

**PROGRAMMED MAINTENANCE AIDS
SOFTWARE SUBSYSTEM DESCRIPTION
NO. 3 ELECTRONIC SWITCHING SYSTEM**

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1. GENERAL

1.01 This section describes the programmed maintenance aids provided for the No. 3 Electronic Switching System (ESS) offices. Programmed maintenance aids are a category of software programs developed to perform tests on crosspoints, line insulation, stations, trunks, and lines in the No. 3 ESS office. The relationship of the programmed maintenance aid programs to the No. 3 office is shown in Fig. 1 for the SO-2 generic and Fig. 2 for the 3E3 generic.

1.02 This section is reissued to incorporate changes necessary to make programmed maintenance aids compatible with both the 3E3 generic and Issue 4 of the SO-2 generic. The following items have been added:

- (a) Description of trunk and line test panel control for the 3E3 generic

- (b) Description of the remote office test line
- (c) Fig. 2, 19, 22, 24, 25, and 26
- (d) Tables I and J.

Revision arrows are used to emphasize the more significant changes.

1.03 Part 4 contains a glossary of terms and definitions necessary for comprehension of the information contained in this document. Part 5 contains a list of abbreviations used in this document.

1.04 The following Bell System Practices provide background information and information in greater detail on some of the operations that are briefly described in this document.

SECTION	TITLE
233-135-105	Trunk and Line Test Panel and Associated Equipment Description and Theory of Operation, No. 3 Electronic Switching System
233-135-110	Remote Office Test Line (ROTL), Description and Theory of Operation, No. 3 Electronic Switching System
233-151-105	Call Processing, Software Subsystem Description, No. 3 Electronic Switching System
233-151-130	Basic Call Processing Software Subsystem Description, No. 3 Electronic Switching System
233-151-155	Peripheral Input/Output Control Software Subsystem Description, No. 3 Electronic Switching System
233-152-120	Teletypewriter Software Subsystem Description, No. 3 Electronic Switching System
233-152-130	Tape Operations Software Subsystem Description, No. 3 Electronic Switching System
233-153-106	Network Fabric Exercise Function Software Subsystem Description, No. 3 Electronic Switching System

SECTION 233-153-105

SECTION	TITLE
233-153-145	◆Remreed Network Fault Isolation Utilities, Software Subsystem Description, No. 3 Electronic Switching System◆
233-190-205	◆Remote Office Test Line Feature Near-End and Far-End Applications, No. 3 Electronic Switching System◆

1.05 The following programs provide additional information relative to this document.

(a) Common Base Level Monitor Program (CBLM), PR-1C950, is the focal point of the base level system and determines the sequencing of all programs.

(b) Application Portion of the Base Level Monitor Program (BLMMA), PR-3H004, performs two basic functions.

(1) BLMMA provides tables that are used by CBLM.

(2) BLMMA invokes routines that are executed once per base level loop.

(c) Common Tape Handler Program (CTAPH), PR-1C957, performs various tape operations requested by client programs. These operations include such functions as opening and closing files, read and write operations, and positioning of the tape. The tape handler is resident and portions are executed at base level, while other portions are executed at interrupt level.

(d) Application Teletype Compatibility Program (TTYAPP), PR-3H015, implements the various teletypewriter operations requested by the client programs. These operations include such functions as processing the various output message calls used by the No. 3 ESS common system programs, removing and restoring messages, and generating the standard office identification text which includes the current data and time.

(e) Maintenance Nonresident Miscellaneous Subroutines (MNRSUB), PR-3H312, is a collection of miscellaneous maintenance subroutines. The main purpose of MNRSUB is to perform similarly to a mini-multiscan function (mini-MSF) for various resident and nonresident programs.

(f) Maintenance Subroutines (MCSUB), PR-3H251, is a collection of subroutines that are called upon by other programs in the performance of maintenance on the system.

(g) Station Ringer Test Handler (SRTH), PR-3H316, is requested when an access code is dialed from a customer handset. This program will test TOUCH-TONE® number code generators, station ground conditions, and station ringer.

(h) Local Test Desk Handler (LTDH), PR-3H311, is a software package used to complement the No. 3 ESS local test desk trunk circuit SD-3H520-01 (CPS-FB519).

(i) Automatic Line Insulation Test (ALIT), PR-3H310, performs the line insulation test on a specified line.

(j) Trunk and Service Circuit Maintenance Aids Program (TSVMON), PR-3H318, provides the means for monitoring circuit errors and failures and then reports the results via TTY output messages.

(k) Trunk, Line, and Service Circuit Nonresident Routines (TSVNR), PR-3H319, contains routines associated with the maintenance of trunks, service circuits, lines, and network links.

(l) Maintenance Audits (MAUD), PR-3H314, performs a series of audits on the counters, bits, and maps listed in Table A.

(m) Network Grid Removal Routines (GRDUTL), PR-3H321, is used to remove from service or restore to service network grids.

(n) Network Fabric Exercise Program (NFEX), PR-3H313, is used to test all 2-wire (tip and ring) talk path connections in the No. 3 ESS network.

(o) Network Grid (NWGRID), PR-3H320, causes a specific network order to be sent to the off-line network controller (NWC).

(p) Trunk and Line Test Panel Controller (TLTPC), PR-3H317, interfaces with manual actions via the trunk and line test panel (TLTP). The TLTP can be used to test trunks, service circuits, lines, and junctors.

(q) ♦Office Test Line Control (OFFTL), PR-3H253, is used to control the dialed-up connections and hardware terminations used to provide the milliwatt (102-type), balance (100-type), loop-around, synchronous, short circuit, open circuit ac/dc open circuit, and charge test line functions.♦

(r) ♦ROTL Access Handler (ROTLA), PR-3H200, establishes and supervises the connections associated with the party establishing the initial connection to the Mini-ROTL access port.

(s) ROTL Communications Handler (ROTLA), PR-3H201, communicates with the Mini-ROTL and initiates and monitors actions in response to its commands.

(t) ROTL Trunk Test Handler (ROTLT), PR-3H202, establishes and supervises connections associated with the trunk selected for testing.♦

1.06 Even though the NFEX program is part of the programmed maintenance aids, it is described in detail in Section 233-153-106.

2. MAINTENANCE

2.01 Software and hardware are arranged to detect service-affecting troubles by making the appropriate per-call checks or by performing maintenance checks on the hardware. The maintenance programs handle the functions related to the detection, diagnosis, and reaction to abnormal office operation.

TROUBLE DETECTION

2.02 Trouble detection is the primary means of inhibiting performance deterioration. Detection schemes are used throughout the system to facilitate identification of problem areas. These procedures utilize hardware and software operations to further ensure the integrity of the system.

2.03 Self-check circuits are provided in the 3A Central Control (3A CC), main store (MAS), and peripheral controllers. These check circuits act as continuous monitors by which the system is notified of erroneous responses.

2.04 During call processing, many checks are made to ensure the validity of system actions. For example, a check is made for high voltage to prevent damage to sensitive circuits associated with

the customer line. Checks are also made to ensure that a customer line is ready for another origination after a previous disconnect (restore-verify check). This check verifies that the line-attending element was restored to the line to allow an origination.

2.05 Routine testing is performed by periodic diagnostics or periodic progression.

2.06 Periodic diagnostics are automatic tests of hardware on a scheduled basis (every 24 hours). These controller diagnostics (TRK, SVC CKT, etc) are read in (paged) from the tape cartridge and are performed by the on-line 3A CC. These diagnostics may also be manually requested via the local or remote maintenance TTY.

2.07 Periodic progression testing is comprised of tests wherein test circuits are automatically connected to line, trunk, or service circuits in an effort to detect latest problems. In addition, the network may also have test circuits associated with it to perform false cross and ground, power cross, and restore-verify tests which are performed on a call basis.

ERROR ANALYSIS

2.08 The error analysis resident software of the No. 3 ESS is invoked by failures in call processing involving the replicated portion of the system. This software receives a report only when there is an error and analyzes problems in categories by comparison. The error rate of a particular circuit is compared with the error rate of its particular group. If the comparative rate is excessive, that particular trunk, line, service circuit, junctor, A-link, or B-link is removed from service and an appropriate TTY message is printed indicating a problem which must be diagnosed later.

2.09 Error analysis and fault detection are described in detail in Section 233-153-135.

QUICK-CHECK

2.10 Quick-check is another form of error analysis and is associated with problems which affect trunks, service circuits, A-links, B-links, and junctors. If three successive errors occur in a particular circuit, the circuit is automatically removed from service, as opposed to the member group failure rate of the error analysis programs.

