Hotline partner (lower station number) in Do Not Disturb are automatically transferred to the secretary/receptionist (higher station number).

FLASH

Flash allows you to obtain a new dial tone without losing control of your line.

To Flash the line:
- Do not hang up.
- Press incoming line key (key 1-5) presently in use.

FORCED INTERCOM RINGING

Forced Intercom Ringing causes all Intercom calls to ring multibutton and four button telephones, rather than be received in the Handsfree Answerback mode. Forced Intercom Ringing may be enabled throughout the entire system (by system programming), individually by the multibutton or four button station user, or as you place an Intercom call.

To force Intercom calls to multibutton and four button stations to ring (as you place the call):
- Lift handset.
- Press INT key.
- Dial 1, then station number.

To force all Intercom calls to your station to ring (i.e., enable Forced Intercom Ringing):
- Lift handset.
- Press INT key.
- Dial 1801.
- Hang up.

To cancel Forced Intercom Ringing (if you have enabled it):
- Lift handset.
Press INT key.
- Dial 1800.
- Hang up.

HANDSFREE (SPEAKERPHONE)

Handsfree (Speakerphone) operation allows the speaker and microphone inside the telephone to to be used for all calls, instead of the handset. If your telephone has an HF button, Handsfree operation is permitted.

To initiate Handsfree mode:
- Press HF key. HF key lights.

To return to handset operation:
- Lift handset. HF key extinguishes.

HANDSFREE ANSWERBACK

Handsfree Answerback allows Intercom calls to be answered using the speaker and microphone in the telephone, instead of the handset. Intercom calls to your station are normally received in the Handsfree Answerback mode. Handsfree Answerback cannot occur if Forced Intercom Ringing is enabled for the system, or if the call was placed using a leading 1.

HOLD

Exclusive Hold

The Exclusive Hold feature provides a Hold indication only at the telephone where the call was placed on Hold. The line does not appear on any other station in the system, and can be retrieved only at the station where the call was placed on Hold.

To place a call on Exclusive Hold:
- Press HOLD key.
- Hang up.

To return to the call:
- Lift handset.
- Press flashing line key.

NOTE: If the call is left on Hold longer than the Hold Recall interval, it will re-ring at your station. If still unanswered, it will ring the attendant.

HOTLINE

Hotline allows two stations to be directly connected for fast, efficient communication and call transfer.

To call Hotline partner:
- Lift handset.
- Press HL key.

To transfer an outside call to the Hotline partner:
- Press HL key.
- Announce call.
- Do not hang up.

Display: EXTENSION YYY

If your Hotline partner accepts the call:
- Hang up.

If your Hotline partner does not want to take the call:
- Press flashing line key to return to call.

If your Hotline partner would like the call in the Handsfree mode:
- Press HL key again.

If your Hotline partner is in Do Not Disturb or busy on a call, your HL key will be steadily illuminated. If you are the secretary/receptionist (higher station number) in a Hotline pair, you will receive a flashing line key and ringing for all calls transferred to your partner (lower station number).

NOTE: If you are the secretary in an executive/secretary Hotline partnership, a call transferred to you will indicate on your telephone as an Off Fluttering incoming line key. A call transferred to the executive will indicate on your telephone as an On Fluttering incoming line key.

Your system may be installed so that you are part of a Hotline group, rather than having a single Hotline partner. If you are the person in your group assigned as the secretary/receptionist, your station number will be the highest number. Any calls transferred from any other station in your group, using just the HL key, will ring your telephone. When any of the partners in the group press the HL key, they will be connected to you. The station that you reach by pressing your HL key is determined during installation.

INTERCOM

To place an Intercom call:
- Lift handset.
- Press INT key.
- Dial station number or press appropriate DSS key (1-14).

Display: | EXTENSION YYY |

If a single line or one button telephone telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call Handsfree unless programmed otherwise.

When an Intercom call is placed to your station, the display will show the station number of the calling party:

Display: | EXT YYY CALLING |

LAST NUMBER REDIAL

To use Last Number Redial:
- Press L# key (REDIAL on display telephone). Handsfree mode is automatically selected.

Display: | LINE XX |

- Lift handset if privacy is desired.

LEAST COST ROUTING

Least Cost Routing (LCR) automatically places your outgoing call on the least expensive available route. Check with the system attendant to see if you are required to use Least Cost Routing to place outgoing calls.

To place a call using Least Cost Routing:
- Lift handset.
- Press outgoing key 12 or 13 (key flashes).
- Dial number.

NOTE: Do not allow more than six seconds to elapse between the digits you dial, or you will have to start the sequence over again.

LINE QUEUING

You can queue (wait your turn) for an outside line when all lines in a group are busy. You will be connected to the first available line in the group that you queued on.

To queue for an outside line (when phone is idle):
- Do not lift handset.
- Press desired outgoing line key (keys 8-13).
- Press C.BACK key. Key illuminates.

Your telephone will ring and the C.BACK key will flash (medium flash) when a line is available.

Display: | CALL BACK CO XX |

To respond to a Line Queue:
- Lift handset and dial as usual. (If your have queued on an LCR key, LCR will redial your call automatically.

MESSAGE WAITING

A Message Waiting indication can be left at a called four button or multibutton station that does not answer.

To leave a Message Waiting:
- Press M.WAIT key. Acknowledgment tone heard.
- Hang up.

The called station will have a flashing M.WAIT key (flashing HLD/TRF key on four button station). In addition, the station at which the message is left will broadcast a tone every 2 minutes indicating that a message is waiting. Every time the tone is broadcast the following message is briefly displayed:

Display: `MSG FROM EXT YYY`

To respond to a Message Waiting indication:
- Lift handset.
- Press M.WAIT key.

Display: `EXTENSION YYY`

The station which placed the Message Waiting indication is automatically signaled.

To cancel a Message Waiting signal left at your telephone:
- Do not lift handset.
- Press M.WAIT key. LED extinguishes.

Since more than one message can be left at your station, canceling the first Message Waiting signal may not extinguish the LED. Continue to press the M.WAIT key until all messages have been canceled.

MICROPHONE CUTOFF/MICROPHONE MUTE

You can turn off the microphone in your telephone at any time.

To turn off the microphone:
- Press DND/MUTE key. Key flashes fast.

To turn the microphone back on:
- Press DND/MUTE key twice. LED extinguishes.

To turn the microphone back on while on a call (if you have turned it off):
- Press DND/MUTE key again. Key extinguishes.

MONITOR

Monitor allows you to dial and listen to the progress of a call without lifting the handset. This feature is also useful to listen to your call if it has been placed on Hold by the outside party. Monitor requires that you lift the handset to speak.

NOTE: If your telephone has a MON key (instead of a HF key), you have the Monitor feature.

To activate Monitor:
- Press MON key.

NIGHT SERVICE

Assigned Night Answer

When the attendant puts the system in the night mode (usually after normal business hours), Assigned Night Answer (ANA) automatically transfers ringing for incoming calls to specified stations. Your station may be one of those assigned to receive night mode ringing.

To answer a night mode call ringing at your telephone:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

Universal Night Answer

Universal Night Answer (UNA) allows you to answer calls that you hear ringing over the Paging system or external alerting device. UNA is activated when the attendant puts the system in the night mode.

To answer a night mode call ringing over the Paging system or external alerting device:
- Lift handset.
- Press flashing incoming line key (keys 1-5).

OR

- Lift handset.
- Press INT key.
- Dial 69.

PAGING

You can page the entire system (All Call) or just selected areas (Zone Page).

All Call Page

To initiate All Call Page:
- Lift handset.
- Press PAGE key.
- Make announcement.
- Hang up.

Zone Page

To initiate Zone Page:
- Lift handset.
- Press INT key.
- Dial desired zone (61-68).
- Make announcement.
- Hang up.

PARK

You can place an outside call in a parking orbit, page a third person and have that person pick up the parked call from any station in the system. There are two types of parking orbits: General Park and Personal Park. An unanswered parked call will re-ring the station which initially parked the call. If the returned call is unanswered, it will ring the attendant.

General Park Orbit

To place a call into a General Park Orbit:
- Press TRF key. Call automatically placed on Hold.
- Dial General Park Orbit code (5Ø-59). Acknowledgment tone audible.

Display:

CO TO ORBIT ZZ

NOTE: If an acknowledgment tone is not heard, that parking orbit is busy. Dial a different parking orbit code.

- Use Paging to announce call and orbit code (5Ø-59).
- Hang up.

To retrieve a call from General Park Orbit:
- Lift handset.
- Press PARK key.
- Dial announced General Park Orbit number (50-59).

Display: | CO FROM ORBIT ZZ |

Personal Park Orbit

Personal Park Orbit provides access to calls that are parked at a particular station. These calls may be answered from any other station by dialing the number of the station where the call is parked.

To Park a call at a station:
- Press TRF key. Internal dial tone audible.
- Dial number of station where call is to be parked.
- Press PAGE key (for All Call Page) or use Zone Page to announce call and station number.
- Hang up.

To retrieve a call from Personal Park Orbit:
- Lift handset.
- Press PARK key.
- Dial the number of the station at which the call was parked.

Display: | PICK-UP FROM YYY |

PLACING A CALL

To place an outside call:
- Lift handset.
- Press outgoing line key (keys 8-13).

Display: | LINE XX |

- Dial telephone number.

Display: | DIGITS |

Display: COST $VV.VV

You may be permitted to access outgoing lines that are not normally available using your outgoing line keys (keys 8-13).

To access lines not available on your outgoing line keys:
- Lift handset.
- Press INT key.
- Dial line group (9Ø-99).

Display: LINE XX

NOTE: Dialing 91-99 accesses line groups 1 through 9. Dialing 90 accesses line group 1Ø.

PRIVATE LINE

A Private Line is a line reserved exclusively for your use when placing a call. Other stations in the system cannot use this line for outgoing calls. In addition, your Private Line may be programmed to ring only on your telephone.

To place or answer a call using your Private Line:
- Lift handset.
- Press incoming line key 5.

Display: LINE XX

NOTE: When the system is in the night mode, your Private Line will not ring over the external speakers or external alerting device.

SAVE

The Save feature stores a frequently called number for automatic dialing at a later time.

To Save a number:
- Lift handset.
- Select outgoing line key.

Display: LINE XX

- Dial number.

Display: DIGITS

- Press SAVE key after digits are dialed or while engaged on call.
- Hang up.

To redial a Saved number:
- Press SAVE key. Handsfree mode is automatically selected.
- Lift handset if privacy is desired.

The call will go out on the highest numbered line in the line group used for the initial call.

SPEED DIAL

The system utilizes two types of memory dialing: Station Speed Dial and System Speed Dial.

Station Speed Dial

The initial 5Ø stations in the system can be programmed for individual speed dialing by using the first 14 keys as bin storage locations. Each bin can store one telephone number, with a maximum of 16 digits. Pauses count as a digit and are stored by dialing #.

To store Station Speed Dial numbers:
- Press OUT/MEM key. Key flashes.+

Display: | PROGRAM MEMORY |

- Press bin (1-14) where number is to be stored. Key flashes.

Display: | NUMBER TO BIN WW |

- Dial number to be stored.
- Press bin key again. Key stops flashing.

Display: | PROGRAM COMPLETE |

+ The system normally uses line group 1 to place all Station Speed Dial calls. If you want to preselect a special line group to be used whenever the bin is accessed, press an outgoing line key in the desired group before pressing the OUT/MEM key. If LCR is installed, the line will be selected for you.

To dial Station Speed Dial numbers:
- Lift handset.
- Press OUT/MEM key.
- Press bin (1-14) where number was stored.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

System Speed Dial

Up to 100 frequently-dialed numbers can be programmed by the main attendant and are available to every station.

To dial the stored System Speed Dial numbers:
- Lift handset.
- Press INT key.
- Dial code (800-899) for desired System Speed Dial number.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

Chaining Bins

Speed Dial bins may be chained to allow dialing of numbers longer than 16 digits.

Manually Chaining Station Speed Dial Bins

To manually chain Station Speed Dial Bins:
- Lift handset.
- Press OUT/MEM key.
- Sequentially press bins to be chained (within six seconds).

A maximum of two bins may be chained.

Chaining a Station Speed Dial Bin to a Manually Dialed Number

To use a manually dialed number with a Station Speed Dial bin:
- Lift handset.
- Press OUT/MEM key.
- Press appropriate bin key. Let number dial out.
- Manually dial second number.

NOTE: This can be done only from unrestricted telephones (Class of Service 0).

Chaining System Speed Dial Bins

You can select up to four System Speed Dial bins to be chained, in any order.

To chain System Speed Dial bins:
- Lift handset.
- Press INT key.
- Dial 8*.
- Dial System Speed Dial bins to be chained (00-99).
- Dial * to end sequence.

Display:	LINE XX

Display:	DIGITS

Display:	COST $VV.VV

Chaining System and Station Speed Dial Bins

Up to three Station Speed Dial bins can be automatically chained to a System Speed Dial bin.

To chain a System Speed Dial bin to Station Speed Dial bins:
- Lift handset.
- Press INT key.
- Dial 8 *.
- Dial bin (ØØ-99) for desired System Speed Dial number.
- Dial #.
- Dial desired bin (Ø1-14). (Do not press bin keys.)
- If another station bin is to be chained, press # between the bin numbers.
- Dial * to end sequence.

Display: LINE XX

Display: DIGITS

Display: COST $VV.VV

Chaining a System Speed Dial Bin to a Manually Dialed Number

You may be able to manually dial a number after a System Speed Dial number:
- Dial System Speed Dial number.
- When system bin has dialed out, manually dial number (within six seconds).

SPLIT

Split allows you to alternate between two CO calls.

While you are on an outside call, a CO Call Waiting tone may alert you that another outside call is waiting.

To talk to the second caller:
- Press HOLD key to put first call on Hold.
- Press flashing line key to answer second call.

To alternate between the two outside calls:
- Press SPLIT.

TRANSFER

You can transfer a call to someone else by one of two methods: Screened (Announced), or Unscreened (Unannounced).

Screened (Announced) Transfer

To Transfer a screened call:
- Press TRF key.
- Dial number (or press DSS key) for station to receive transfer.

Display: | EXTENSION YYY |

- Announce call and wait for reply.
- If party accepts the transfer, hang up.

If the party does not take the call, do not hang up. You must press the flashing line key to return to the call.

Unscreened (Unannounced) Transfer

To Transfer an unscreened call:
- Press TRF key.
- Dial number (or press DSS key) for station to receive transfer.
- Wait two seconds (to send Call Waiting tones).

Display: | EXTENSION YYY |

- Hang up.

If the party does not take the call, the call will be returned to you. Press the flashing line key to return to the call.

VOLUME CONTROL

Two volume control thumbwheels are located on the front edge of the telephone. The left thumbwheel is used to adjust the volume of the Page Receive, Splash Tone, Ring Tone and Background Music (BGM). The right thumbwheel controls the volume of incoming Handsfree Answerback and Handsfree conversations. To increase volume, turn the thumbwheels counterclockwise. On display telephones, volume is controlled by the VOL UP and VOL DN keys.