PROGRAMMED MAINTENANCE AIDS

2.11 Programmed maintenance aids are a group of resident and nonresident programs (Part 3) that are used by the maintenance personnel to either define a problem or verify a predetermined fault within the system. These programs are initiated automatically or manually.

3. PROGRAMMED MAINTENANCE AIDS

GENERAL

3.01 Programmed maintenance aids are software tools which maintenance personnel can use to test a problem area or to verify a fault that has already been found automatically by maintenance software self-checks.

FUNCTIONAL OVERVIEW

3.02 Functions performed by the programmed maintenance aids include:

- (a) Station ringer test line
- (b) Loop-around test line
- (c) Milliwatt (102-type) test line
- (d) Balance (100-type) test line
- (e) Synchronous test line
- (f) AC-DC open circuit test line
- (g) Short circuit, open circuit, and charge test line
- (h) Local test desk
- (i) Automatic line insulation test
- (j) Trunk and service circuit maintenance
- (k) Trunk, line, and service circuit nonresident routines
- (l) Maintenance audits
- (m) Network grid removal
- (n) Network fabric exercise

- (o) Network grid
- (p) Trunk and line test panel
- (q) Remote office test line.

3.03 The software programs used for programmed maintenance aids are both resident and nonresident programs. These programs are initiated by an automatic or manual request. The resident programs are stored in MAS and nonresident programs are stored on magnetic tape.

3.04 The nonresident programs must be loaded into on-line memory by an automatic or manual request to the multiscan function controller (MSFC). There are several off-line programs stored on magnetic tape and the MSFC determines whether the requested program can be written into memory without interfering with other off-line functions currently resident in memory. When the request is granted, the tape handler program will be called to load the requested program into memory. When the request is denied, the return code of the requesting program is a failure code. This sequence is outlined in Fig. 2.

3.05 The functional relationship of these programs in programmed maintenance aids is shown in Fig. 1 and 2. These programs are not related; however, they are grouped for functional purposes since they interface with the same on-line programs. Normally, only one nonresident program can be resident in memory at any one time, and the function must be completed or aborted before another off-line program can be loaded. A priority function in MSFC determines these relationships. Generally, the programmed maintenance aids operate in the following sequence.

- (1) An automatic or manual request is granted.
- (2) The MSFC calls for the program to be loaded or denies the request.
- (3) The requestor is kept advised as progress is made in loading the programmed maintenance aid program.
- (4) When the program is loaded, an initial entry to the program initializes control words for the program.

- (5) During each base level loop, the programmed maintenance aid program is enabled.
- (6) External inputs are scanned to determine program functions to be executed.
- (7) A success or error is generated as tests are performed and error codes are returned for interpretation.
- (8) When all tests are complete or an error aborts the program, test results and/or termination code are returned.
- (9) A final entry to the programmed maintenance aid program is made to restore the network and to clear control functions.

The programmed maintenance aid programs follow the above sequence but may not carry out each detail of the sequence.

FUNCTIONAL DESCRIPTION

3.06 The following paragraphs provide not only basic information on each programmed maintenance aid program but also a description of the program organization.

A. Maintenance Nonresident Miscellaneous Subroutines (MNRSUB)

3.07 The main purpose of the MNRSUB program is to act like a mini-multiscan function (mini-MSF) for various resident and nonresident programs. MNRSUB is also a collection of miscellaneous maintenance subroutines. The mini-MSF and the miscellaneous subroutines are described in more detail in the following paragraphs.

Mini-MSF Control Subroutine

3.08 The purpose of the maintenance mini-MSF routine is to pass control to any of a set of miscellaneous maintenance routines all under a single MSF function (Fig. 4).

3.09 A task is requested by setting the active MSF bit (AMSF) in the nonresident maintenance scratch area (Fig. 5) and storing the appropriate user code (USERCD), transient call record number (TCRN), and user data in that area. When the user has had an opportunity to receive this data, the AMSF bit is cleared freeing the buffer for

subsequent requests. As long as at least one task is active and no abort entry code has been received from the MFSC, the mini-MSF busy bit (MSF) will be set in the scratch area. If an abort entry code is received, both MSF and AMSF are cleared. When both bits are clear, the mini-MSF may be either idle or in the process of aborting.

3.10 The task status block (TKSBLK) in program ATSD contains one word per implemented task. A one in any bit results in a call to the corresponding task at an entry point indicated by the position of the bit.

3.11 Upon receiving a request for a task, the mini-MSF sets the initial entry bit for that task, clears the initial entry bit, sets the per-scan entry bit, and calls the task at its initial entry point. Otherwise, the user is free to assign and manipulate the entry point flags as desired.

3.12 Upon entry to the mini-MSF, every active user is called at each flagged entry point in order, beginning with the initial entry and proceeding to the higher order bits in the task status word.

3.13 The user can be terminated by either returning to the mini-MSF with a return code of three or clearing all entry point flags in the task status word. In the first case, termination occurs immediately. In the second case, the user will still be called at any higher order entry points which were flagged when the current entry to the mini-MSF was made. Table B contains a list of the user codes and the tasks they represent.

3.14 For the SO-2 generic, the MMSF0 is a base level loop function and not a multiscan function. It handles the resident programs SRTH, LTDH, and ALIT.

3.15 For the SO-2 generic, the MMSF1 is a multiscan function that handles the nonresident programs TSVMON, TSVNR, MAUD, and GRDUTL.

3.16 For the 3E3 generic, the MMSF0 is a base level loop function and not a multiscan function. It handles the resident programs SRTH, LTDH, ALIT, and TSVMON and the multiple remove/restore requests of TSVNR.

3.17 For the 3E3 generic, the MMSF1 is a multiscan function that handles the nonresident programs

MAUD and GRDUTL and the multiple status requests of TSVNR.♦

3.18 Both MMSF0 and MMSF1 can be performing tests at the same time without interfering with each other.

Miscellaneous Maintenance Subroutines

3.19 Located within program MNRSUB is a collection of miscellaneous maintenance subroutines. A brief description of each subroutine follows.

Maintenance Trunk and Service Circuit Monitor (MCTSVM) Subroutine

3.20 The MCTSVM subroutine is requested when a TTY message is entered requesting monitoring or outputting of hardware errors analyzed by the error analysis program. This subroutine is an interface between the TTY program and the TSVMON program. MNRSUB is the control program and TSVMON is the client program.

3.21 After the TTY message has been received, this subroutine sets up the user code and then sets up the condition with the MSF function in the MMSFC1 control section (CSECT). On the next base level loop, the mini-MSF gets control, processes this information, and then passes control to the TSVMON program.

3.22 The TSVMON program provides for the actual testing to be performed. TSVMON is described in paragraphs 3.107 through 3.109.

3.23 The TTY input messages used to activate TSVMON are listed in Table C and described in greater detail in the Input Message Manual (IM-3H300).

Maintenance Audits Interface (AU_MAINT) Subroutine

3.24 The AU_MAINT subroutine is an interface between the TTY program and the MAUD program. The AU_MAINT subroutine is requested when the TTY message **AU:MAINT!** is entered. This subroutine requests the mini-MSF client program MAUD to perform audits of various maintenance data. This request may ask to perform all of the maintenance audits or a specific audit. A list of the maintenance audits is shown in Table A.

3.25 After the TTY message has been received, this subroutine sets up the user code and then sets up the condition with the MSF function in the MMSFC1 CSECT. On the next base level loop the mini-MSF assumes control, processes this information, and then passes control to the MAUD program.

3.26 The MAUD program provides for the actual audits to be performed. MAUD is described in paragraphs 3.203 through 3.223.

Route Alarms (RTE_ALM) Subroutine

3.27 The RTE_ALM subroutine is called when the TTY message **RTE:ALM!** is entered. This subroutine is the software equivalent of operating the alarm transfer key (ALARM TRFR) on the system status panel. It routes critical, major, and minor alarms to a remote location. Critical, major, and minor alarms (both visual and audible) are retired after 5 seconds. The TTY message **ACP:ALM!** returns the alarm indications to the local office.

Inhibit Building Alarms (INH_BLDG) Subroutine

3.28 The INH_BLDG subroutine is called when the TTY message **INH:BLDG!** is entered. This subroutine is the software equivalent of operating the inhibit building alarm key (INHIBIT BUILDING ALARM) on the system status panel. It inhibits all building alarm scan points except the fire alarm. All other building alarm scan points will be ignored. The TTY message **ALW:BLDG!** rearms all building alarms.