APPENDIX C
OPERATIONAL SPECIFICATION
FOR
TCX-128 FOUR BUTTON KEY TELEPHONE

TABLE OF CONTENTS

NOTE: Wherever these instructions tell you to lift handset, you may press the MON key instead. Refer to the Monitor feature.

ACCOUNT CODE CAPABILITY

Four Button Key Telephones may enter Account Code numbers, of up to nine digits.

To assign an account code as you place a call:
- Lift handset.
- Place outside call.
- Dial # (within three seconds).
- Dial Account Code.

Calls are processed in the normal manner and recorded in chronological order at the SMDR printer.

ANSWERING A CALL

To answer a call:
- Lift handset.

BACKGROUND MUSIC

The telephone speaker may be used to broadcast Background Music.

To turn Background Music on or off:
- Press the HLD/TRF key.

To regulate the volume of Background Music:
- Turn left volume control clockwise to decrease volume.
- Turn left volume control counterclockwise to increase volume.

BARGE IN

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

Your calls may be interrupted by certain stations that are programmed during installation to Barge In. You will hear three short tone bursts as a Barge In occurs. Your station may be programmed during installation to block Barge In.

CALL PICKUP, DIRECTED

To answer an outside call you hear ringing at a nearby station:
- Lift handset.
- Dial # #.
- Dial number of station that is ringing.

The ringing call may be answered only if it was transferred from another station in the system.

CALL PICKUP, GROUP

To pick up an outside call you hear ringing at another station in your Pickup Group:
- Lift handset.
- Press flashing PKUP/CONF key.

The ringing call may be answered only if it was transferred from another station in the system.

Normally, you will receive ringing for all calls transferred to you, in addition to all calls programmed to ring at your station. You may also enable your telephone to ring for calls to other stations in your pickup group which do not normally ring on your telephone.

To receive ringing in the Pickup Group:
- Lift handset.
- Dial 1 plus 803.

To prevent ringing in the Pickup Group:
- Lift handset.
- Dial 1 plus 802.

CALL WAITING

Call Waiting, Attendant

When busy on a call, you may receive a signal that an Intercom call from the attendant is waiting to be answered. The Attendant Call Waiting indication is a double beep.

To answer an Attendant Call Waiting signal:
- Press HLD/TRF key. You are connected to the attendant. (Outside call will be put on Hold. Intercom call will be dropped.)

NOTE: If you hear dial tone after pressing the HLD/TRF key, the Call Waiting signal was from an incoming CO call. Refer to CO Call Waiting.

To return to the initial outside call on Hold:
- Press HLD/TRF key.

To alternate between the initial outside call and the attendant:
- Press HLD/TRF key.

Call Waiting, CO Call

When busy on a call, you may receive a signal that an outside (CO) call is waiting to be answered. This call may be a call ringing into your station or a call transferred from another station. The CO Call Waiting indication is a double beep.

To answer a CO Call Waiting signal:
- Press HLD/TRF key.
- When you hear dial tone, hang up.+
- When telephone rings, lift handset. You are connected to waiting call.

To answer a CO Call Waiting signal, if you are part of a Pickup Group:
- Press HLD/TRF key.
- When you hear dial tone, press flashing PKUP/CONF key.+

If the initial call was a CO call, it will be put on Hold. If the initial call was an Intercom call, it will be dropped.

+If the Call Waiting signals are from the attendant, you will not hear dial tone and you will be automatically connected to the attendant.

NOTE: To alternate between two CO calls, use the Split feature.

CALLBACK

If you make an Intercom call to a busy station, you may automatically be alerted when that station becomes free.

To initiate Callback:
- Press MW/CB key. LED illuminates.
- Hang up.

When the busy station becomes available, your telephone will ring and your MW/CB key will flash (slow flash).

To answer Callback:
- Lift handset.

You are connected automatically to the called station.

If you are busy on a call, a multibutton or four button station user may leave a Callback request on your telephone. You see this request as a flashing (fast) MW/CB key. When you hang up, the station which left the Callback will be signalled. If that station answers the signal, an Intercom call will be automatically placed to your station.

CONFERENCE

Conference permits a three-way telephone conversation. There are two types of Conference features: Add-On Conference and Line Conference.

Add-On Conference

To add a second internal party to an outside call:
- Press HLD/TRF key. Outside call placed on Hold. Internal dial tone audible.
- Dial internal station number to be added to conference.
- Announce conference.
- Press PKUP/CONF key. All three parties are connected. +

To join a conference (when announced), a Four Button Key telephone user must press the PKUP/CONF key within 10 seconds.

Line Conference

To create a conference call with two external lines:
- Press HLD/TRF key. First call placed on Hold.
- Establish second call on another line.
- Press PKUP/CONF key. +
- Announce conference. All three parties are connected.

+Do not answer another incoming call while a conference is being established. As the most recent call, this call would be included in the conference instead of the intended call.

DIRECT INWARD LINES

Certain outside lines may ring directly into your station without having to be transferred by the attendant. These Direct Inward Lines ring identically to transferred calls. Consult with the system attendant to find out which lines ring your station directly.

DISTINCTIVE RINGING

You may always differentiate between Intercom ringing and outside call ringing. Intercom ringing consists of a 1.5 second ring burst followed by a 2.5 second pause. Outside (and transferred) calls always ring with two short bursts followed by a pause. Intercom calls will ring only if Forced Intercom Ringing is enabled.

FORCED INTERCOM RINGING

Forced Intercom Ringing causes all Intercom calls to ring multibutton and four button telephones, rather than be received in the Handsfree Answerback mode. Forced Intercom Ringing may be enabled throughout the entire system (by system programming), individually by the multibutton or four button station user, or as you place an Intercom call.

To force Intercom calls to multibutton and four button stations to ring (as you place the call):
- Lift Handset.
- Dial 1, then station number.

To force all Intercom calls to your station to ring (i.e., enable Forced Intercom Ringing):
- Lift handset.
- Dial 181.
- Hang up.

To cancel Forced Intercom Ringing (if you have enabled it):
- Lift handset.
- Dial 180Ø.
- Hang up.

HANDSFREE ANSWERBACK

Handsfree Answerback allows Intercom calls to be answered using the speaker and microphone in the telephone, instead of the handset. Intercom calls to your station are normally received in the Handsfree Answerback mode. Handsfree Answerback cannot occur if Forced Intercom Ringing is enabled for the system, or if the call was placed using a leading 1.

HOLD

Exclusive Hold

To place a call on Exclusive Hold:
- Press HLD/TRF key.
- Hang up.

To return to the call:
- Lift Handset.
- Dial *.

NOTE: If the call is left on Hold longer than the Hold Recall interval, the call will re-ring at your station. If still unanswered, it will ring the attendant.

INTERCOM

To place an Intercom call:
- Lift handset or press MON key.
- Dial station number (301-363, 401-465, 0 for attendant).

If you use the MON key to place an Intercom call, you must lift the handset to talk.

If a single line or one button telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call Handsfree unless programmed otherwise.

LAST NUMBER REDIAL

The last number dialed is placed in memory and may be redialed automatically.

To initiate Last Number Redial:
- Lift handset.
- Dial #.
- Dial 1.

LEAST COST ROUTING

Least Cost Routing (LCR) automatically places your outgoing call on the least expensive available route. Check with the system attendant to see if you are required to use Least Cost Routing to place outgoing calls. If LCR is installed, you will not be able to access a specific line group (90-99) to place a call.

To place a call using Least Cost Routing:
- Lift handset.
- Dial 9.
- Dial number.

NOTE: Do not allow more than six seconds to elapse between the digits you dial, or you will have to start the sequence over again.

LINE QUEUING

You may queue (wait your turn) for an outside line when all lines in a group are busy.

To queue for an outside line when you access an outside line group and receive a busy signal:
- Press MW/CB key. LED illuminates.
- Hang up.

The MW/CB LED will flash (medium flash) and your telephone will ring when a line is available.

When your telephone rings:
- Lift handset.
- Dial number.

If you do not answer the Line Queuing ring within 1Ø seconds, your queue will be canceled.

MESSAGE WAITING

A Message Waiting indication may be left at a called station that does not answer.

If you have made an Intercom call and there is no answer:
- Press MW/CB key.
- Hang up.

The station given a Message Waiting signal will have a flashing HLD/TRF key and will emit a tone every two minutes.

To respond to a Message Waiting indication at your telephone:
- Lift handset.
- Press flashing HLD/TRF key.

The station leaving the Message Waiting is automatically signaled. If the HLD/TRF key continues to flash, then another message is still waiting.

You may cancel a Message Waiting signal left at your telephone:
- Do not lift handset or press MON key.
- Press flashing HLD/TRF key.

MONITOR

Monitor allows you to dial and listen to the progress of a call without lifting the handset. This feature is also useful to listen to your call if it has been placed on Hold by the outside party. Monitor requires that you lift the handset to speak.

To activate Monitor:
- Press MON key.

NIGHT SERVICE

Assigned Night Answer

When the attendant puts the system in the night mode (usually after normal business hours), Assigned Night Answer (ANA) automatically transfers ringing for incoming calls to specified stations. Your station may be one of those assigned to receive night mode ringing.

To answer a night mode call ringing at your telephone:
- Lift handset.

Universal Night Answer

Universal Night Answer (UNA) allows you to answer calls that you hear ringing over the Paging system or external alerting device. UNA is activated when the attendant puts the system in the night mode.

To answer a call ringing over the Paging system or external alerting device:
- Lift handset.
- Dial 69.

PAGING

You may page the entire system (All Call) or just selected areas (Zone Page).

All Call Page

To initiate All Call Page:
- Lift handset.
- Dial 6Ø.
- Make announcement.
- Hang up.

Zone Page

To initiate Zone Page:
- Lift handset.
- Dial desired zone (61-68).
- Make announcement.
- Hang up.

PARK

You may place an outside call in a parking orbit, page a third person and have that person pick up the parked call from any station in the system. There are two types of parking orbits: General Park and Personal Park. An unanswered parked call will re-ring the station which initially parked the call. If the returned call is unanswered, it will ring the attendant.

General Park Orbit

To place a call into a General Park Orbit:
- Press HLD/TRF key. Intercom dial tone audible.
- Dial General Park Orbit code (5Ø-59). Acknowledgement tone audible.
- Press HLD/TRF key. Internal dial tone audible.
- Dial 6Ø (All Call), 61-68 (Zone Page).
- Announce call and orbit code (5Ø-59).
- Hang up.

NOTE: If an acknowledgement tone is not heard, that parking orbit is busy. Dial a different parking orbit.

To retrieve a call from General Park Orbit:
- Lift handset.
- Dial announced General Park Orbit code (5Ø-59).

Personal Park Orbit

Personal Park Orbit provides access to calls that are parked at a particular station. These calls may be answered from any other station by dialing the number of the station where the call is parked.

To Park a call at a station:
- Press HLD/TRF key. Internal dial tone audible.
- Dial number of station where call is to be parked.
- Press HLD/TRF key. Internal dial tone audible.
- Dial 6Ø (All Call), 61-68 (Zone Page) and announce call and station number.
- Hang up.

To retrieve a call from Personal Park Orbit:
- Lift handset.
- Dial # #.
- Dial the number of the station where the call was parked.

PLACING A CALL

To place an outside call (if LCR is not installed):
- Lift handset. Dial tone audible.
- Dial 9.
- Dial line group number (0-9) to get dial tone.+
- Dial telephone number.

+Line groups 1-9 are accessed by dialing 91-99. Line group 10 is accessed by dialing 90.

SPEED DIAL

The system utilizes two types of speed dialing: Station Speed Dial and System Speed Dial.

Station Speed Dial

Up to 10 frequently dialed numbers may be stored per station, with 16 digits maximum per number. Pauses count as a digit and are stored by dialing #. Only the first 50 stations in the system have access to Station Speed Dial.

To store Station Speed Dial numbers:
- Lift handset.
- Dial # 7.
- Dial line group (0-9).+
- Dial bin 0-9 (10 storage locations).
- Dial number to be stored (maximum 16 digits).+
- Dial *.

+Dialing 1-9 stores line groups 1-9. Dialing 0 stores line group 10. If LCR is installed, the system overrides the line group assignment you have made and places the call on the least expensive available route.

To use your Station Speed Dial:
- Lift handset.
- Dial 7.
- Dial 0-9 (bin where desired number was stored).

System Speed Dial

Up to 100 frequently-dialed numbers may be programmed into system memory by the attendant and may be made available to every station in the system (unless limited by Class of Service or Toll Restriction). Only the attendant may program or change System Speed Dial numbers.

To use System Speed Dial numbers:
- Lift handset. Dial tone audible.
- Dial desired code (800-899).

Chaining System Speed Dial Bins

You can select up to four System Speed Dial bins to be chained, in any order.

To chain System Speed Dial bins:
- Lift handset.
- Dial 8*.
- Dial System Speed Dial bins to be chained (00-99).
- Dial * to end sequence.

SPLIT

Split allows you to automatically place your first call on Hold and answer a second incoming call. While you are on an outside call, a Call Waiting tone will alert you that another outside call is waiting.

To talk to the second caller:
- Press HLD/TRF key. First call placed on Hold.
- Hang up.
- When telephone rings, lift handset.

You may alternate between two outside calls as follows:
- Press HLD/TRF key.
- Dial *.

TRANSFER

You may Transfer a call by one of two methods: Screened (Announced) or Unscreened (Unannounced).

Screened (Announced) Transfer

To Transfer a screened call:
- Press HLD/TRF key.
- Dial station number to receive call.
- Announce call.

If the party accepts the Transfer:
- Hang up.

If the party does not take the call, then return to the outside call as follows:
- Press HLD/TRF key.
- Dial # #.
- Dial number of station that was to receive Transfer.

If the called party responds to your announcement using the handset (and hangs up before you can retrieve the call), then return to the call as follows:
- Press HLD/TRF key.
- Dial *.

Unscreened (Unannounced) Transfer

To Transfer an unscreened call:
- Press HLD/TRF key.
- Dial station number to receive transfer.
- Wait 2 seconds (to send Call Waiting tones).
- Hang up.

If the party does not take the call, the call will be returned to you.

VOLUME CONTROLS

Two volume control thumbwheels are located on the front edge of the telephone. The left thumbwheel is used to adjust the volume of the Page Receive, Splash Tone, Ring Tone, and Background Music (BGM). The right thumbwheel controls the volume of incoming Handsfree Answerback conversations. To increase volume turn the thumbwheels counterclockwise.

APPENDIX D
OPERATIONAL SPECIFICATION
FOR
TCX-128 ONE BUTTON SINGLE LINE TELEPHONE

TABLE OF CONTENTS

ACCOUNT CODE CAPABILITY

Single Line One Button Telephones can enter Account Code numbers of up to nine digits.

To assign an account code as you place a call:
- Lift handset.
- Place outside call.
- Dial # (within three seconds).
- Dial Account Code.

Calls are processed in the normal manner and recorded in chronological order at the SMDR printer.

ANSWERING A CALL

To answer a call:
- Lift handset.

BARGE IN

> **CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.**

Your calls can be interrupted by certain stations that are programmed during installation to Barge In. You will hear three short tone bursts as a Barge In occurs. During system installation, your station may be programmed to block Barge In.