Accept Alarms (ACP_ALM) Subroutine

3.29 The ACP_ALM subroutine is called when the TTY message **ACP:ALM!** is entered. This subroutine is the software equivalent of releasing the alarm transfer key on the system status panel. It returns the critical, major, and minor alarm indications to the local office.

Allow Building Alarms (ALW_BLDG) Subroutine

3.30 The ALW_BLDG subroutine is called when the TTY message **ALW:BLDG!** is entered. This subroutine is the software equivalent of releasing the inhibit building alarm key on the system status panel. It rearms all building alarms

by removing the inhibit status from the building alarm scan points.

Test Switching Control Center (TST_SCC) Subroutine

3.31 The TST_SCC subroutine is called when the TTY message **TST:SCC!** is entered. This subroutine tests the telemetry interface and displays in the switching control center (SCC). A number of indicators are activated on the system status panel, and the panel is then removed from service for 10 seconds. The SCC can then interrogate the panel and expect to see all indicators active. After 10 seconds, the system status panel is restored to service.

Peripheral Pulse Distributor Order (ORD_PPD) Subroutine

3.32 The ORD_PPD subroutine is called when the TTY message **ORD_PPD!** is entered. (Refer to the Input Message Manual for an explanation of the TTY message.) This subroutine executes a series peripheral pulse distributor (PPD) order to set the state of some peripheral decoder (PD) points to any desired state. If only one state of the triplet is requested, that state is written out to the PD once and the subroutine is terminated. If two states are given, the PD triplet is toggled back and forth between the two states every base level loop until the terminate command is inputted. The terminate command is the **STOP:UTIL!** TTY message.

Caution: *Care should be exercised in the use of this subroutine since calls in progress and the general health of the system can be affected.*

Battery Boost Test (TST_BB) Subroutine

3.33 The TST_BB subroutine is used to test the battery boost converters which may have turned off due to a momentary power surge. This subroutine is called when the TTY message **TST:BB!** is entered. It tests the battery boost converters on all equipped network frames. All converters are momentarily turned off and then turned back on. An output message is then generated to convey the state of the battery boost scan point. This test is used to distinguish between transient and hard battery boost alarms.

B. Maintenance Subroutines (MCSUB)

3.34 The MCSUB program is a collection of subroutines that are called upon by other programs in the performance of maintenance of the system. The following is a brief description of the maintenance subroutines in MCSUB.

Request a Mini-MSF Function (MMSF) Routine

3.35 The MMSF routine is used to request the mini-controller and load its request buffer. The entry point MMSF_TCR performs the above, selects a TCR, and saves R6 through R13 in slots 6 through 13 of the TCR. The TCR number is then saved in the mini-controller request buffer (Fig. 5) in TCRN for scheduling of the request for the mini-MSF function.

3.36 The MMSF routine is invoked by CSECTs MMSF0, MMSF1, and MLTP in the MNRSUB program when GRDUTL, TSVMON, and MAUD request MMSF function.

Maintenance System Status Panel Status Administration (MCSSPS) Routine

3.37 The MCSSPS routine is called once each base level loop to administer various indicators on the system status panel (SSP). The following functions are performed.

- (a) Light or extinguish the TDC lamp.
- (b) Light or extinguish the NPR ACT lamp.
- (c) Light or extinguish the FORCE lamp.
- (d) Toggle the local/remote alarming state when the ALARM TRFR key is pressed.
- (e) Toggle the building alarming state when the INHIBIT BUILDING ALARM key is pressed.
- (f) Release minor audible alarm after time-out.
- (g) Release all alarms after time-out if remote alarming is active.
- (h) Release all alarms when the ALARM RELEASE key is pressed.

3.38 When the ALARM TRFR key is administered (paragraph 3.37d), a TTY message is printed indicating that the alarms are or are not transferred. The output message format **† REPT ALM www TFR** is described in detail in the Output Message Manual OM-3H300.

3.39 When the INHIBIT BUILDING ALARM key is administered (paragraph 3.37e), the TTY output message **† INH BLDG ALM** is printed to indicate that any future building alarm (except fire) will not sound in the office (OM-3H300).

Maintenance Progress Marks For Nonresident Code (MCNRPM) Routine

3.40 The maintenance base level progress mark, MAINT_, is used by the trunk and line test panel control (TLTPC), local test desk handler (LTDH), and station ringer test handler (SRTH) programs to provide an interface with the call processing programs.

3.41 When the progress mark is invoked by the TCR SCAN as the result of a time-out or a base level action bit being set, the progress mark copies the status of the base level action bit and sets the MSG bit in the low two bits of BASEPM in the TCR, changing the BASEPM from MAINT to MAINT2 or MAINT3. Also, when the MAINT progress mark is invoked by the TCR SCAN as the result of a time-out or a base level action bit being set, the progress mark zeroes the base level action bit in the TCR and resets the TCR timing word to 10 minutes.

3.42 All reports from the input monitor are ignored. If either MAINT2 or MAINT3 is activated in the base level TCR SCAN, the progress mark assumes that the nonresident program is no longer monitoring the TCR and the TCR is failed.

Station Ringer Test Resident Interface (MCSRT) Routine

3.43 The resident, non-MSF code for the station ringer tests the call for association with call forwarding or add-on, selects an idle station ringer test circuit, and requests the mini-MSF controller before telling call processing to collect the rest of the digits. If the call is for call forwarding or add-on, if an idle station ringer test circuit is not available, or if the mini-MSF rejects the request, the call is routed to TRNSDISC in the disconnect

progress marks (DISCON) program and the line is given reorder. If a problem is found, a transfer is taken to reorder.

Local Test Desk Resident Interface (MCLTD) Routine

3.44 This routine is the resident interface for the local test desk handler (LTDH). This interface is used by the call processing to activate the LTDH when an origination of a local test desk (LTD) trunk has been detected.

3.45 There are three possible entry points which enable call processing to identify to LTDH the type of connection that was made from the LTD trunk to the line to be tested. The three possible entry points are as follows.

- (a) NOTEST—Indicates that the LTD trunk is connected to the line to be tested via a no-test vertical.
- (b) LTD_INIT—Indicates that the LTD trunk is directly connected to a line.
- (c) LTD_FAIL—Indicates that the LTD failed to connect to the line to be tested and that a failure response is to be given.

Base Level Utility Scan (UTILBS) Routine

3.46 This routine is called by the common utilities (CUTIL) program when the application utility function is active. It passes control to the current user via the address stored at U1ADDR in application temporary store definition (ATSD). If the user active flag is not set or the user overlay segment is not loaded, a failure return is made to shut down the application utility entry.

3.47 When the user returns, the data in R0-1 will be placed into the SSP display buffer if the display flag is set in U1ADDR in the ATSD. To terminate, the user should reset the user active flag. The pointer to U1ADDR is passed in R14-15.

Activate Or Deactivate Application Utility (UTILON/UTILOF) Routine

3.48 These routines activate or deactivate an application utility function. For UTILON, the call must be followed by an ADDR constant that will be saved in U1ADDR in the ATSD. A

failure return is made if either a common system or an application utility function is active.

Monitor Scan (MON_SCAN) Routine

3.49 This routine is called when the input message **MON:SCAN sc rw!** is typed. When this message is acted upon, it monitors a row in the scanner once per base level loop and initiates a periodic display of the state of the scanner row on the system status panel. An output message of **NG**, **RL**, or **OK** will be printed. **NG** will be printed if the scanner number is illegal. **RL** will be printed if the monitor request is rejected. This occurs if the system status panel display is already in use or if the application utility exit is busy. **OK** will be printed if the monitor request is accepted.

3.50 This routine is stopped and the buffer is freed when the input message **STOP:UTIL!** is typed.

C. Station Ringer Test Handler (SRTH)

Basic Information

3.51 The SRTH program is requested when an access code is dialed from the customer handset. A program interface diagram is shown in Fig. 6. As directed, this program will test:

- (a) TOUCH-TONE number code generators
- (b) Station ground conditions
- (c) Station ringer.

In addition, the program will verify that the directory number which was dialed is assigned to the terminal equipment number that originated the call.

3.52 The normal call processing routines are used for those portions of the call that involve connection to the network or disconnection from the network. For example, the customer dial pulse receiver is used to collect digits as for a normal call. The transient call record (TCR) is marked with a maintenance progress mark and the TCR may be controlled for a longer than normal period before the TCR timer times out.

3.53 The tests on the station ringer utilize the station ringer test circuit.

Program Organization

3.54 An SRTH entry point will be entered each base level by the MNRSUB program. A program flow diagram is shown in Fig. 7. The initial entry (SRTIETRY) reserves a call block in ATSD and initializes this 6-word block with the SRT TABLE (SRT_TAB) parameters. These parameters include the triplet address, a timer to limit test time, and a progress mark to determine activities to be performed during each base level entry of SRTH. The first progress mark set is digit collection since the directory number is dialed (next) for the station. SRTH checks the received digits to determine that the terminal equipment number (TEN) for the station is assigned to the dialed directory number.

3.55 Succeeding calls from MNRSUB will be to SRTBL, and the digits will be stored in the TCR by the normal call processing programs. When all digits are received, the translation of the directory number to the TEN is requested. The TENs in the TCR are compared, and equal TENs return dial tone whereas unequal TENs return a busy signal.

3.56 After the completion of the directory number verification, SRTH expects the TOUCH-TONE digits 1, 2, . . . , 8, 9, 0. The TOUCH-TONE (TT) test verifies the transmitted tones for the numbers. The number sequence stored in the TCR is checked for 1 through 0 (10). When the proper sequence is detected, two bursts of high tone are returned and, when an improper sequence is detected, a single burst of high tone is sent. When special tones (#, *) are received, a success code is returned. After a success or fail tone is returned, dial tone is reapplied and the TT test may be repeated.

3.57 The next sequence will be started when a switchhook flash is detected. The SRTH interprets the switchhook flash as an order to commence the off-hook tip and ring to ground test. The SRTH test circuit measures the resistance; a high resistance results in steady high tone and low resistance results in 60 impulse per minute (ipm) of high tone.

3.58 The station is placed on-hook, and SRTH stops the result of the last test and starts the station ringer test. This test involves coin control circuits when the station is a coin station. The proper coin test, return, and drain will be

applied. A successful return of coin or no-ground present on the leads initiates connection of a ringing circuit to the line to ring the station, and high tone will be present when answered. An unsuccessful test (ground present on the leads) sends 60 ipm to the station with no ringing sent to the station.

3.59 Program SRTH terminates when an on-hook greater than 1.3 seconds is detected after the TT test or after the ringer test.

3.60 A timer is maintained so that a limited amount of time elapses for completing the station ringer tests. When the time-out occurs, the connection to the network is removed and the call block (SRTTAB) is cleared.

3.61 When an entry is made to SRTH and an unresolvable condition exists in the program, the TOUCH-TONE test state is forced, and the program must be directed to the desired test by flash of switchhooks to initiate the off-hook resistance test, then on-hook to initiate the ringer test.

3.62 When a network order failure code is returned to SRTH by the subroutine that attempted to carry out the order, SRTH calls FAILSUB to clear the call, then clears SRTTAB, terminating SRTH.

D. Local Test Desk Handler (LTDH)

Basic Information

3.63 The LTDH program is a software package used to complement the No. 3 ESS incoming local test desk trunk circuit (SD-3H520-01 (CPS-FB519)). The local test desk trunk permits maintenance personnel to test any line in a No. 3 ESS office. This trunk provides a metallic path to the line in question so that maintenance personnel can perform any test provided by the local test desk.

3.64 The LTDH program provides those software interfaces required to perform the test from the local test desk (for example, testing a line ferrod or a subscriber TOUCH-TONE set). With either of these tests, the LTDH program responds to the request for these tests and also acknowledges and responds to test results via tones.

3.65 The local test desk handler per scan entry (LTDHPE) routine is the controlling routine

of the local test desk handler. It performs the coordinating functions needed in processing requests made by the local test desk. The local test desk may make the following requests.

- (a) TOUCH-TONE Test—Tests a subscriber TOUCH-TONE set.
- (b) Line Ferrod Test—Tests a line ferrod.
- (c) Disconnect—Will disconnect the local test desk from the network and terminate that local test desk.

3.66 The local test desk handler program is structured to service two local test desks concurrently.

3.67 The local test desk handler program allows the local test desk to perform full functional testing of subscriber lines.

System Operation

3.68 Customer lines in a No. 3 ESS office can be tested by a local test desk (LTD) either locally or remotely. The maintenance personnel at an LTD makes a test connection to the No. 3 ESS through an incoming LTD trunk (FB519) (Fig. 8). This connection can be dedicated or nondedicated and can require the use of an interface circuit.

3.69 An on-site dedicated arrangement (Fig. 9) does not require an interface circuit. A remote dedicated arrangement within 1500 ohms (Fig. 10) requires a test trunk ringing circuit (SD-96474-01) to allow ringing of customer lines by the maintenance personnel at the LTD. All other arrangements require the use of an RTC 99311 (paragraph 3.90). The RTC 99311 can be connected to the LTD in one of the following ways:

- (a) Remote dedicated greater than 1500 ohms (Fig. 11)
- (b) Remote nondedicated (Fig. 12)
- (c) Remote dedicated day/nondedicated night (Fig. 13)
- (d) Remote nondedicated day/night (Fig. 14).

3.70 Each No. 3 ESS office can have up to two LTD trunks, so that two LTDs can test customer lines simultaneously. The LTDH program is used for control of LTD trunks, some failure tones, the line ferrod test, TOUCH-TONE test, and disconnect request.

Establishing A Connection

3.71 When an LTD is connected via a dedicated facility, seizure of the incoming LTD trunk occurs when the maintenance personnel at the No. 14 LTD insert the primary test cord in the test jack associated with the circuit under test or by operating the associated outgoing trunk (OG) key at the No. 16 LTD. When an RTC 99311 is used, this circuit is seized and, in turn, causes the incoming LTD trunk circuit to be seized.

3.72 When an LTD is connected via a nondedicated facility, the maintenance personnel must dial an autoconnect trigger number over the DDD link. This number is recognized by the system program as a callback request, and the autoconnect feature then sets up a connection through the RTC 99311 to the LTD associated with the called trigger number. The LTD is then rung in the same manner as an incoming call. This callback is then answered by inserting a primary cord into the appropriate jack at the No. 14 LTD or by operating the PRI or SEC key at the No. 16 LTD. The maintenance personnel listen to ten seconds of confirmation tone after dialing the trigger number and then disconnects. If callback has not occurred within 2 minutes, the autoconnect has failed or the RTC 99311 is busy and the maintenance personnel must redial the trigger number. Busy tone is returned if the maintenance personnel remain off-hook and the autoconnect has failed or the RTC 99311 is busy.

3.73 After the seizure of the RTC 99311 and the LTD trunk has occurred, the maintenance personnel must operate the KP key. Operation of the KP key causes the supervisory ferrod in the trunk circuit (Fig. 15) to saturate. When saturated, this ferrod indicates an origination to the system program. When the origination is recognized, a multifrequency (MF) receiver and a network path are selected. The MF receiver is connected to the trunk circuit and placed in the proper state.

3.74 The trunk circuit is switched to the bypass state via the peripheral decoder (PD). In this state, the trunk circuit extends the trunk conductors to the line and/or trunk switching circuit and provides a tip-ring reversal. This tip-ring reversal is used so that the end of the wink signal in the receiver results in a ground on the ring lead to the LTD. After the trunk circuit is switched to the bypass state, battery reversal in the receiver at the end of the wink signal causes the S lamp at the LTD to light. This indicates to the maintenance personnel that the system is ready to receive digits. The supervisory ferrod in the trunk circuit is disconnected and supervision of the LTD is maintained in the digit receiver.

Inpulsing Completed

3.75 After the proper number of digits has been received, the trunk circuit is switched to the hold state and the receiver is disconnected and idled. The network path to the line to be tested is established after the digits are received, but not cut through to the LTD until the KP key is released. The trunk circuit is then switched to the test state so that the maintenance personnel at the LTD have dc access to the customer line. The LTDH program takes control at this point. There is a 1-minute time limit during which the KP key must be released after dialing. Until the KP key is released, the maintenance personnel can only monitor and then disconnect. If it is not released within this time limit, the LTD is disconnected from the line to be tested. The maintenance personnel at the LTD can then reoriginate by operating the KP key. If the LTD is autoconnected and this time-out occurs, the autoconnected path will not be taken down so that the maintenance personnel at the LTD can reoriginate.

Failure Tones

3.76 Overflow tone is returned to the maintenance personnel at the LTD if the trunk circuit cannot be connected to a line because of a network path not being available or if the required no-test vertical is busy. A steady high tone is returned when an invalid condition has occurred in translations.