CALL PICKUP, DIRECTED

To answer an outside call you hear ringing at a nearby station:
- Lift handset.
- Dial # #.
- Dial number of station that is ringing.

The ringing call can be answered only if it was transferred from another station in the system.

CALL PICKUP, GROUP

To pick up an outside call you hear ringing at another station in your Pickup Group:
- Lift handset.
- Dial 22.

The ringing call can be answered only if it was transferred from another station in the system.

CALL WAITING

Call Waiting, Attendant

When busy on a call, you may receive a signal that an Intercom call from the attendant is waiting to be answered. The Attendant Call Waiting indication is a double beep.

To answer an Attendant Call Waiting signal:
- Press HOLD/TRANSFER bar. (Outside call will be put on Hold. Intercom call will be dropped.)

If the attendant is not busy on another call, you will be directly connected.

NOTE: If you hear dial tone after you press and release hookswitch, Call Waiting signal was from an incoming CO call, not from the attendant. See CO Call Waiting.

To return to the initial outside call on Hold:
- Press HOLD/TRANSFER bar.

To alternate between the initial outside call and the attendant:
- Press HOLD/TRANSFER bar.

Call Waiting, CO Call

When busy on another call, you may receive a signal that an outside (CO) call is waiting to be answered. This call can be a call ringing into your station or a call transferred from another station. The CO Call Waiting indication is a double beep.

To answer a CO Call Waiting signal:
- Hang up. Initial call terminated.
- When telephone rings, lift handset. You will be connected to the waiting call.

OR

- Press HOLD/TRANSFER bar. First call (if CO call) will be placed on Hold.
- Hang up.
- When telephone rings, lift handset.

NOTE: To alternate between the two calls, use the Split feature.

CALLBACK

If you are busy on a call, a multibutton or four button station user can leave a Callback request on your telephone. When you hang up, the station which left the Callback will be signaled. If that station answers the signal, an Intercom call will be automatically placed to your station.

CONFERENCE

Add-On Conference

The Single Line One Button Telephone cannot initiate conference calls; however, it can be included in an Add-On Conference initiated from a multibutton or four button telephone.

To join an Add-On Conference:
- Stay on line after conference is announced.

DIRECT INWARD LINES

Certain outside lines may ring directly into your station, without having to be transferred by the attendant. These Direct Inward Lines ring identically to transferred calls. Consult with the system attendant to find out which lines ring your station directly.

DISTINCTIVE RINGING

The system may be programmed to allow you to differentiate Intercom ringing from outside call ringing. Normally, Intercom and outside call ringing consists of a 1.5 second ring burst followed by a 4.5 second pause. If your system has Distinctive Ringing enabled, outside calls will ring with two short bursts followed by a pause. Intercom calls will ring with a 1.5 second ring burst followed by a 4.5 second pause.

FORCED INTERCOM RINGING

Forced Intercom Ringing causes all Intercom calls to ring multibutton and four button telephones, rather than be received in the Handsfree Answerback mode. Forced Intercom Ringing can be enabled throughout the entire system (by system programming), individually by the multibutton or four button station user, or as you place an Intercom call.

To force Intercom calls to multibutton and four button stations to ring (as you place the call):
- Lift Handset.
- Dial 1, then station number.

The called party must lift the handset to talk.

HOLD

Exclusive Hold

To place a call on Exclusive Hold:
- Press HOLD/TRANSFER bar.

To return to the call:
- Press HOLD/TRANSFER bar.
- Dial *.

NOTE: If the call is left on Hold longer than the Hold Recall interval, the call will re-ring at your station. If still unanswered, it will ring the attendant.

INTERCOM

To place an Intercom call:
- Lift handset.
- Dial station number (301-363, 401, 402-465, or 0 for attendant).

If a single line or one button telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call in the Handsfree Answerback mode unless programmed otherwise.

LAST NUMBER REDIAL

The last number dialed is placed in memory and can be redialed automatically.

To initiate Last Number Redial:
- Lift handset.
- Dial #.
- Dial 1.

LEAST COST ROUTING

Least Cost Routing (LCR) automatically places your outgoing call on the least expensive available route. Check with the system attendant to see if you are required to use Least Cost Routing to place outgoing calls. If LCR is installed, you will not be able to access a specific line group (90-99) to place a call.

To place a call using Least Cost Routing:
- Lift Handset.
- Dial 9.
- Dial number (with less than six seconds between digits).

NIGHT SERVICE

Assigned Night Answer

When the attendant puts the system in the night mode (usually after normal business hours), Assigned Night Answer (ANA) automatically transfers ringing for incoming calls to specified stations. Your station may be one of those assigned to receive night mode ringing.

To answer a night mode call ringing at your telephone:
- Lift handset.

Universal Night Answer

Universal Night Answer (UNA) allows you to answer calls that you hear ringing over the Paging system or external alerting device. UNA is activated by the attendant, usually after normal business hours.

To answer a call ringing over the Paging system or external alerting device:
- Lift handset.
- Dial 69.

PAGING

You can page the entire system (All Call) or just selected areas (Zone Page).

All Call Page

To initiate All Call Page:
- Lift handset.
- Dial 60.
- Make announcement.
- Hang up.

Zone Page

To initiate Zone Page:
- Lift handset.
- Dial desired zone (61-68).
- Make announcement.
- Hang up.

PARK

You can place an outside call in a parking orbit, page a third person, and have that person pick up the parked call from any station in the system. There are two types of parking orbits: General Park and Personal Park. An unanswered parked call will re-ring the station which initially parked the call. If the returned call is unanswered, it will ring the attendant.

General Park Orbit

To place a call into a General Park Orbit:
- Press HOLD/TRANSFER bar, Intercom dial tone is audible.
- Dial General Park Orbit code (50-59). Acknowledgment tone heard.
- Press HOLD/TRANSFER bar. Intercom dial tone is audible.
- Dial 60 (All Call), 61-68 (Zone Page).
- Announce call and orbit code (50-59).
- Hang up.

NOTE: If the acknowledgment tone is not heard after dialing a General Park Orbit code, that orbit is busy. Dial another orbit code.

To retrieve a call from General Park Orbit:
- Lift handset.
- Dial announced General Park Orbit code (50-59).

Personal Park Orbit

Personal Park Orbit provides access to calls that are parked at a particular station. These calls can be answered from any other station by dialing the number of the station where the call is parked.

To Park a call at a station:
- Press HOLD/TRANSFER bar. Intercom dial tone audible.
- Dial number of station where call is to be Parked.
- Press HOLD/TRANSFER bar. Intercom dial tone audible.
- Dial 60 (All Call), 61-68 (Zone Page).
- Announce call and station number.
- Hang up.

To retrieve a call from Personal Park Orbit:
- Lift handset.
- Dial # #.
- Dial the number of the station at which the call was parked.

PLACING A CALL

To place an outside call (if LCR is not installed):
- Lift handset.
- Dial 9.
- Dial line group number (Ø-9) to get dial tone.+
- Dial telephone number.

+Line groups 1-9 are accessed by dialing 91-99. Line group 1Ø is accessed by dialing 9Ø.

SPEED DIAL

The system utilizes two types of Speed Dial: Station Speed Dial and System Speed Dial.

Station Speed Dial

Up to 1Ø frequently-dialed numbers may be stored per station with 16 digits maximum per number. Pauses count as a digit and are stored by dialing #. Only the first 5Ø stations in the system have access to Station Speed Dial.

To store Station Speed Dial numbers:
- Lift handset. Dial tone audible.
- Dial # 7.
- Dial line group (Ø-9)+.
- Dial bin Ø-9 (1Ø storage locations).
- Dial number to be stored (maximum 16 digits).
- Dial *.

+Dialing 1-9 stores line groups 1-9. Dialing Ø stores line group 1Ø. If LCR is installed, the system overrides the line group assignment you have made and places the call on the cheapest available route.

To use your Station Speed Dial:
- Lift handset.
- Dial 7.
- Dial Ø-9 (bin where desired number was stored).

System Speed Dial

Up to 1ØØ frequently-dialed numbers can be programmed into system memory by the attendant and can be made available to every station in the system (unless limited by Class of Service or Toll Restriction). Only the attendant can program or change System Speed Dial numbers.

To dial a System Speed Dial number:
- Lift handset. Dial tone is audible.
- Dial desired code (8ØØ-899).

Chaining System Speed Dial Bins

You can select up to four System Speed Dial bins to be chained, in any order.

To chain System Speed Dial bins:
- Lift handset.
- Dial 8*.
- Dial System Speed Dial bins to be chained (00-99).
- Dial * to end sequence.

SPLIT (Alternate)

With Split you can automatically place your first call on Hold and answer a second incoming call. While you are on an outside call, a Call Waiting tone will alert you that another outside call is waiting.

To talk to the second caller:
- Press HOLD/TRANSFER bar. First call placed on Hold.
- Hang up.
- When telephone rings, lift handset to talk to second caller.

You can alternate between two outside calls as follows:
- Press HOLD/TRANSFER bar.
- Dial *.

TRANSFER

You can Transfer a call by one of two methods: Screened (Announced) or Unscreened (Unannounced).

Screened (Announced) Transfer

To Transfer a screened call:
- Press HOLD/TRANSFER bar.
- Dial destination station number.
- Announce call.

If the party accepts the transfer:
- Hang up.

If the party does not take the call, then return to the outside call as follows:
- Press HOLD/TRANSFER bar.
- Dial # #.
- Dial number of station that was to receive transfer.

If the called party responds to your announcement using the handset (and hangs up before you can retrieve the call), then return to the call as follows:
- Press HOLD/TRANSFER bar.
- Dial *.

Unscreened (Unannounced) Transfer

To Transfer an unscreened call:
- Press HOLD/TRANSFER bar. Call placed on Hold.
- Dial destination station number.
- Hang up.

If the party does not take the call, the call will ring back to you.

APPENDIX E
OPERATIONAL SPECIFICATION
FOR
TCX-128 SINGLE LINE (2500 TYPE) TELEPHONE

TABLE OF CONTENTS

NOTE: When the instructions say Flash, press hookswitch for one second and release.

ACCOUNT CODE CAPABILITY

Single line (25ØØ type) telephones can enter Account Code numbers of up to nine digits.

To assign an account code as you place a call:
- Lift handset.
- Place outside call.
- Dial # (within three seconds).
- Dial Account Code.

Calls are processed in the normal manner and recorded in chronological order at the SMDR printer.

ANSWERING A CALL

To answer a call:
- Lift handset.

BARGE IN

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

Your calls can be interrupted by certain stations that are programmed during installation to Barge In. You will hear three short tone bursts as a Barge In occurs. During system installation, your station may be programmed to block Barge In.

CALL PICKUP, DIRECTED

To answer an outside call you hear ringing at a nearby station:
- Lift handset.
- Dial # #.
- Dial number of station that is ringing.

The ringing call can be answered only if it was transferred from another station in the system.

CALL PICKUP, GROUP

To pick up an outside call you hear ringing at another station in your Pickup Group:
- Lift handset.
- Dial 22.

The ringing call can be answered only if it was transferred from another station in the system.

CALL WAITING

Call Waiting, Attendant

When busy on a call, you may receive a signal that an Intercom call from the attendant is waiting to be answered. The Attendant Call Waiting indication is a double beep.

To answer an Attendant Call Waiting signal:
- Flash. (Outside call will be put on Hold. Intercom call will be dropped.)

If the attendant is not busy on another call, you will be directly connected.

NOTE: If you hear dial tone after you press and release hookswitch, Call Waiting signal was from an incoming CO call, not from the attendant. See CO Call Waiting.

To return to the initial outside call on Hold:
- Flash.

To alternate between the initial outside call and the attendant:
- Flash.

Call Waiting, CO Call

When busy on another call, you may receive a signal that an outside (CO) call is waiting to be answered. This call can be a call ringing into your station or a call transferred from another station. The CO Call Waiting indication is a double beep.

To answer a CO Call Waiting signal:
- Hang up. Initial call terminated.
- When telephone rings, lift handset. You will be connected to the waiting call.

OR

- Flash. First call (if CO call) will be placed on Hold.
- Hang up.
- When telephone rings, lift handset.

NOTE: To alternate between the two calls, use the Split feature.

CALLBACK

If you are busy on a call, a multibutton or four button station user can leave a Callback request on your telephone. When you hang up, the station which left the Callback will be signaled. If that station answers the signal, an Intercom call will be automatically placed to your station.

CONFERENCE

Add-On Conference

The single line (25ØØ type) telephone cannot initiate conference calls; however, it can be included in an Add-On Conference initiated from a multibutton or four button telephone.

To join an Add-On Conference:
- Stay on line after conference is announced.

DIRECT INWARD LINES

Certain outside lines may ring directly into your station, without having to be transferred by the attendant. These Direct Inward Lines ring identically to transferred calls. Consult with the system attendant to find out which lines ring your station directly.

DISTINCTIVE RINGING

The system may be programmed to allow you to differentiate Intercom ringing from outside call ringing. Normally, Intercom and outside call ringing consists of a 1.5 second ring burst followed by a 4.5 second pause. If your system has Distinctive Ringing enabled, outside calls will ring with two short bursts followed by a pause. Intercom calls will ring with a 1.5 second ring burst followed by a 4.5 second pause.

FORCED INTERCOM RINGING

Forced Intercom Ringing causes all Intercom calls to ring multibutton and four button telephones, rather than be received in the Handsfree Answerback mode. Forced Intercom Ringing can be enabled throughout the entire system (by system programming), individually by the multibutton or four button station user, or as you place an Intercom call.

To force Intercom calls to multibutton and four button stations to ring (as you place the call):
- Lift Handset.
- Dial 1, then station number.

The called party must lift the handset to talk.

HOLD

Exclusive Hold

To place a call on Exclusive Hold:
- Flash.

To return to the call:
- Flash.
- Dial *.

NOTE: If the call is left on Hold longer than the Hold Recall interval, the call will re-ring at your station. If still unanswered, it will ring the attendant.

INTERCOM

To place an Intercom call:
- Lift handset.
- Dial station number (3Ø1-363, 4Ø1, 4Ø2-465, or Ø for attendant).

If a single line or one button telephone is called, it will ring. If the station called is a multibutton or four button telephone, it will receive your call in the Handsfree Answerback mode unless programmed otherwise.

LAST NUMBER REDIAL

The last number dialed is placed in memory and can be redialed automatically.

To initiate Last Number Redial:
- Lift handset.
- Dial #.
- Dial 1.

LEAST COST ROUTING

Least Cost Routing (LCR) automatically places your outgoing call on the least expensive available route. Check with the system attendant to see if you are required to use Least Cost Routing to place outgoing calls. If LCR is installed, you will not be able to access a specific line group (9Ø-99) to place a call.

To place a call using Least Cost Routing:
- Lift Handset.
- Dial 9.
- Dial number (with less than six seconds between digits).

NIGHT SERVICE

Assigned Night Answer

When the attendant puts the system in the night mode (usually after normal business hours), Assigned Night Answer (ANA) automatically transfers ringing for incoming calls to specified stations. Your station may be one of those assigned to receive night mode ringing.

To answer a night mode call ringing at your telephone:
- Lift handset.

Universal Night Answer

Universal Night Answer (UNA) allows you to answer calls that you hear ringing over the Paging system or external alerting device. UNA is activated by the attendant, usually after normal business hours.