3.77 These failure tones and other tones must be controlled by the LTDH program because the LTD trunk circuit is different from other trunks in that its supervisory scan point is latched up when the trunk circuit is operated. This prevents

disconnect from being seen in the normal manner. The LTDH program uses the directed scan points of the trunk to determine if an on-hook has occurred at the LTD. When disconnect is seen, the failure tone connection is torn down by the LTDH program. A failure tone normally times out in 30 seconds if no disconnect is seen.

Test Procedures

3.78 The LTDH program provides those software interfaces required to test a line ferrod or a customer TOUCH-TONE set from an LTD and to recognize a disconnect request from the LTD. The LTDH program not only responds to the request for these tests, but also acknowledges and responds to test results via tones.

Line Ferrod Test

3.79 Prior to initiating the line ferrod test, the T key at the LTD should be operated, placing a bridge across tip-ring at the LTD and providing a dc path through the customer line ferrod to ground. To test the line ferrod of the called line, the maintenance personnel operate the 3WO key which opens the sleeve lead at the LTD. When this test request is recognized, the LTDH program closes the line cutoff contacts, restoring the line ferrod to the line. The line ferrod will saturate if it is working properly. The LTDH program causes the line ferrod to be scanned. If the line ferrod is saturated, the LTDH program switches the incoming LTD trunk circuit to the dial tone state. If the line ferrod is not saturated, no response is given. Refer to Fig. 15 for connections of the line being tested.

3.80 Supervision of the LTD is maintained on a trunk scan point that is saturated during the period when dial tone is returned to the tester. Release of the T key opens the current path, causing this ferrod to de-energize. When this unsaturated ferrod is detected by the LTDH program, the trunk circuit is switched to the test (bypass) state. The maintenance personnel may repeat the test by operating the T key or terminate the test by releasing the 3WO key. When the termination of the test is detected by the LTDH program, the customer line cutoff contacts are opened and the trunk circuit remains in the test state.

3.81 If the line ferrod test fails (ie, dial tone is not heard), it may be repeated as in paragraph 3.80 by releasing and reoperating both the T key and the 3WO key. The trunk circuit does not change state if the customer line ferrod fails to saturate.

3.82 If the line under test is denied origination, no dial tone is given but the cutoff will be closed so that the battery and ground can be measured. Office records are to be checked when this response is given.

3.83 If the line under test is denied termination or has a key scan point, a 1-second burst of dial tone is returned. This also indicates that the line ferrod did saturate. If the line ferrod does not saturate, no dial tone is heard. Office records should be checked to determine if the line is denied termination or has a key scan point.

3.84 ♦If the subscriber attempts to originate a call while the line ferrod test is in progress, interrupted dial tone will be heard while the T key is released. The maintenance personnel should release the connection to the line to enable the subscriber to have service.♦

TOUCH-TONE Test

3.85 To test a customer TOUCH-TONE station set, the maintenance personnel need the assistance of someone at the customer premises. The maintenance personnel must apply the proper ringing voltage by operating one of the ringing keys to alert the customer or repair personnel on the premises and then operate the T key to apply talk battery and ground to the line. The maintenance personnel then operate the TT key which applies low resistance positive battery to the LTD end of the sleeve lead. When this test request is detected by the LTDH program, the trunk circuit is switched to the hold state. An idle station ringer test circuit, SD-3H520-01 (CPS-FB521), is then selected. If a station ringer test circuit is not available or the customer has gone on-hook, the LTD is given overflow tone through the junctor circuit until a test release (TT key released) occurs.

3.86 The station ringer test handler (SRTH) program also works in conjunction with the LTDH program. The LTDH program first selects the station ringer test circuit, connects the LTD to port 1 and informs the SRTH program to connect

to port 0 and perform the test. The SRTH program connects the A port of the station ringer to the customer line, performs one cycle of the TOUCH-TONE pad test, gives the success/fail tone response, and signals the LTDH program that the station ringer test is completed. While the LTD is connected to port 1 of the station ringer test circuit, the LTD has the capability of hearing inputs from the customer line and responses from the station ringer test circuit (Fig. 16). The maintenance personnel then have 7 minutes in which to use the station ringer test circuit before it is automatically disconnected by the SRTH program.

3.87 If the digit sequence 1, 2, 3, ..., 0 is received in numerical order or any single digit greater than 0 is received (*, #) and the tones are within the proper frequency and amplitude tolerance, the customer and the maintenance personnel at the LTD hear a success tone of two 500-ms bursts of high tone separated by 500 ms. If any tone is received in an incorrect order or a tone is out of tolerance, a failure tone which consists of a single 500-ms burst of high tone is returned.

3.88 When the maintenance personnel at the LTD release the TT key, high resistance negative battery is connected to the LTD end of the sleeve lead. This is recognized by the LTDH program as a test release, and the customer line and LTD trunk are disconnected from the station ringer test circuit and reconnected to each other.

Disconnect Request

3.89 Disconnect may be accomplished in one of the following two ways:

(a) By operating the disconnect key associated with the trunk connected to the No. 3 ESS. When the key is operated, low resistance negative battery is connected to the sleeve lead and tip and ring are opened at the LTD. When this condition is recognized by the LTDH program, the trunk circuit is switched to the idle state and the network path and customer line are also idled.

(b) By operating the KP key on the keyshelf. When this key is operated, the same electrical condition of the sleeve lead is maintained; however, the tip and ring are not opened at the LTD. The LTDH program disconnects the LTD and normal call processing, recognizes this as a new

origination, and proceeds as previously described in paragraphs 3.73 through 3.75.

RTC 99311 Configurations

3.90 The RTC 99311 is a 2-port device that can have both ports dedicated, one port dedicated and one port nondedicated, both ports nondedicated, or use only one port which can be either dedicated or nondedicated. Only one office equipment number (OEN) is needed for a RTC 99311. This OEN is for a nondedicated arrangement when either one or both ports are nondedicated.

3.91 A night transfer scan point is required when a night test desk arrangement is to be used. This scan point must be saturated by operation of the NC key at the day center before the night center can be connected to the RTC 99311. The No. 3 ESS can have only one night transfer scan point. This scan point (Fig. 17) is a fixed scan point and is designated as LTDNTP 0, 00, 4. If the No. 3 ESS office is equipped with two RTC 99311s, only one port of one RTC 99311 can be designated as a night LTD connection point. When the night transfer scan point is set, either the day center or the night center can seize RTC 99311. However, the NC key at the day center must be released before any kind of test can be performed from the day center.

3.92 Applique circuits in the RTC 99311 block each port when the other is in use and return busy tone (60 ipm) to the blocked port. The RTC 99311 gets 60 ipm from the No. 3 ESS and, through the configuration of the night transfer circuitry, the RTC 99311 puts the 60 ipm through the port that is to be refused. The only time the 60 ipm is actually heard is by the day center when the day center is dedicated and the night center is nondedicated. If the night transfer scan point is not set and the trigger number for the nondedicated night is dialed, the autoconnect feature will refuse to make the connection because it is defined as being a night center. A night center cannot be connected unless the night transfer scan point is set. When the night transfer scan point is set, the night center can come in via autoconnect. If autoconnect did make the connection and the night center is active, the day center will be given 60 ipm through the circuitry of the RTC 99311 if it tries to come in. When both ports are nondedicated, the autoconnect feature routes them to reorder in the No. 3 ESS or, if the night transfer scan point

is not set, this feature refuses to make the connection altogether.

3.93 The night transfer scan point refusal is different than the actual hardware built into the RTC 99311. Normally, a far-end test trunk or line circuit (SD-99308-01) is in front of the RTC 99311. When the No. 3 ESS is equipped with an RTC 99311, the far-end test trunk or line circuit is not required. Instead, the autoconnect feature and its associated applique circuits are used.

3.94 The tone circuits of the RTC 99311 are not required with autoconnect. This hardware refusal is utilized only if the night center is active. When this occurs, the circuitry of the RTC 99311 places 60 ipm on the dedicated port to which the day center is connected. With this type of connection, the maintenance personnel would hear a 60-ipm tone if the day center tried to seize the RTC 99311. If the night center is not active, the day center can come in at any time and release the NC key.

Autoconnect

3.95 The No. 3 ESS autoconnect facility provides a means to obtain a secure switched link to the ESS. The autoconnect is initiated by a user dialing a trigger telephone number that terminates at the ESS. This call is routed to a confirmation tone (high tone) if requested facilities are available or to busy tone if the facilities are not available. The calling party must wait for 10 seconds of confirmation tone and then go on-hook. If the facilities are available, the ESS calls a prestored return telephone number associated with the dialed trigger number. When the called party answers, a secure connection is made with the No. 3 ESS. If the callback has not occurred within 2 minutes, the autoconnect has failed and the caller must redial the trigger number.

3.96 The LTD autoconnect is different from a TTY autoconnect in that it is not associated with a TTY controller or an autoconnect line circuit (FB518). To maintain this autoconnect connection, it is necessary for the LTD to automatically generate a pilot pulse every 60 seconds or whenever a key is operated. If the pilot pulse is not detected by the pilot pulse scan point (Fig. 17) for a period of 2 minutes, the LTDH program causes the connection to drop the same as if the disconnect key had been operated. The No. 3 ESS has provisions for two

pilot pulse scan points, one pilot pulse scan point for each RTC 99311. These scan points are designated LTDPP0 and LTDPP1 and should be assigned respectively as scan points 0, 26, 15 and 0, 27, 0.

E. Automatic Line Insulation Test (ALIT)

Basic Information

3.97 This resident program is requested by manual action (TTY message **TST:LINE**) or by an automatic request during the daily maintenance period(s). The maintenance periods are scheduled during nonbusy hours and are controlled by the time-of-day clock. A program interface diagram is shown in ♦Fig. 18 for the SO-2 generic and Fig. 19 for the 3E3 generic.♦

3.98 The initial entry to the ALIT program is made when MNRSUB calls INIT_ALIT. This entry loads all initial parameters and sets the MSF active bit. Each base level loop ALIT is enabled to continue line tests.

3.99 After the initial entry, ALIT performs the SELF-CHECK functions to ensure that the circuit is operating properly. In the self-check sequence, an order is sent to the ALIT circuit. After a delay, the circuit is scanned to verify that the order was acted upon by the circuit. A mismatch causes the abort routine to be entered, and an error code is printed to indicate the self-check error.

3.100 When all self-check tests have been successfully completed, the actual line test routines are implemented. The line test routines will:

- (a) Short tip to ground and test ring to ground (SRG)
- (b) Short tip to ring and test tip and ring to ground (TRG)
- (c) Test for foreign electromotive force (FEMF).

Ground start, unassigned terminals, and busy lines are not tested by ALIT.

3.101 The line insulation test circuit is used to check the customer lines.

Program Organization

3.102 Each base level entry to ALIT accomplishes a portion of the total ALIT program until all lines are tested or until an error occurs that causes an error abort message. After a portion of ALIT instructions are read from memory and acted upon, a continue-multiscan function is returned to the MSFC. When the program is complete or an error occurs, the abort-multiscan function is returned to the MSFC.

3.103 A functional flow diagram of ALIT is shown in Fig. 20. The initial base level entry is at INIT_ALIT. This entry will initialize the control words, set the MSF active bit, and return to the MSFC. The next entry stores the starting parameters for a complete office check (automatic) or for a single line (manual). The manual request is checked for errors and, when present, an error message is printed and ALIT is terminated.

3.104 The common routine is entered and the TEST START message is printed. Since there is no diagnostic program for ALIT, a series of predetermined orders are sent. The results of these orders are compared to the expected results stored in the program.

3.105 After the self-check is completed, the line insulation tests are performed on the selected line or on all nonbusy, nonground start lines in the office.

3.106 Each line is tested by:

- (a) Shorting the tip to ground and measuring the ring to ground resistance (SRG)
- (b) Shorting the tip and ring and measuring the tip and ring to ground resistance (TRG)
- (c) Measuring the tip and ring for foreign electromotive force (FEMF).

3.107 At least three base level loops (200 ms/loop) are required to test each line. The result of each test (SRG, TRG, FEMF) is stored until the line is completely tested. An all-tests-pass condition increments testing to the next line. A failure causes the result of the test to be printed at the maintenance TTY. When an excessive number of line failures occur, ALIT is terminated.

A list of error codes and the associated error condition is given in Table D.

F. Trunk and Service Circuit Maintenance Aids Program (TSVMON)

General

3.108 The TSVMON program provides the means for monitoring circuit errors and failures and then reporting the results via TTY output messages.

3.109 In No. 3 ESS, a number of integrity checks are made by call processing during the normal processing of telephone calls. Upon a failure of a check (such as false cross and ground, continuity, restore-verify, or others), information identifying the peripheral circuits involved is passed to the trunk, line, service circuit, and network link error analysis (TSVEA) program for error accumulation and analysis. The main purpose of the monitoring routine is to provide maintenance personnel access to the error information reported by the report circuit trouble (**REPT CKT TRBL**) TTY output message regarding a particular circuit before it is interpreted by error analysis. This error information is then presented in readable form. A particular circuit is monitored by keeping a count of total errors that occur and each type of error that occurred at least once involving this circuit. The results of the monitoring will be printed on the TTY upon request.

3.110 The monitoring program will be used by maintenance personnel as an additional maintenance aid in obtaining information about troublesome problems that are not resolved correctly by the error analysis and diagnostic programs normally used.

3.111 The monitoring program TSVMON performs two functions to fulfill its main purpose: monitoring and reporting.

Monitoring

3.112 The monitoring function is able to monitor the following classes (circuit types) of peripheral circuits:

- Trunks

- Service circuits
- A-Links
- Wire B-Links
- Junctor B-Links
- Lines.

3.113 For each circuit type, monitoring can be performed on a specific circuit, a group of circuits for a type, or all circuits of a type. In addition, five individual monitors, in any combination of the types mentioned in paragraph 3.112, can be performed concurrently.

3.114 Monitoring is performed by incrementing a count for the total number of errors that have occurred involving the monitored circuit and setting a flag for each type of error for these monitored circuits.

3.115 At present, there are 21 error types which are listed in Table E. Not all types of errors can occur for a circuit type. Therefore, the error being interpreted is checked to see if the circuit being monitored can be involved in the error. These circuit types are shown in Table F.

3.116 To output the monitored results, the maintenance personnel must request that these results be printed by entering **OP:MON!** TTY input message. After the monitored results have been printed, monitoring continues from that point.

Reporting

3.117 Reporting is the function by which the maintenance personnel can request that errors in the error analysis input buffer be printed on the TTY every time an error occurs. This information is printed in a form which lists all circuits involved in the current error.

3.118 The reporting function has the option of reporting all errors that occur or only those of the error type specified on the input request. If reporting is requested on a specific error type, a maximum of three such requests are possible.

3.119 Both monitoring and reporting can be active concurrently. However, each function must be terminated independently.

3.120 Consult the No. 3 ESS Input Message Manual (IM-3H300) and the Output Message Manual (OM-3H300) for a description and explanation of the input and output TTY messages.

Program Organization

Initial Entry

3.121 A TTY request for error information from the error input buffer is indicated. There are two types of requests that can be made: monitoring and reporting. Refer to paragraphs 3.112 through 3.120 for an explanation of monitoring and reporting.

3.122 The TSVMON program is designed to be nonresident and operate under the mini-MSF controller. The information necessary to handle the request is passed via the mini-MSF request buffer and a TCR.

Monitoring

3.123 The MON_P subroutine performs the monitoring process. This subroutine compares data (ie, group and member number) requested to be monitored against data interpreted from the error received. When a match is found, the error count is incremented and the error flag bit for the error type received is set.

3.124 The MON_P subroutine also checks to see if the circuit being monitored is detected under the error received. If not, it skips the circuit being monitored and compares the error received against all the circuits being monitored.

3.125 An additional check is performed on the circuit being monitored to determine if all circuits of this type are to be monitored. If not, the regular procedure is followed. However, if all the circuits of one type are to be monitored, no comparison of group and member numbers is performed.

Reporting

3.126 The REPT_P subroutine performs the reporting process. This subroutine will compare the error type of the current error to the error types which have a report request. When a match is found, the data interpreted from the current error will be formatted and a TTY message

issued. If no specific error types have a report request but a report request was entered, reporting will be performed on all errors. The error types that will be reported on are listed in Table E.

Reported Error Types

3.127 The following error types will be reported upon when a report request is initiated. The appropriate trunk, service circuit, A-link, B-link, junctor, or line will be tested to see if the error of failure exists. A list of the reported error types is provided in Table E.