To answer a call ringing over the Paging system or external alerting device:
- Lift handset.
- Dial 69.

PAGING

You can page the entire system (All Call) or just selected areas (Zone Page).

All Call Page

To initiate All Call Page:
- Lift handset.
- Dial 60.
- Make announcement.
- Hang up.

Zone Page

To initiate Zone Page:
- Lift handset.
- Dial desired zone (61-68).
- Make announcement.
- Hang up.

PARK

You can place an outside call in a parking orbit, page a third person, and have that person pick up the parked call from any station in the system. There are two types of parking orbits: **General Park** and **Personal Park.** An unanswered parked call will re-ring the station which initially parked the call. If the returned call is unanswered, it will ring the attendant.

General Park Orbit

To place a call into a General Park Orbit:
- Flash, Intercom dial tone is audible.
- Dial General Park Orbit code (50-59). Acknowledgment tone heard. +
- Flash. Intercom dial tone is audible.
- Dial 60 (All Call), 61-68 (Zone Page).
- Announce call and orbit code (50-59).
- Hang up.

NOTE: If the acknowledgment tone is not heard after dialing a General Park Orbit code, the orbit you dialed is busy. Dial another orbit code.

To retrieve a call from General Park Orbit:
- Lift handset.
- Dial announced General Park Orbit code (50-59).

Personal Park Orbit

Personal Park Orbit provides access to calls that are parked at a particular station. These calls can be answered from any other station by dialing the number of the station where the call is parked.

To Park a call at a station:
- Flash. Intercom dial tone audible.
- Dial number of station where call is to be Parked.
- Flash. Intercom dial tone audible.
- Dial 60 (All Call), 61-68 (Zone Page).
- Announce call and station number.
- Hang up.

To retrieve a call from Personal Park Orbit:
- Lift handset.
- Dial # #.
- Dial the number of the station at which the call was parked.

PLACING A CALL

To place an outside call (if LCR is not installed):
- Lift handset.
- Dial 9.
- Dial line group number (Ø-9) to get dial tone.+
- Dial telephone number.

+Line groups 1-9 are accessed by dialing 91-99. Line group 1Ø is accessed by dialing 9Ø.

SPEED DIAL

The system utilizes two types of Speed Dial: Station Speed Dial and System Speed Dial.

Station Speed Dial

Up to 1Ø frequently-dialed numbers may be stored per station with 16 digits maximum per number. Pauses count as a digit and are stored by dialing #. Only the first 5Ø stations in the system have access to Station Speed Dial.

To store Station Speed Dial numbers:
- Lift handset. Dial tone audible.
- Dial # 7.
- Dial line group (Ø-9)+.
- Dial bin Ø-9 (1Ø storage locations).
- Dial number to be stored (maximum 16 digits).
- Dial *.

+Dialing 1-9 stores line groups 1-9. Dialing Ø stores line group 1Ø. If LCR is installed, the system overrides the line group assignment you have made and places the call on the cheapest available route.

To use your Station Speed Dial:
- Lift handset.
- Dial 7.
- Dial Ø-9 (bin where desired number was stored).

System Speed Dial

Up to 1ØØ frequently-dialed numbers can be programmed into system memory by the attendant and can be made available to every station in the system (unless limited by Class of Service or Toll Restriction). Only the attendant can program or change System Speed Dial numbers.

To dial a System Speed Dial number:
- Lift handset. Dial tone is audible.
- Dial desired code (8ØØ-899).

Chaining System Speed Dial Bins

You can select up to four System Speed Dial bins to be chained, in any order.

To chain System Speed Dial bins:
- Lift handset.
- Dial 8*.
- Dial System Speed Dial bins to be chained (00-99).
- Dial * to end sequence.

SPLIT (Alternate)

With Split you can automatically place your first call on Hold and answer a second incoming call. While you are on an outside call, a Call Waiting tone will alert you that another outside call is waiting.

To talk to the second caller:
- Flash. First call placed on Hold.
- Hang up.
- When telephone rings, lift handset to talk to second caller.

You can alternate between two outside calls as follows:
- Flash.
- Dial *.

TRANSFER

You can Transfer a call by one of two methods: Screened (Announced) or Unscreened (Unannounced).

Screened (Announced) Transfer

To Transfer a screened call:
- Flash.
- Dial destination station number.
- Announce call.

If the party accepts the transfer:
- Hang up.

If the party does not take the call, then return to the outside call as follows:
- Flash.
- Dial # #.
- Dial number of station that was to receive transfer.

If the called party responds to your announcement using the handset (and hangs up before you can retrieve the call), then return to the call as follows:
- Flash.
- Dial *.

Unscreened (Unannounced) Transfer

To Transfer an unscreened call:
- Flash. Call placed on Hold.
- Dial destination station number.
- Hang up.

If the party does not take the call, the call will ring back to you.

APPENDIX F
OFF PREMISES EXTENSION
DESCRIPTION AND INSTALLATION MANUAL

OFF PREMISES EXTENSION
DESCRIPTION AND INSTALLATION MANUAL

TABLE OF CONTENTS PAGE

1. GENERAL

1.01 The Off Premises Extension (OPX) Adaptor Printed Circuit Board (PCB), B-OBX-A, enables a Class C OPX line supplied by the local telephone company to be connected to a TCX-128, EK-1648, EK-1232 and EK-816 system via a port on the B-8SLU-B PCB. This adaptor meets the requirements defined in FCC Facility Interface Code OL13C and EIA Specification 464-1. A telephone in a distant location connected to the system via the OPX Interface Circuit, will have access to all system features available to single line telephones. The B-OPX-A PCB requires ancillary equipment and additional connections.

1.02 The OPX equipment installed in a system can also be used to enhance the performance of a single line telephone assigned as an On Premises Extension (ONX). A single line telephone, assigned as an ONX, does not need to be modified with a TIE Electronic Tone Ringer.

NOTE: The OPX must be installed by a certified technician.

Required Equipment

1.03 An OPX interface requires additional connections and the following equipment: B-OPX-A PCB, B-8SLU-B PCB, a 48V Power Supply, Ringing Generator and a 13 Card Key Service Unit (KSU) or a 6 Card KSU. The recommended units are the Tellabs 48V Power Supply, the Tellabs Ringing Generator and the ITT 13 Card KSU or the ITT 6 Card KSU. The 13 Card KSU allows for future expansion and is recommended for systems which may require tielines at a later date.

Each B-OPX-A PCB provides circuitry for one Off Premises Extension. The PCB is inserted into a standard 6 card or 13 Card KSU.

One B-8SLU-B PCB is required in the system KSU when an OPX is installed in the system. An B-8SLU-B PCB can serve up to 8 OPXs.

6 Card KSU and Power Supply

1.04 The 6 Card KSU is designed for wall mounting and holds a maximum of 6 B-OPX-A PCBs. These boards are inserted into the hinged shelf or rack (Figure 1). The 48V Power Supply and Ringing Generator are mounted inside the KSU cabinet (Figure 2). The shelf containing the PCBs is hinged so that it can be opened to provide access to two 50-pin connecting blocks. One block is split.

Functions of the connecting blocks when installing an OPX are as follows:

Block A--Contains connections from the B-8SLU-B PCB to the OPX extensions.

Block B--Contains internal wiring of the 6 Card KSU and requires no additional wiring.

Block C--Contains connections from the 48V Power Supply and Ringing Generator. Provides connections for telco lines.

13 Card KSU and Power Supply

1.05 The 13 Card KSU is designed for wall mounting. Eight of the 13 card positions can be used for B-OPX-A PCBs (Figure 3). Remaining positions can be used to accommodate future tieline applications. The 13 Card KSU is similar to the 6 Card KSU in that the Power Supply and Ringing Generator are mounted on the shelf (Figure 4). The 13 Card KSU contains four 50-pin plugs located on the back of the unit and a terminal block located on the front.

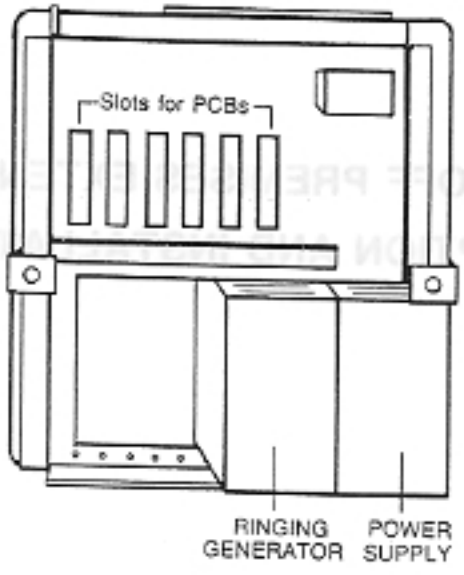


Figure 1 6 CARD KSU OUTSIDE VIEW

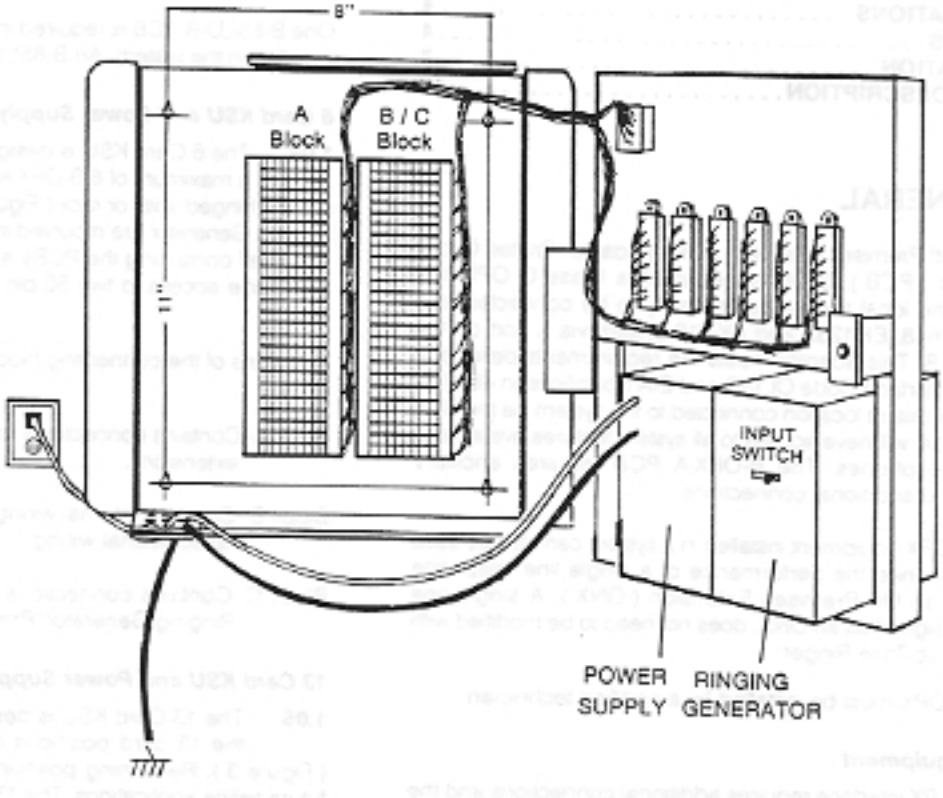


Figure 2 6 CARD KSU WITH HINGED SHELF OPENED

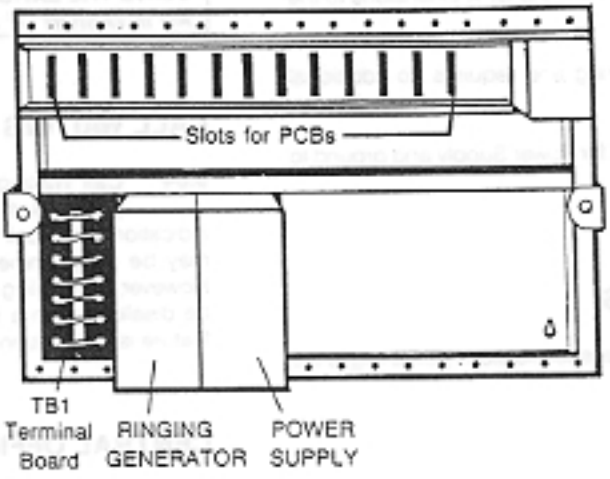


Figure 3 13 CARD KSU OUTSIDE VIEW

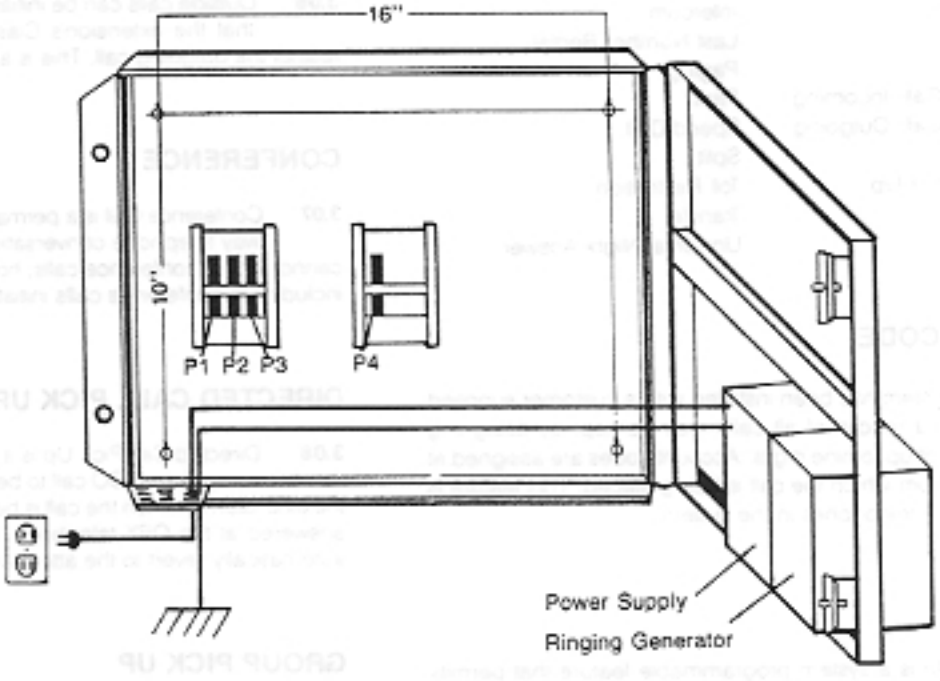


Figure 4 13 CARD KSU WITH HINGED SHELF OPENED

Assignments of the plugs when installing an OPX are as follows:

Plugs 1 & 2--Used for connections from the B-8SLU-B PCB to the OPX extensions and from the OPX extensions to the telco lines.

Plug 3-- Contains internal wiring and requires no additional wiring.

Plug 4-- Provides connections for Power Supply and ground to each station.