Continuity (CONT) Failure

3.128 A continuity failure indicates that current is not flowing in a tip-ring loop formed partly by a path in the network. The problem may be in the network or in the circuits connected to the network completing the current loop.

3.129 There are two sources of continuity failure.

- (a) Supervision Continuity Failure—Indicates that supervision failed to transfer from one circuit to another along a network path.

Note: When supervision fails to transfer from a line to a customer dial pulse receiver (CDPR), the line is rescanned from its line scan point to verify that it is off-hook before reporting a failure.

- (b) Transmitter Continuity Failure—Indicates that dc current is not flowing from an MF or dial pulse (DP) transmitter through a network path to an outgoing or two-way trunk just prior to outpulsing digits.

3.130 A continuity failure may involve a full path between two connected circuits or, in case of a supervision continuity failure, may involve only a half-path between a junctor and a connected circuit. When a line fails error analysis because of several continuity failures, it may be a showering line. When this happens, the line is removed from service for about 20 seconds to lessen its effect on call processing.

3.131 When a continuity failure occurs, interpretation is performed on the following circuits:

- (a) Full-Path Continuity Failure

- (1) X connected circuit and Y connected circuit

- (2) X A-link and junctor

- (3) Y A-link and B-link

- (b) X Half-Path Failure Only

- (1) X connected circuit

- (2) X A-link and junctor

- (c) Y Half-Path Failure Only

- (1) Y connected circuit

- (2) Y A-link and B-link

- (3) Junctor.

Ringling Continuity (RC) Failure

3.132 A ringling continuity failure indicates that ringing current is not flowing from a ringing circuit through a network path to a line when it should be.

Note: Ringling continuity failures are considered to be the same as continuity failures for A-links, junctors, and B-links.

3.133 When a ringling continuity failure occurs, interpretation is performed on the following ringling circuit and connected line:

- (a) X A-link and junctor

- (b) Y A-link and B-link.

False Cross and Ground (ECG) Failure

3.134 A false cross and ground failure indicates that there is false battery and/or ground on a tip-ring path through the network. The first stage crosspoints of the path are open, and the test is made by applying a false cross and ground failure test circuit to the path via a test vertical.

3.135 When a false cross and ground failure occurs, interpretation is performed on the following false cross and ground failure test circuit:

- (a) X A-link and junctor

- (b) Y A-link and B-link.

Network Controller (NWC) Failure

3.136 A network controller failure indicates that the same network controller order failed to execute correctly from both SYC 0 and SYC 1. The problem is probably in the unduplicated portion of the network control. For a short period of time, further network controller errors in the same area of the network will not attempt to switch controllers but will continue to pass information to error analysis. The failing network order may be either a first- and second-stage order or a third-stage order.

3.137 When a network controller failure occurs, error interpretation is performed on the following circuits:

- (a) X First and Second Stage Order
 - (1) X connected circuit
 - (2) X A-link and junctor
- (b) Y First and Second Stage Order
 - (1) Y connected circuit
 - (2) Y A-link and B-link
- (c) Third Stage Order—Junctor and B-Link.

Low Leakage Resistance (LLR) Error

3.138 A low leakage resistance error indicates that an idle line looks off-hook to a ringing circuit before ringing current is applied.

Note: When such a failure occurs, the line is rescanned from the junctor to verify that it is on-hook before reporting a failure.

3.139 When a low leakage resistance failure occurs, interpretation is performed on the following circuits:

- (a) Connected Line
- (b) Ringing Circuit.

Line Cutoff (LCO) Failure

3.140 A line cutoff failure indicates that a line scan point looks off-hook after the cutoff contacts have been opened.

3.141 When a line cutoff failure occurs, interpretation is performed on the originating line circuit only.

TOUCH-TONE Receiver (TTR) Failure

3.142 A TOUCH-TONE receiver failure indicates that an illegal TOUCH-TONE digit is present at a TOUCH-TONE receiver. A legal digit consists of exactly 1-out-of-4 low tones and 1-out-of-4 high tones.

3.143 When the TOUCH-TONE receiver error occurs, interpretation is performed on the following circuits:

- (a) Connected Line
- (b) TOUCH-TONE Receiver.

MF Receiver (MFR) Failure

3.144 An MF receiver failure indicates that the key pulse (KP) digit was not received first, the start (ST) digit was not received last, or an illegal multifrequency digit is present at an MF receiver. A legal digit consists of exactly 2-out-of-6 frequencies.

3.145 When an MF receiver error occurs, interpretation is performed on the following circuits:

- (a) Incoming (or two-way) trunk
- (b) MF receiver.

False Trunk Origination (FTO)

3.146 For the 3E3 generic only a false trunk origination error indicates that an incoming (or 2-way) MF trunk went off-hook and while being connected to a MF receiver, went back on-hook signaling an abandon. When an incoming (or 2-way) MF trunk fails error analysis or quick-check because of several false trunk origination errors, it may be a **bouncing trunk**. The trunk is then placed in the locked-out state (LKO) and put in the trunk

timing table for 10 minutes to throttle the alarm and error messages. When a false trunk origination error occurs, error analysis is performed on the incoming (or 2-way) MF trunk circuit only.♦

Permanent Signal Time-Out (PST)

3.147 A permanent signal time-out indicates that an incoming (or two-way) trunk originated and then timed out before sending any digits. The trunk is made high and wet (a bylink trunk gets 30 seconds of recorder tone first). Dial pulse digits are collected at the trunk and MF digits are collected at the MF receiver.

3.148 When an MF permanent signal time-out occurs, interpretation is performed on the MF receiver circuit only.

Partial Dial Time-Out (PDT)

3.149 A partial dial time-out is the same as a permanent signal time-out except the trunk timed out after sending one or more digits. Failure treatment is the same.

3.150 When an MF partial dial time-out occurs, interpretation is performed on the MF receiver circuit only.

MF Transmitter (MFT) Failure

3.151 An MF transmitter failure indicates that a multifrequency digit failed a 2-out-of-6 check or, for some other reason, a digit was not outputted by the transmitter.

3.152 When an MF transmitter error occurs, interpretation is performed on the MF transmitter only.

No-Start Dial (NSD) Error

3.153 A no-start dial error indicates that an outgoing (or two-way) trunk (after being connected to a transmitter) timed out before returning to a start dial (wink start or delay dial). A trunk failure, because of a steady off-hook, is made high and wet. The trunk is supervised at the transmitter for a loop trunk and at the trunk for E and M trunks.

3.154 When a no-start dial error occurs, interpretation is performed on the following circuits:

(a) Loop Trunk

(1) Outgoing (or two-way) trunk (steady on-hook only)

(2) Transmitter

(b) E and M Trunk—Outgoing (or two-way) trunk (steady on-hook only).

Excessive Dial Pulses (EDP) Error

3.155 An excessive dial pulses error indicates that too many dial pulses (11 or more) to form a legal digit were received from an incoming (or two-way) trunk.

3.156 When an excessive dial pulses error occurs, interpretation is performed on the incoming (or two-way) trunk circuit only.

Automatic Number Identification Start (ANIS) Failure

3.157 An automatic number identification (ANI) indicates that a centralized automatic message accounting (CAMA) trunk failed to give a start signal between the sending of the called number and the calling number.

3.158 When an ANI start failure occurs, interpretation is performed on the outgoing CAMA trunk circuit only.

Coin Line Circuit (CLC) Failure

3.159 A coin line circuit failure indicates that a dial tone first coin line circuit failed to provide a loop closure to hold supervision of the junctor when placed in the +48V supervision state. The dial tone first line was just connected to an operator and +48V supervision is being returned to the line to disable the TOUCH-TONE pad.

3.160 When a coin line circuit failure occurs, interpretation is performed on the dial tone first coin line circuit only.

No-Coin Control (NCC) Error

3.161 A no-coin control error indicates that a coin control circuit failed to detect the presence of a coin about to be collected. Collect voltage was applied from the coin control circuit to a connected coin line, and the coin that was supposed to be there was not detected.

3.162 When a no-coin control error occurs, interpretation is performed on the following circuits:

- (a) Connected coin line
- (b) Coin control circuit.

Stuck-Coin Control (SCC) Error

3.163 A stuck-coin control error indicates that a coin control circuit continued to detect the presence of a coin after applying collect or return voltage to a connected coin line.

3.164 When a stuck-coin control error occurs, interpretation is performed on the coin control circuit only.

Restore-Verify (RV) Failure

3.165 A restore-verify failure indicates that current is not flowing in a line scan point during the verify test. The cutoff contacts of the line are restored (closed) and a verify test is made by connecting a restore-verify test circuit to the line via a test vertical and network path. The test circuit provides a loop closure for loop start lines and a ground for ground start lines.