2. SPECIFICATIONS

2.01 Refer to Table 1 for technical specifications pertaining to the OPX.

3. FEATURES

3.01 The following paragraphs provide information on the features that are available to a single line telephone used as an OPX. Each feature paragraph provides a description of the feature. Table 2 shows the features that are available in each system. Instruction for use of the feature is contained in the appropriate system single line User's Guide. The following features are available:

Account Code
Barge-In
Call Waiting
Central Office Call, Incoming
Central Office Call, Outgoing
Conference
Directed Call Pick-Up
Group Pick-Up
Hold
Intercom
Last Number Redial
Paging
Park
Speed Dial
Split
Toll Restriction
Transfer
Universal Night Answer

ACCOUNT CODE

3.02 If the system has been installed with a customer supplied printer, a record of all calls may be kept by assigning account codes of up to nine digits. Account codes are assigned at the telephone from which the call is being placed. This feature is available from all telephones in the system.

BARGE-IN

3.03 Barge-In is a system programmable feature that permits designated extensions to override the system privacy on other specified extensions. When this feature is invoked, the conversation in progress receives a Barge-In signal (splash tones) followed by a delay, and then the voice of the extension user who is barging-in. Extensions can be programmed individually to block Barge-In. Unless the call is terminated, only the party initiating the Barge-In can release the Barge-In status.

CAUTION: UNAUTHORIZED MONITORING OF CALLS USING THE BARGE-IN FEATURE MAY BE INTERPRETED AS AN INVASION OF PRIVACY.

CALL WAITING

3.04 Call Waiting is a system programmable feature which provides a busy station with an audible and visual indication that a call is waiting to be answered. The entire system may be programmed to allow or disallow Call Waiting signals. However, if signaling is allowed on a system wide basis it may still be disallowed on a station wide basis. All programming for this feature is done during installation.

CENTRAL OFFICE CALL, INCOMING

3.05 Central Office Call, Incoming is a system programmable feature. Incoming calls can be answered from any extension programmed to receive calls. Incoming CO calls provide a distinctive tone signal at the extension.

CENTRAL OFFICE CALL, OUTGOING

3.06 Outside calls can be initated from any extension provided that the extension's Class of Service (COS) does not restrict the outgoing call. This is a system programmable feature.

CONFERENCE

3.07 Conference Call is a permanent feature that permits a three-way telephone conversation. The Off-Premises Extension cannot initiate conference calls: however, these telephones can be included in conference calls initiated by other key telephones.

DIRECTED CALL PICK UP

3.08 Directed Call Pick Up is a permanent feature that permits a transferred CO call to be answered at an extension near the extension to which the call is being transferred. The call can be answered at the OPX telephone. If the call is unanswered, it will automatically revert to the attendant.

GROUP PICK UP

3.09 Group Pick Up is a system programmable feature. It permits an incoming CO line call to be answered from any extension within a selected pickup group, including the Off-Premises Extension. Multiple pickup groups can be established in the system; however, each extension can belong to only one group. Each extension in a pickup group may be individually programmed to receive ringing for a call directed to its group.

Table 1 OPX SPECIFICATIONS

OPX Capacity:
Single line telephone as OPX 8
Maximum Line Loss - 1300 ohms

Tellabs 8102 Ringing Generator:
Input voltage: 22 - 26VDC or 44 - 56VDC, switch selectable. Set switch to 48V position.
Input current at 48VDC: 75mA idle, 250mA full load (48VDC is used with the OPX.
Output: 85 - 135 VAC, 5 Watts maximum.
Ring Equivalence: Up to 5 high impedance ringers simultaneously.
Fusing: Input to ringing generator: 1 amp slow-blow cartridge type. (Bussman 3AG or equivalent)
Polarity: Floating output may be biased positively or negatively.
Dimensions and Weight:
3" W × 7" H × 7" D (18cm × 7cm × 18cm) 5lbs. (3 kg).
Operating Environment:
20 - 130° F (−7 - 54° C), humidity −95%, non condensing.
Part number: 5W 8102.

Power Supply:
Tellabs 8001 Power Supply.
Input voltage range:
105 - 130VAC rms, 57 - 63Hz, single phase.
Output: 24 or 48VDC, switchable, 1 ampere maximum current. Set switch to 48V position.
Regulation: +1.0 or −1.0 volt, no load to full load, low line to high line.
Ripple: 2mV RMS typical: 5mV RMS maximum, measured at full load and low line voltage.
Output protection: Current / voltage foldback, activated at approximately 1.2 amperes output current.
Short circuit protection: Will tolerate output short circuit of any duration.
Polarity: Either positive or negative output terminal can be referenced to ground.
Fusing: Line fuse, 1.5 ampere.
Operating Environment: 20-120° F (−7 - 49° C) no load to full load, low line to high line (humidity to 95%, non condensing).
Dimensions and Weight:
3" W × 7" H × 7" D (18cm × 7cm × 18cm).
Approximately 7 lbs.
Part Number: 1A-8001.

KSUs:
Dimensions:
6 Card KSU:
13" W × 16" H × 11" D (33cm × 41cm × 30cm).
13 Card KSU:
25" W × 16" H × 11" D (64cm × 41cm × 30cm).
Part Numbers: ITT 6 Card KSU: 501A00-101
ITT 13 Card KSU: 512A00-101

T2009H

Table 2 OPX FEATURES

FEATURE	TCX-128	EK-1648	EK-1232	EK-818
Account Code	X	X	X	X
Barge-In	X	–	X	X
Call Waiting	–	X	–	X
Central Office Call, Incoming	X	X	X	X
Central Office Call, Outgoing	X	X	X	X
Conference	X	X	X	X
Directed Call Pick-Up	X	–	X	–
Group Pick-Up	X	–	X	–
Hold	X	X	X	X
Intercom	X	X	X	X
Last Number Redial	X	X	X	X
Paging	X	X	X	X
Park	X	–	X	–
Speed Dial	X	X	X	X
Split	X	–	X	–
Toll Restriction	X	X	X	X
Transfer	X	X	X	X
Universal Night Answer	X	X	X	X

X: Indicates system has feature.
–: Indicates system does not have feature.

HOLD

3.10 Hold is a permanent feature for placing a call in a temporary waiting condition. If the call is left on hold longer than the programmed period, the call will ring again at the extension.

INTERCOM

3.11 Intercom (ICM) is a system programmable feature. Intercom (internal) calls can be initiated from any extension in the system. If the extension being called is a key telephone, the called party can respond Handsfree. If the called party has a 2500 type single line telephone, the handset must be lifted for response. On ICM calls from single line telephones, the called extension will receive a distinctive ICM ring tone.

LAST NUMBER REDIAL

3.12 Last Number Redial is a permanent feature available to all extensions capable of placing outside calls. This feature stores the last manually dialed outside telephone number to be automatically redialed at a later time. The number is held in memory regardless of whether the call was answered or not answered (not picked up or busy).

PAGING

3.13 Paging is a system programmable feature. There are two types of Paging: ***All Call Paging*** and ***Zone Paging.***

All Call Paging

3.14 All Call Paging is broadcast over all extensions in the system except those extensions programmed not to receive page announcements. All Call Paging may be initiated from any of the telephones in the system. Off-Premises Extensions cannot receive All Call Paging. Optional external amplifiers and speakers can also be connected to each zone for page broadcasts.

Zone Paging

3.15 Zone Paging provides paging to groups of extensions. Multibutton telephones may receive paging via the speakerphone. Off-Premises Extensions cannot receive Zone Paging; however, they can initiate Zone Page.

PARK

3.16 You can park an outside call, page a third person and have that person pick up the parked call from any extension in the system. There are two types of parking orbits: ***General Orbit*** and ***Personal Park Orbit***. This is a permanent feature telephones used in the system.

General Park Orbit

3.17 General Park Orbit provides access to parked calls from any extension in the system. A call is retrieved from a General Park Orbit by dialing designated codes.

Personal Park Orbit

3.18 Personal Park Orbit provides access to calls that are parked at a particular extension. These calls can be answered at any other extension by dialing the extension number of the extension where the call is parked.

SPEED DIAL

3.19 Speed Dial is a programmable feature that permits automatic dialing of stored telephone numbers. There are two types of Speed Dial: System Speed Dial and Extension Speed Dial. Extension Class of Service and Toll Restriction programming can deny or limit Speed Dial for a particular extension.

3.20 Extensions can store frequently dialed numbers as Extension Speed Dial numbers. The attendant can store frequently dialed numbers as System Speed Dial numbers. System Speed Dial numbers are available to every extension in the system.

SPLIT

3.21 Split is a permanent feature that allows an extension user to place a call on hold and answer a second incoming call. Using the Split feature the user can alternate between the two calls. This feature may be accessed on all telephones used in the system.

TOLL RESTRICTION

3.22 Toll Restriction is a programmable feature that prohibits selected extensions from placing unauthorized long distance (toll) calls. Extensions can be restricted to internal calls, local calls, Speed Dial, or selected area codes depending on the Class of Service designated for that line and / or extension.

TRANSFER

3.23 Transfer is a permanent feature that transfers an established outside call to a different extension. Calls may be transferred unscreened (unannounced) or screened (announced). Transferred calls that are unanswered return to the attendant after a programmable period of time.

UNIVERSAL NIGHT ANSWER

3.24 The NIGHT key on the Attendant Multibutton Key Telephone is used during off hours to put the system in the Universal Night Answer (UNA) mode. In this mode telephones and optional external page systems, so programmed during installation, can receive indications of incoming calls. The ability to put the system into the UNA mode is available at the attendant's extension only.

3.25 Off-Premises Extensions (2500 type single line telephones) can answer Night Ringing heard over the paging system. When more than one incoming CO line is ringing, while the system is in the Universal Night Answer mode, these telephones will automatically access the first incoming call.

NOTE: The incoming CO lines which will ring at all extensions in the Universal Night Answer mode are programmed individually. This allows special lines, such as Direct Inward Lines (DILS) or Private Lines to ring only at selected extensions as they do when the system is in the normal daytime mode. These special lines will not ring over the paging circuit.

4. INSTALLATION

Preparation

4.01 The following paragraphs provide instructions for connecting the OPX to the system equipment. It is recommended that the 6 Card and 13 Card KSU be mounted on a separate mounting board to the left of the system equipment and near a separate 115VAC, 15 amp outlet (Figures 5a and b). The maximum line loss for the OPX is 1300 ohms.

4.02 Before proceeding with the installation, have the necessary hardware and cables available. This includes: exterior grade plywood backboard, 25-pair cable for telco connection, standard 4-conductor (quad) station cabling, grounding wire (14 AWG), connecting blocks (66M1-50 type with bridging clips), modular jack (625 A, 625 F, or equivalent) and the appropriate mounting hardware.

Mount the 6 Card or 13 Card KSU as follows:

- *Attach the plywood backboard in the designated location with the appropriate fasteners. Mark the equipment layout on the board using the installation layout drawing (Figure 5).*
- *Drill pilot holes at these points and insert suitable fasteners having a ¼ inch shank diameter. Screw in fasteners until the clearance between the fastener head and the mounting surface is ¼ inch.*
- *Mount the KSU on the four fasteners and tighten each fastener until the KSU is securely attached to the mounting surface.*

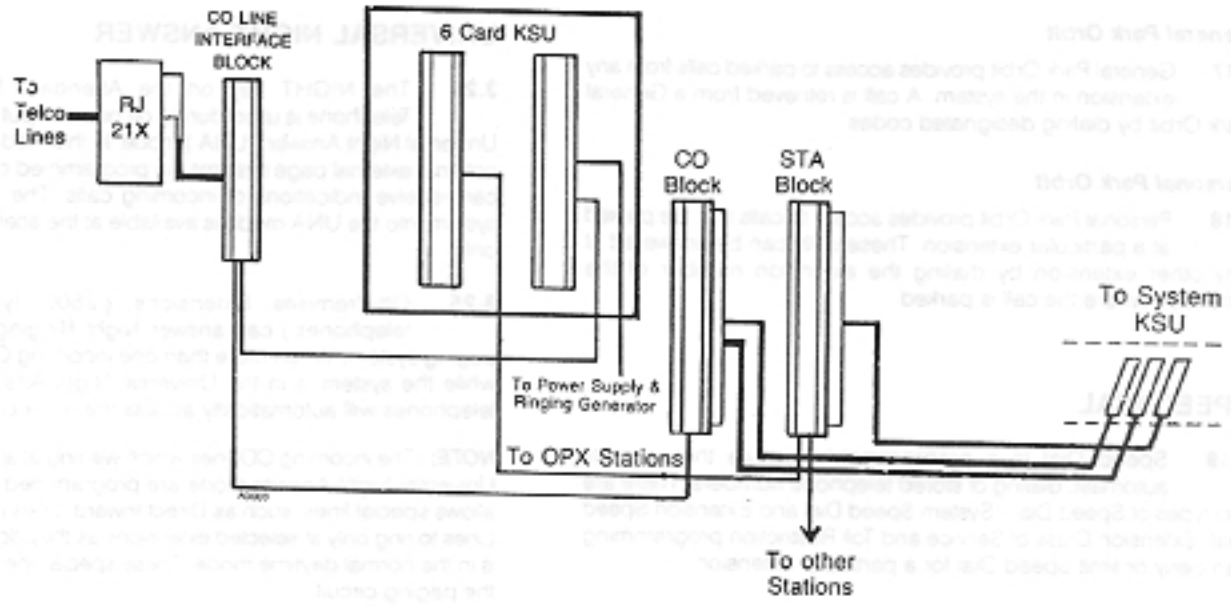


Figure 5a OPX INSTALLATION WITH 6 CARD KSU

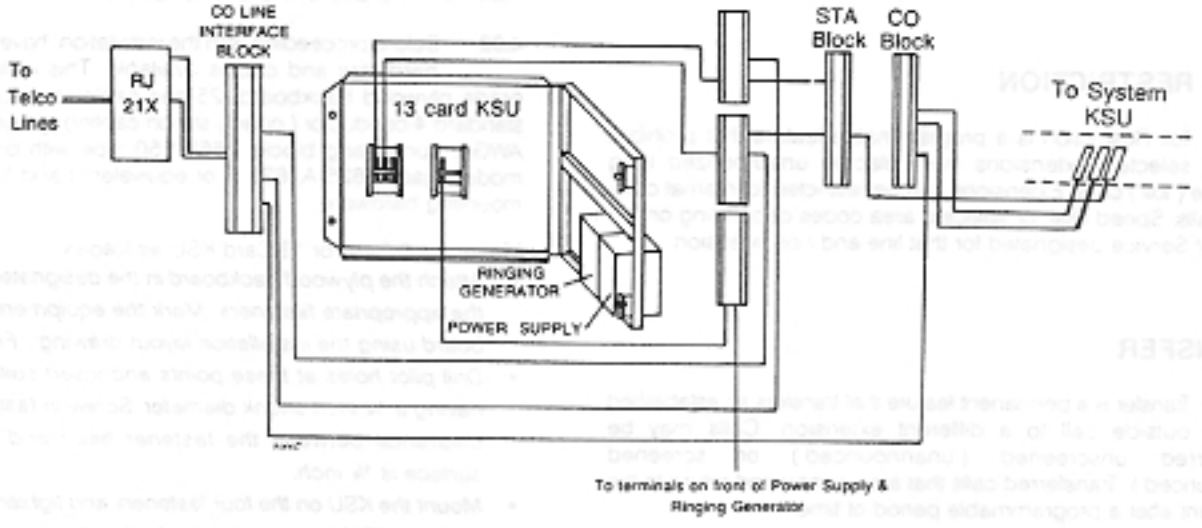


Figure 5b OPX INSTALLATION WITH 13 CARD KSU

4.03 The Power Supply and Ringing Generator are mounted on the hinged rack of the 6 Card or 13 Card KSU (Figures 2 and 4). The Power Supply and Ringing Generator should be mounted near the terminal board on a 13 Card KSU to facilitate cross connecting.

4.04 Mount three additional 66M1-50 connecting blocks to the left of the system KSU when a 13 Card KSU is installed. These blocks are used to access the connections on the connectors P1, P2 and P4 located inside the 13 Card KSU. P1 and P2 provide access to system and telco connections; P4 provides access to the Power Supply.

4.05 Check to ensure that the station plug (P3-P8 in the main system KSU or P3 to P9 if an expansion cabinet is used), which corresponds to B-8SLU-B serving the OPX, is connected to the appropriate station / OPX block. Refer to Section 5, INSTALLATION, of the System Description and Installation Manual.

NOTE: It is recommended that the B-8SLU-B serving the OPX be inserted in the system KSU slots J13, J12, J10, J9 or J8. This prevents having to cross connect to two station blocks to access the connections for the eight OPXs. The expansion cabinet, when applicable, can also be used. It is recommended that the B-8SLU-B be inserted into slot J16, J14, J13, J11, J10 or J9 of the expansion cabinet.

4.06 Ground the KSU and Power Supply by connecting a 14 AWG wire to the positive (+) terminal on the Power Supply and a cold water pipe ground (Figures 6, 7).

4.07 Connect the 6 Card or 13 Card KSU to the Power Supply and Ring Generator as follows (Figures 6, 7):

NOTE: Check to ensure the switches on both units are in the OFF position when cross connecting. Switches should be in the position labeled 48V when the system is operating.

To connect the 6 Card KSU to the Power Supply and Ringing Generator (Figure 6, Table 3):

- *The AG connections for each OPX on block C must be jumpered (terminals 1, 3, 5, 7, 9 and 11) and connected to terminal 43, also on the C block.*
- *The AB connections for each OPX on block C must be jumpered (terminals 2, 4, 6, 8, 10 and 12) and connected to terminal 44, also on the C block.*
- *Connect terminal 44, designated as AB, from the C Block in the KSU to the -V screw terminal on the Ringing Generator.*
- *Connect terminal 48, designated as RB, from the C Block to the screw terminal labeled +/- 105 on the Ringing Generator.*
- *Connect terminal 43, designated AG on the C Block to the terminal labeled +V on the Ringing Generator.*
- *Jumper the -V terminal on the Ringing Generator to the COM terminal on the Ringing Generator.*
- *Connect the screw terminal labeled +V on the Ringing Generator to the + terminal on the Power Supply.*
- *Connect the COM terminal on the Ringing Generator to the negative (-) terminal on the Power Supply.*

To connect the 13 Card KSU to the Power Supply and Ringing Generator (Figure 7, Table 4):

- *Terminals 1, 4, 7, 10, 13, 16, 19 and 22 (designated as GND) on the P4 block must be jumpered together and cross connected to theGND terminal on the TB1 terminal board in the 13 Card KSU.*
- *Terminals 3, 6, 9, 12, 15, 18, 21 and 24 (designated as -48VT) on the P4 block must be jumpered together and cross connected to the AB terminal on the TB1 terminal board in the 13 Card KSU.*
- *Connect the AB terminal on TB1 terminal board on the 13 Card KSU to the -V terminal on the Ringing Generator.*
- *Connect the RNG terminal to the +/- 105 terminal on the Ring Generator.*
- *Connect the GND terminal to the +V terminal on the Ring Generator.*
- *Jumper the -V terminal to the COM terminal on the Ring Generator.*
- *Connect the COM terminal on the Ringing Generator to the negative (-) terminal on the Power Supply.*
- *Connect the +V terminal on the Ringing Generator to the positive (+) terminal on the Power Supply.*

Crossconnections to the 6 Card KSU

4.08 Connections from the B-8SLU-B are made on the A block (Figure 8 and Table 5) in the 6 Card KSU. Use two pair wire to cross connect the appropriate SLU connector block to the A Block in the 6 Card KSU. For each OPX, cross connect clips 1-5 as follows:

- *Cross connect the GRN wire from the AT lead on the station block to the T terminal of the A block in the 6 Card KSU.*
- *Cross connect the RED wire from the AR terminal on the station block to the R terminal of the A block.*
- *Cross connect the BLK wire from the BT terminal on the station block to the A terminal of the A block.*
- *Cross connect the YEL wire from the BR terminal on the station block to the L terminal on the A block.*

NOTE: Clip 6 on block A contains connections for internal wiring and requires no additional connections.

Crossconnections to 13 Card KSU

4.09 Connections from the B-8SLU-B are made via connectors P1 and P2. Plug a 25-pair cable into P1 (extensions 1-5) and P2 (extensions 6-8) connectors and punch down the free conductors according to standard telephony code on the two additional 66M1-50 blocks to be designated as a P1 and P2 block. Use quad wire to cross connect the station / OPX block to the P1 and P2 block (Tables 6, 7).

- *Cross connect the GRN lead to AR terminal on the station block to terminal 13 on the P1 Block.*
- *Cross connect the RED lead to AT terminal on the station block to terminal 4 on the P1 Block.*
- *Cross connect the YEL lead to BT terminal on the station block to terminal 8 on the P1 Plug.*
- *Cross connect the BLK lead to BR terminal on the station block to terminal 25 on the P1 Plug.*

NOTE: P3 requires no additional wiring.

4.10 Repeat the preceeding procedure for each OPX.

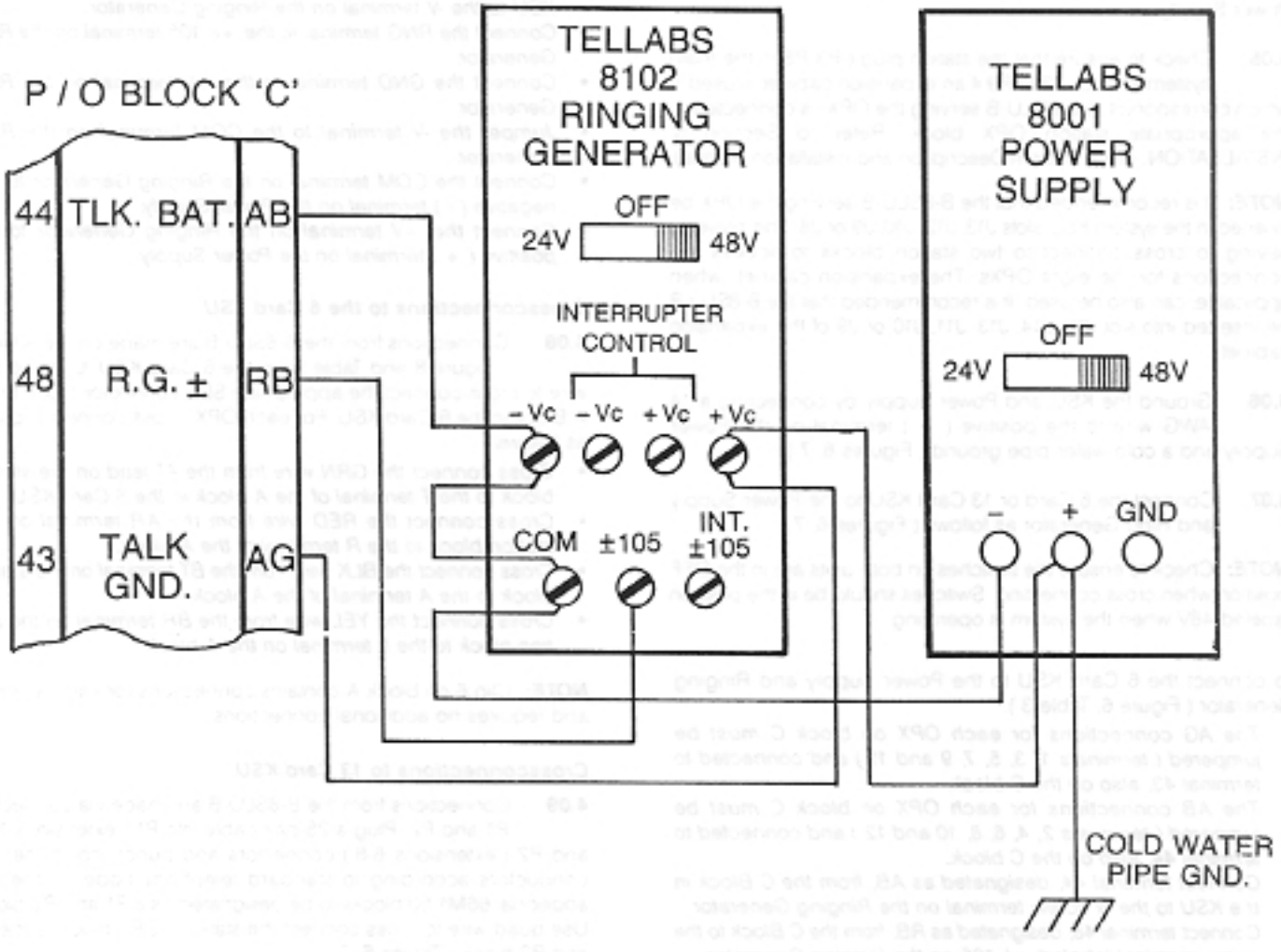


Figure 6 CONNECTING 6 CARD KSU TO POWER SUPPLY AND RINGING GENERATOR

Table 3 6 CARD KSU B / C BLOCK CONNECTIONS

BLOCK B							BLOCK C			
FEATURE	LEAD DESIG.	TERMINAL NUMBER	CLIP 1	CLIP 2	CLIP 3	CLIP 3	CLIP 2	CLIP 1	TERMINAL NUMBER	LEAD DESIG.	FEATURE	
	B	1	*	*	**	**	*	*	1	AG		
	R 2	2	*	*	**	**	*	*	2	AB	LINE 1	
	B	3	*	*	**	**	*	*	3	AG		
	R 3	4	*	*	**	**	*	*	4	AB	LINE 2	
	B	5	*	*	**	**	*	*	5	AG		
	R 4	6	*	*	**	**	*	*	6	AB	LINE 3	
	B	7	*	*	**	**	*	*	7	AG		
	R 5	8	*	*	**	**	*	*	8	AB	LINE 4	
	B	9	*	*	**	**	*	*	9	AG		
	R 6	10	*	*	**	**	*	*	10	AB	LINE 5	
	B	11	*	*	**	**	*	*	11	AG		
	R 7	12	*	*	**	**	*	*	12	AB	LINE 6	
	B	13	*	*	**	**	*	*	13			
	R 8	14	*	*	**	**	*	*	14			
	B	15	*	*	**	**	*	*	15			
	R 9	16	*	*	**	**	*	*	16			
	B	17	*	*	**	**	*	*	17	BZ		
	R 0	18	*	*	**	**	*	*	18	BZ1		
LINE 1	B1 BZ1	19	*	*	**	**	*	*	19	RN		
	R1 BZ	20	*	*	**	**	*	*	20	ST		
LINE 2	B1 BZ1	21	*	*	**	**	*	*	21	LF1		
	R1 BZ	22	*	*	**	**	*	*	22	LW1		
LINE 3	B1 BZ1	23	*	*	**	**	*	*	23	LF2		
	R1 BZ	24	*	*	**	**	*	*	24	LW2		
LINE 4	B1 BZ1	25	*	*	**	**	*	*	25	T	LINE 1	
	R1 BZ	26	*	*	**	**	*	*	26	R		
LINE 5	B1 BZ1	27	*	*	**	**	*	*	27	T	LINE 2	OPX
	R1 BZ	28	*	*	**	**	*	*	28	R		
LINE 6	B1 BZ1	29	*	*	**	**	*	*	29	T	LINE 3	LINES
	R1 BZ	30	*	*	**	**	*	*	30	R		
	CAS	31	*	*	**	**	*	*	31	T	LINE 4	
	CAS	32	*	*	**	**	*	*	32	R		TO
	CAS	33	*	*	**	**	*	*	33	T	LINE 5	
	CAS	34	*	*	**	**	*	*	34	R		TELCO
	CAS	35	*	*	**	**	*	*	35	T	LINE 6	
	CAS	36	*	*	**	**	*	*	36	R		
		37							37	LG1	LP GND	
		38							38	LB1	LP BAT	
		39							39	LG2	LP GND	
		40							40	LG2	LP BAT	
		41							41	BG	RLY GND	
		42							42	BR	RLY BAT	
SPARE		43							43	AG	TLK GND	
		44							44	AB	TLK BAT	
		45							45	BG	RLY GND	
		46							46			
		47							47	RG	RG GND	
		48							48	RB	RG	
		49							49	RG	BZ GND	
		50							50	RB	BZ	

* Connect to clips as required.
** Pre-wiring is terminated on this clip, no additional wiring is required.

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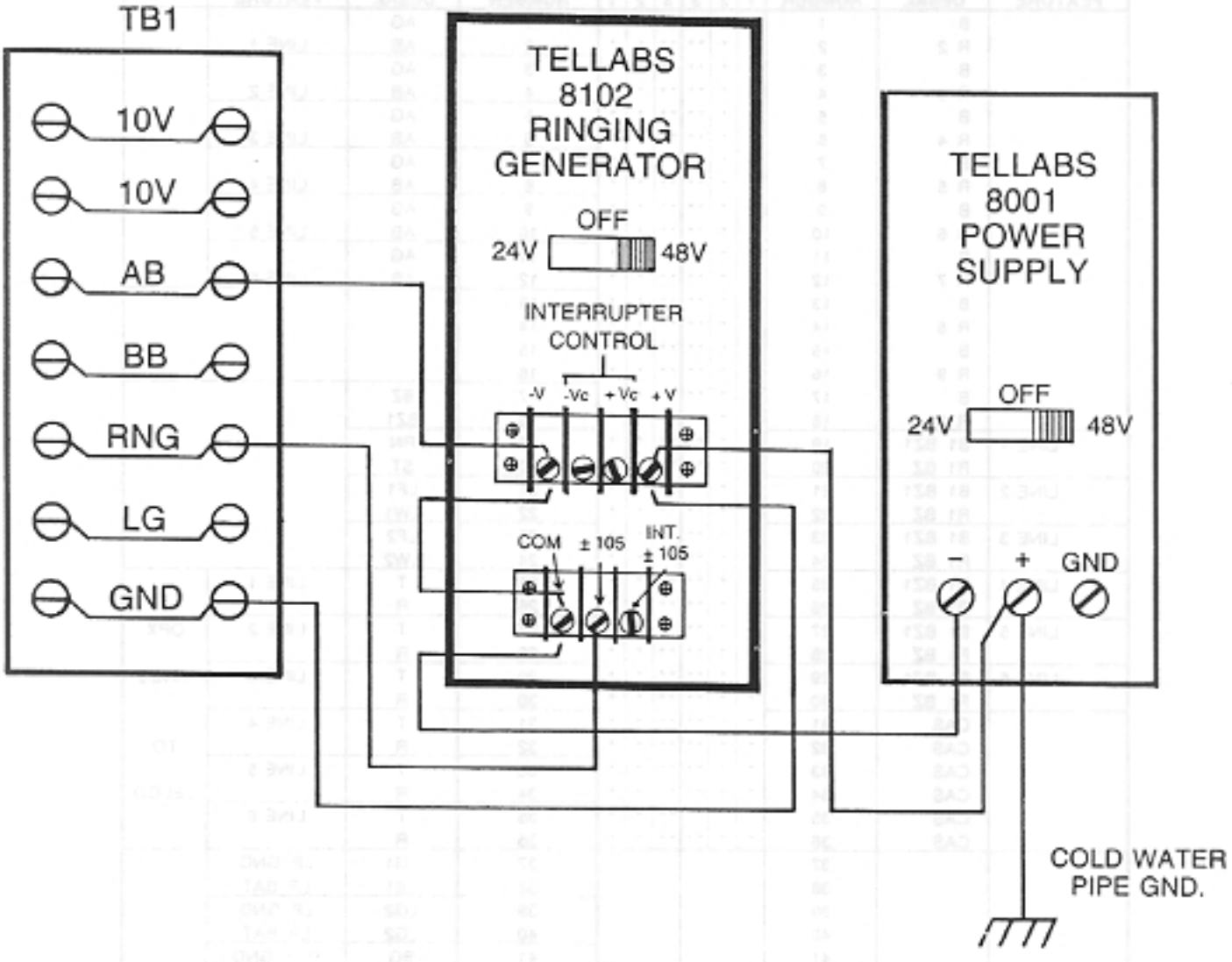

Figure 7 CONNECTING 13 CARD KSU TO POWER SUPPLY AND RINGING GENERATOR

Table 4 13 CARD KSU P4 CONNECTIONS

25 Pair Cable		P4 Connector	
Conn Pin	Color Code	Block Term.	Function
26	WHT-BLU	1	GND
1	BLU-WHT	2	
27	WHT-ORN	3	-48 VT
2	ORN-WHT	4	GND
28	WHT-GRN	5	
3	GRN-WHT	6	-48 VT
29	WHT-BRN	7	GND
4	BRN-WHT	8	
30	WHT-SLT	9	-48 VT
5	SLT-WHT	10	GND
31	RED-BLU	11	
6	BLU-RED	12	-48 VT
32	RED-ORN	13	GND
7	ORN-RED	14	
33	RED-GRN	15	-48 VT
8	GRN-RED	16	GND
34	RED-BRN	17	
9	BRN-RED	18	-48 VT
35	RED-SLT	19	GND
10	SLT-RED	20	
36	BLK-BLU	21	-48 VT
11	BLU-BLK	22	GND
37	BLK-ORN	23	
12	ORN-BLK	24	-48 VT
38	BLK-GRN	25	
13	GRN-BLK	26	
39	BLK-BRN	27	
14	BRN-BLK	28	
40	BLK-SLT	29	
15	SLT-BLK	30	
41	YEL-BLU	31	
16	BLU-YEL	32	
42	YEL-ORN	33	
17	ORN-YEL	34	
43	YEL-GRN	35	
18	GRN-YEL	36	
44	YEL-BRN	37	
19	BRN-YEL	38	
45	YEL-SLT	39	
20	SLT-YEL	40	
46	VIO-BLU	41	
21	BLU-VIO	42	
47	VIO-ORN	43	
22	ORN-VIO	44	
48	VIO-GRN	45	
23	GRN-VIO	46	
49	VIO-BRN	47	
24	BRN-VIO	48	
50	VIO-SLT	49	
25	SLT-VIO	50	

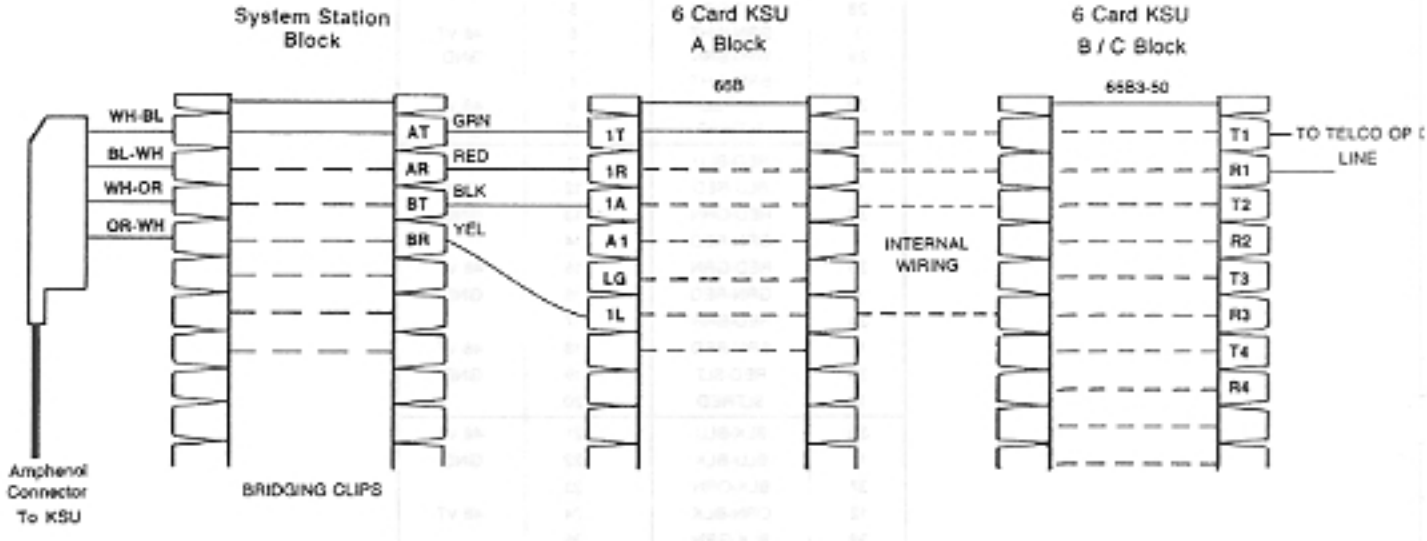

Figure 8 6 CARD KSU CROSSCONNECTIONS

Table 5 6 CARD KSU A BLOCK CONNECTIONS

BLOCK A										
OPX NUMBER FROM SLU BLOCK	STATION CABLE	LEAD DESIGNATION	TERMINAL NUMBER	CLIP 1 *	CLIP 2 *	CLIP 3 *	CLIP 4 *	CLIP 5 *	CLIP 6 **
STA. 1	GREEN	T	1						
	RED	R	2						
	BLACK	A	3						
		A1	4						
		LG	5						
	YELLOW	L	6						
STA. 2	GREEN	T	7						
	RED	R	8						
	BLACK	A	9						
		A1	10						
		LG	11						
	YELLOW	L	12						
STA. 3	GREEN	T	13						
	RED	R	14						
	BLACK	A	15						
		A1	16						
		LG	17						
	YELLOW	L	18						
STA. 4	GREEN	T	19						
	RED	R	20						
	BLACK	A	21						
		A1	22						
		LG	23						
	YELLOW	L	24						
STA. 5	GREEN	T	25						
	RED	R	26						
	BLACK	A	27						
		A1	28						
		LG	29						
	YELLOW	L	30						
STA. 6	GREEN	T	31						
	RED	R	32						
	BLACK	A	33						
		A1	34						
		LG	35						
	YELLOW	L	36						
N / A		T	37						
		R	38						
		T	39						
		R	40						
		LG	41						
		L	42						
		LG	43						
		L	44						
N / A		B	45						
		R	46						
		B	47						
		R	48						
		B	49						
		R	50						

* Connect to clips as required.
** Pre-wiring is terminated on this clip, no additional wiring is required.

Table 6 13 CARD KSU P1 CONNECTIONS

25 Pair Cable		P1 Connector			Station Cable	Interconnect
Conn Pin	Color Code		Block Term.	Function	To Station Block	To Trunk Interface
26	WHT-BLU	OPX 1	1	OPX 1T		WHT-BLU
1	BLU-WHT		2	OPX 1R		BLU-WHT
27	WHT-ORN		3	CX T	GRN	
2	ORN-WHT		4	CX R	RED	
28	WHT-GRN		5	CX†	BLK	
3	GRN-WHT		6			
29	WHT-BRN		7			
4	BRN-WHT		8	CX†	YEL	
30	WHT-SLT		9			
5	SLT-WHT		10			
31	RED-BLU	OPX 2	11	OPX 2T		WHT-BLU
6	BLU-RED		12	OPX 2R		BLU-WHT
32	RED-ORN		13	CX T	GRN	
7	ORN-RED		14	CX R	RED	
33	RED-GRN		15	CX†	BLK	
8	GRN-RED		16			
34	RED-BRN		17			
9	BRN-RED		18	CX†	YEL	
35	RED-SLT		19			
10	SLT-RED		20			
36	BLK-BLU	OPX 3	21	OPX 3T		WHT-BLU
11	BLU-BLK		22	OPX 3R		BLU-WHT
37	BLK-ORN		23	CX T	GRN	
12	ORN-BLK		24	CX R	RED	
38	BLK-GRN		25	CX†	BLK	
13	GRN-BLK		26			
39	BLK-BRN		27			
14	BRN-BLK		28	CX†	YEL	
40	BLK-SLT		29			
15	SLT-BLK		30			
41	YEL-BLU	OPX 4	31	OPX 4T		WHT-BLU
16	BLU-YEL		32	OPX 4R		BLU-WHT
42	YEL-ORN		33	CX T	GRN	
17	ORN-YEL		34	CX R	RED	
43	YEL-GRN		35	CX†	BLK	
18	GRN-YEL		36			
44	YEL-BRN		37			
19	BRN-YEL		38	CX†	YEL	
45	YEL-SLT		39			
20	SLT-YEL		40			
46	VIO-BLU	OPX 5	41	OPX 5T		WHT-BLU
21	BLU-VIO		42	OPX 5R		BLU-WHT
47	VIO-ORN		43	CX T	GRN	
22	ORN-VIO		44	CX R	RED	
48	VIO-GRN		45	CX†	BLK	
23	GRN-VIO		46			
49	VIO-BRN		47			
24	BRN-VIO		48	CX†	YEL	
50	VIO-SLT		49			
25	SLT-VIO		50			

† Provides POWER/CONTROL signals to the electronic ringer.

Table 7 13 CARD KSU P2 CONNECTIONS

25 Pair Cable		P2 Connector			Station Cable	Interconnect
Conn Pin	Color Code		Block Term.	Function	To Station Block	To Trunk Interface
26	WHT-BLU	OPX 6	1	OPX 6T		WHT-BLU
1	BLU-WHT		2	OPX 6R		BLU-WHT
27	WHT-ORN		3	CX T	GRN	
2	ORN-WHT		4	CX R	RED	
28	WHT-GRN		5	CX†	BLK	
3	GRN-WHT		6			
29	WHT-BRN		7			
4	BRN-WHT		8	CX†	YEL	
30	WHT-SLT		9			
5	SLT-WHT		10			
31	RED-BLU	OPX 7	11	OPX 7T		WHT-BLU
6	BLU-RED		12	OPX 7R		BLU-WHT
32	RED-ORN		13	CX T	GRN	
7	ORN-RED		14	CX R	RED	
33	RED-GRN		15	CX†	BLK	
8	GRN-RED		16			
34	RED-BRN		17			
9	BRN-RED		18	CX†	YEL	
35	RED-SLT		19			
10	SLT-RED		20			
36	BLK-BLU	OPX 8	21	OPX 8T		WHT-BLU
11	BLU-BLK		22	OPX 8R		BLU-WHT
37	BLK-ORN		23	CX T	GRN	
12	ORN-BLK		24	CX R	RED	
38	BLK-GRN		25	CX†	BLK	
13	GRN-BLK		26			
39	BLK-BRN		27			
14	BRN-BLK		28	CX†	YEL	
40	BLK-SLT		29			
15	SLT-BLK		30			
41	YEL-BLU		31			
16	BLU-YEL		32			
42	YEL-ORN		33			
17	ORN-YEL		34			
43	YEL-GRN		35			
18	GRN-YEL		36			
44	YEL-BRN		37			
19	BRN-YEL		38			
45	YEL-SLT		39			
20	SLT-YEL		40			
46	VIO-BLU		41			
21	BLU-VIO		42			
47	VIO-ORN		43			
22	ORN-VIO		44			
48	VIO-GRN		45			
23	GRN-VIO		46			
49	VIO-BRN		47			
24	BRN-VIO		48			
50	VIO-SLT		49			
25	SLT-VIO		50			

† Provides POWER/CONTROL signals to the electronic ringer

PCB Strapping

4.11 One B-8SLU-B PCB is required to serve the maximum of eight extensions. The PCB must be strapped in the 2-3 position to indicate that single line telephones are used (Figure 9). The SLU PCB can be inserted in any station position in the main or expansion cabinet (if used). However it is recommended that the PCB be inserted in a position where one 25 pair cable out of the KSU serves all 8 station ports. This prevents cross connecting two station blocks to access the 8 OPXs.

4.12 The B-OPX-A PCB serves one Off Premises extension. It must be strapped for the desired ring mode. Strap E1 and E2 to provide the Norm ring mode (1 second on; 3 seconds off). Strap E2 and E3 to provide the Extend ring mode (2 seconds on; 2 seconds off) (Figure 10). An OPX with a longer loop may require the Extend strapping to ensure proper ring detection.

Connections to Telco

4.13 Each OPX requires one OPX line. Access to OPX lines are provided on the RJ21X connecting block with CO lines. The OPX line(s) is designated as 1LM. Plug a female ended 25-pair cable into the telco RJ21X. Punch down free connectors into a 66M1-50 connecting block to be designated as CO Line Interface Block.

Connect the 6 Card KSU to the OPX lines as follows (Table 3):

- *Cross connect terminals 25-36 in the C Block, depending on the number of OPX lines required, to the terminals for the OPX lines on the CO Line Interface Block.*

Connect the 13 Card KSU depending on the number of OPX lines required, as follows (Tables 6, 7):

- *Cross connect terminals 1 and 2 for OPX line 1; 11 and 12 for OPX line 2; terminals 21 and 22 for OPX line 3; terminals 31 and 32 for OPX line 4; and terminals 41 and 42 for OPX line 5 on the P1 Block to the CO Line Interface Block.*
- *Cross connect terminals 1 and 2 for OPX line 6; terminals 11 and 12 for OPX line 7; and terminals 21 and 22 for OPX line 8 on P2 Block to the CO Line Interface Block.*

On Premises Extension

4.14 The same installation procedures are used when connecting an On Premises Extension (ONX). The telephone used as an ONX is connected to the terminals on the C block (or P1 and P2 block) that are normally connected to the CO Line Interface Block.

5. CIRCUIT DESCRIPTION

General

5.01 An on-card voltage regulator provides 12 volts DC to powe all logic circuits. OPX Tip and OPX Ring are protected by metal-oxide varistors (MOVs) against possible lightning strikes.

Refer to Figure 11 for electrical connections to OPX adaptor.

5.02 Ring Equivalence Number (REN) considerations when connecting off-premise stations are provided in Figure 12

Figure 12 shows the relationship between the ring enable signal found on one SLU card. The ring equivalence number (REN) o the station pairs shown (1 and 2), (3 and 4), (5 and 6), (7 and 8) must not exceed 5.0B, when both stations in each pair be addressed to ring at the same time.

Call Originating

5.03 When the OPX station connected to the adaptor is signaled by the system, the Ring Detect Circuit senses the change in DC voltage (from 24VDC to 9VDC) on the SLU Tip lead referenced to SLU BLK and generates a Ring Enable signal. The Ring Relay Drive Circuit uses this Enable signal to turn on the Ring Relay (RR). This relay applies GND to OPX Tip and ringing generator (90VAC @ 20Hz) to OPX Ring. A strap option is provided for 2 modes of ringing: Norm (1 second on, 3 seconds off) or Extend (2 seconds on, 2 seconds off). This option is provided because 1 second may not be long enough for reliable ring detection by remote equipment on long loops. The ringing generator must be biased to -48 volts DC. When the called party goes off hook, a DC current is generated. The Ring Trip Circuit senses this current and generates a Reset signal which shuts off the ring relay. The talk path is now established.

Call Answering

5.04 When the OPX station goes off hook, a DC current of at least 20ma flows through the battery-feed coil (T1) and the two resistors (Figure 13). This current is detected by the Loop Current Detector. This detector closes a DC path across SLU Tip and SLU Ring. Current flows through this path and an off hook condition is detected on the SLU card. System ICM dial tone is heard at the OPX station.

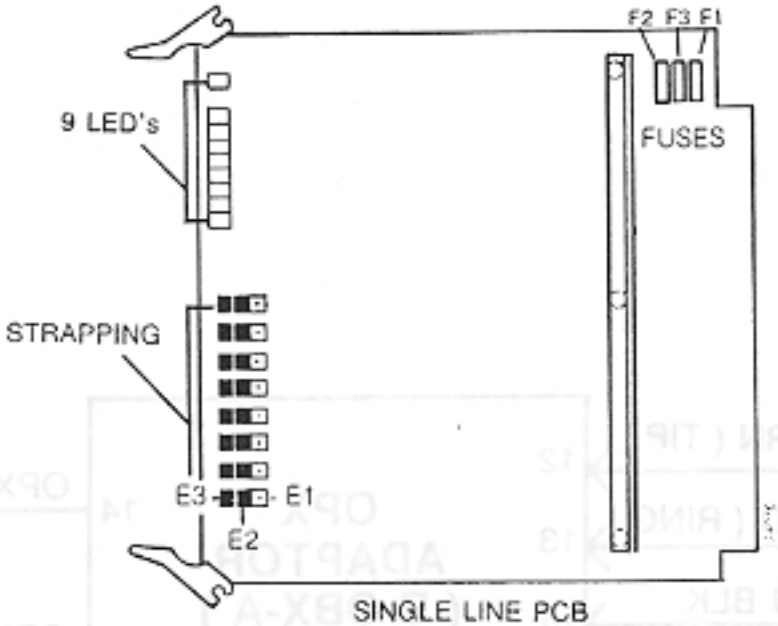

Figure 9 B-8SLU-B PCB

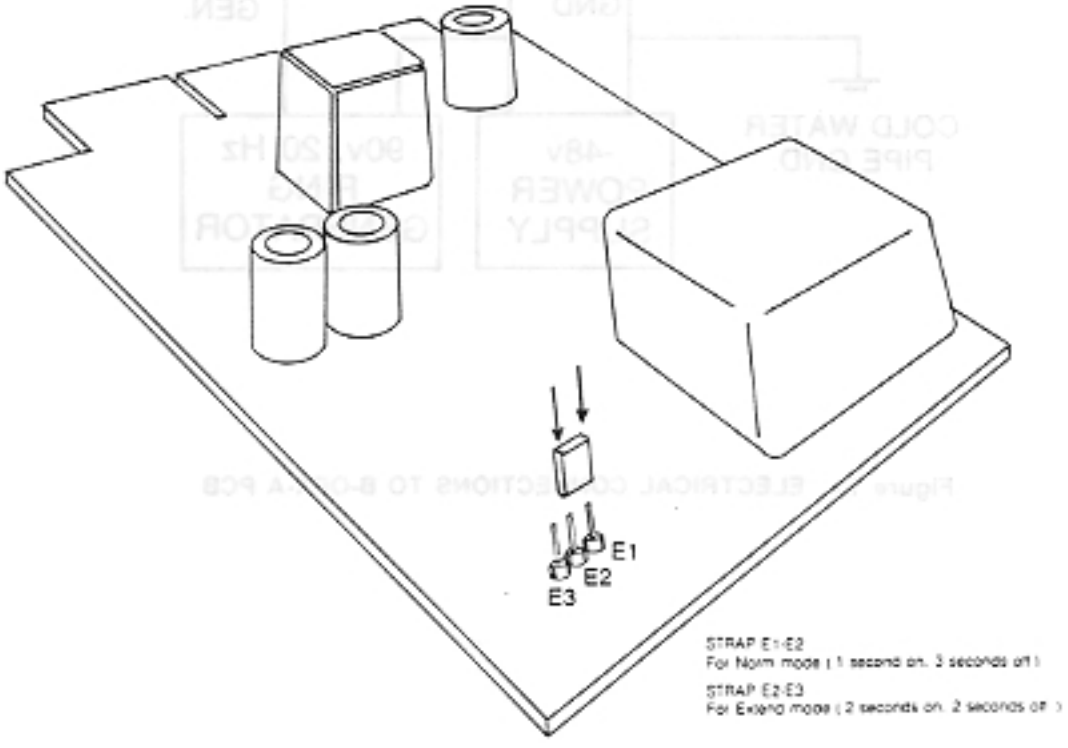

Figure 10 B-OPX-A PCB WITH STRAP OPTIONS

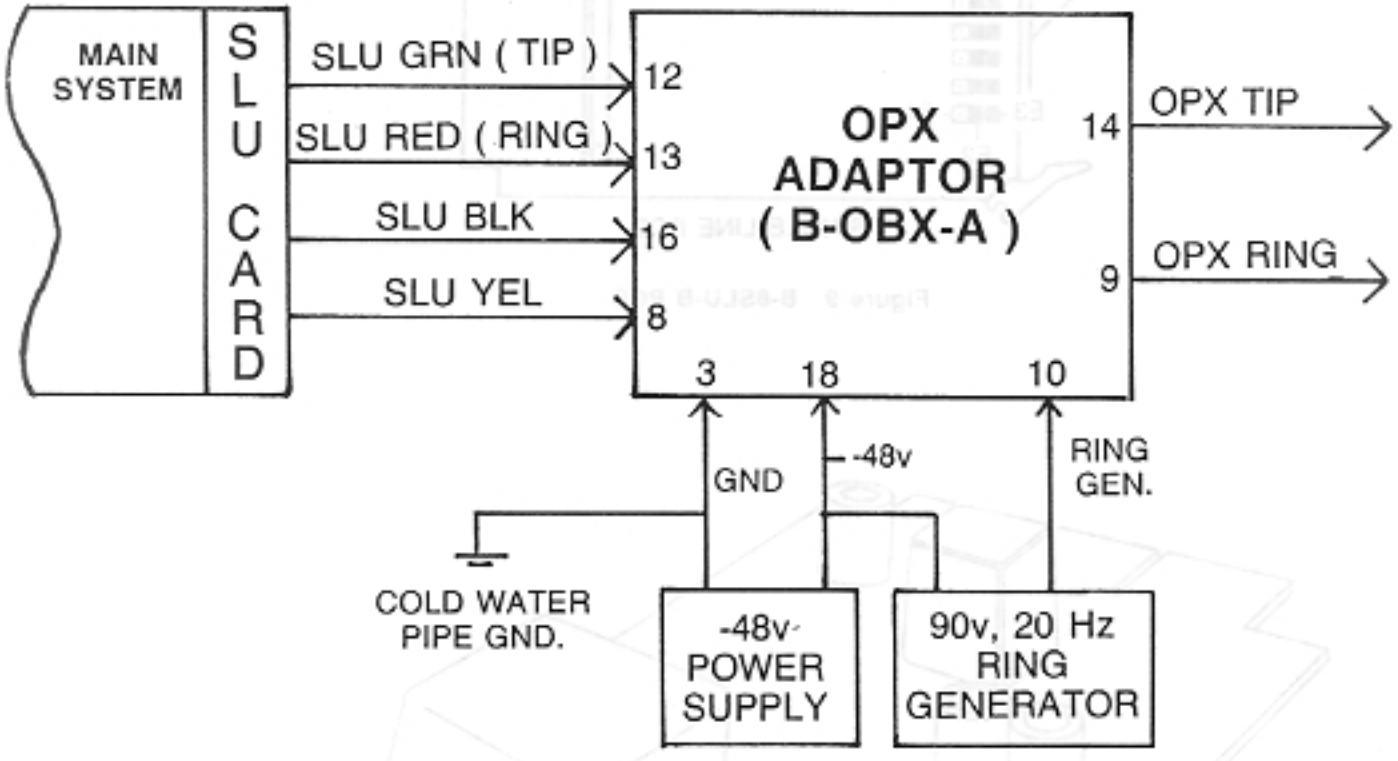

Figure 11 ELECTRICAL CONNECTIONS TO B-OPX-A PCB

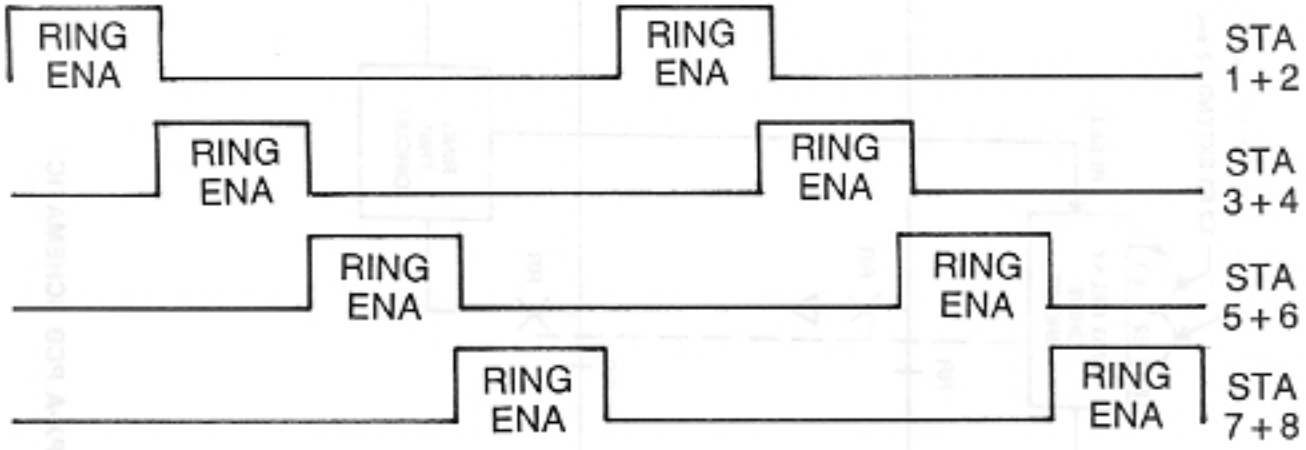

Figure 12 B-8SLU-B RING ENABLE CYCLES

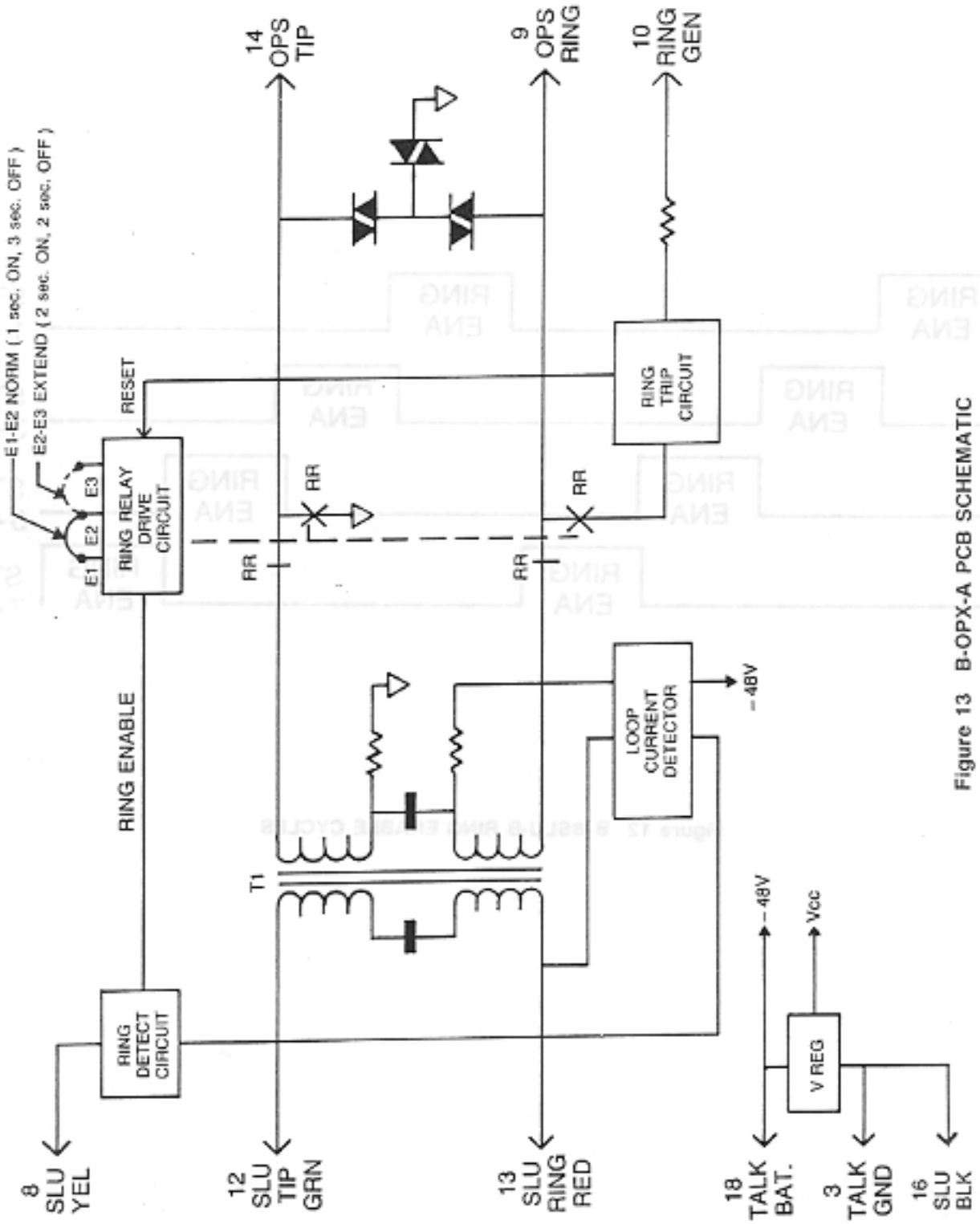

Figure 13 B-OPX-A PCB SCHEMATIC