3.166 When restore-verify failure occurs, interpretation is performed on the following circuits:

- (a) Loop Start Restore-Verify Failure—Loop start restore-verify test circuit
- (b) Ground Start Restore-Verify Failure—Ground start restore-verify test circuit.

Line Circuit Restore-Verify (LCRV) Failure

3.167 A line circuit restore-verify failure is the same as a regular restore-verify failure (paragraph 3.165) except that the verify test is

made by placing the noise immunity line circuit in the restore-verify state.

3.168 When line circuit restore-verify failure occurs, interpretation is performed on the connected line circuit only.

Power Cross (PX) Failure

3.169 A power cross failure indicates that there is false ac or dc power on a line terminal. The test is made by applying a power cross test circuit to the line via a test vertical and network path. When a power cross failure occurs, call processing opens the test vertical and performs a phony test to determine if the power cross test circuit itself is faulty. Call processing leaves the cutoff contacts of the line open (high and dry).

3.170 To serve and close the line cutoff contacts when the retry fails, the line is left out of service and prints a TTY removal message.

3.171 When power cross failure occurs, interpretation is performed on the following circuits:

- (a) Connected Line
- (b) Test Vertical Test Circuit.

G. Trunk, Line, and Service Circuit Nonresident Routines (TSVNR)

Basic Information

3.172 The TSVNR program contains routines associated with the maintenance of trunks, service circuits, lines, and network links. The routines are designed to be nonresident for the SO-2 generic since immediate execution when needed is unnecessary. For the 3E3 generic, the multiple remove/restore requests of TSVNR are resident and the multiple status requests of TSVNR are nonresident.

3.173 The following three basic functions are provided by the routines in the TSVNR program.

- (a) Processing of a TTY input request for a multiple (peripheral decoder group or fuse) removal or restoral. The request removes from service or restores to service a particular trunk, service circuit, or junctor plus all of the remaining

circuits on the same peripheral decoder group (PDG) or fuse pair (talk and signal).

(b) Processing of a TTY input request for a multiple status. The request asks for a list of out-of-service circuits. This list is either for trunks, service circuits, lines, or network links.

(c) Processing of a TTY input request for a test vertical removal or restoral. The request removes from service or restores to service a single junctor test vertical, wire test vertical, test vertical test circuit, or test vertical test multiple.

Program Organization

3.174 The trunk, line, service circuit, and network link TTY message handler (TSVREQ) program is the TTY input message handler for TSVNR. TSVREQ is a collection of TTY input message processing subroutines. The messages handled are those that remove from service, restore to service, and output the status of trunks, service circuits, lines, and network links. Refer to TSVREQ for the input messages used in relation to TSVNR and the Input Message Manual (IM-3H300) for a description of these input messages.

3.175 The various routines contained within TSVNR are described briefly in the following paragraphs.

Multiple Request Initial Entry Point (MREQ_IE) Routine

3.176 This routine is the initial entry point to TSVNR from the mini-MSF. A TTY request for a multiple (PDG or fuse) removal or restoral has been received. The request is for a particular trunk, service circuit, or junctor, plus all of the circuits on the same PDG or fuse pair (talk and signal).

3.177 This subroutine is designed to be nonresident and operate under the mini-MSF controller. The information necessary to handle this request is passed via the mini-MSF request buffer and TCR.

Distributor Triplet Address Hunt (DTA_HUNT)

3.178 This subroutine searches for a trunk or service circuit with the given distribution triplet address (DTA). A mask must be supplied to indicate which bits of the DTA to consider in the search. The search begins at a given group and member number and continues through succeeding members of each succeeding group until the DTA is found, a time break is needed, or the search has finished the final group number specified.

3.179 Since this subroutine could require adequate real time, it limits itself by asking for a time break after accessing translations a specified number of times. It is the responsibility of the calling program to actually take the time break.

Locked-Out Conditional Removal (LKO_CDL)

3.180 The LKO_CDL subroutine attempts to conditionally remove a trunk or service circuit from service as the result of a manual request. If successful, the circuit is placed in the locked-out (LKO) idle state and a TTY message is printed.

3.181 There are two alternate entry points to this subroutine. The locked-out unconditional removal (LKO_UCL) entry point attempts to unconditionally place a trunk or service circuit in the LKO idle state. The disable unconditional removal (DSA_UCL) entry point attempts to unconditionally place a trunk in the disabled (DSA) state.

Conditional Junctor Removal (JRMV_CDL)

3.182 This subroutine attempts to conditionally remove a junctor from service as the result of a manual request. If successful, the junctor is placed in the out-of-service state and a TTY message is printed.

3.183 There are two alternate entry points to this subroutine. The unconditional junctor removal (JRMV_UCL) entry point attempts to unconditionally remove a junctor from service. The unconditional wire B-link removal (BRMV_UCL) entry point attempts to unconditionally remove a wire B-link from service.

Line Removal (LRMV)

3.184 The LRMV subroutine attempts to remove a line from service as the result of a manual message. If successful, the line cutoff contact is opened, the line is placed in the out-of-service state, and a TTY message is printed.

Conditional Restoral (RST_CDL)

3.185 This subroutine attempts to conditionally restore a trunk or service circuit to service as the result of a manual request. If successful, the circuit is placed in the active (ACT) idle state and a TTY message is printed.

3.186 The unconditional restoral (RST_UCL) entry point is an alternate entry point that attempts to unconditionally place a trunk or service circuit in the ACT idle state.

Conditional Junctor Restoral (JRST_CDL)

3.187 The JRST_CDL subroutine attempts to conditionally restore a junctor to service as the result of a manual request. If successful, the junctor is placed in the in-service (active) idle state and a TTY message is printed.

3.188 There are two alternate entry points to this subroutine. The unconditional junctor restoral (JRST_UCL) entry point attempts to unconditionally restore a junctor to service. The unconditional B-link restoral (BRST_UCL) entry point attempts to unconditionally restore a wire B-link to service.

Line Restoral (LRST)

3.189 This subroutine attempts to restore a line to service as the result of a manual request. If successful, the line cutoff contact is closed, the line is placed in the in-service (active) idle state, and a TTY message is printed.

Status Initial Entry (STAT_IE)

3.190 The STAT_IE subroutine is invoked when a TTY request for multiple status has been received. It is a request to identify the current state of those circuits that are out-of-service. The request is either for trunks, service circuits, lines, or network links.

3.191 This routine is designed to be nonresident and to operate under the mini-MSF controller. The information necessary to handle this request is transmitted via the mini-MSF request buffer and possibly a TCR.

Out-Of-Service Hunt (OOS_HUNT)

3.192 This subroutine searches for a trunk or service circuit in one of three out-of-service states: locked out (LKO), disabled (DSA), or high and wet (HAW). The search begins at a given group and member number and continues through succeeding members of each group until either an out-of-service circuit is found, a time break is needed, or the search has finished the final group number specified.

3.193 Since the subroutine could require a considerable amount of real time, it limits itself by asking for a time break after accessing translations a number of times. It is the responsibility of the calling program to actually take the time break.

Line Out-Of-Service (LINE_OOS)

3.194 The LINE_OOS subroutine searches for a line in one of three out-of-service states: out-of-service (OOS), HAW, or plugging-up (PLUGUP). A mask must be supplied to indicate which states to consider in the search. The search begins at a given terminal equipment number (TEN) and continues through succeeding terminals of each concentrator group until an out-of-service line is found, a time break is needed, or the search has finished the final concentrator group specified. The search also succeeds if an unassigned terminal in an out-of-service state is found.

3.195 Since this subroutine could require a considerable amount of real time, it limits itself by asking for a time break after accessing translations a number of times. It is the responsibility of the calling program to actually take the time break.

Remove Test Vertical (RMV_TV)

3.196 This subroutine handles the **RMV:TV #!** TTY input messages. The default case will place a single junctor test vertical, wire test vertical, test vertical test circuit, or test vertical test multiple in the out-of-service state on the condition that

the out-of-service limit has not been reached for the test vertical type specified. Refer to IM-3H300 for a description of these input TTY messages.

Remove Junctor Test Vertical, Check Wire Test Vertical States (JTV_OOS)

3.197 The JTV_OOS subroutine attempts to remove the specified junctor test vertical from service. If the specified junctor test vertical is already out of service or operator busy or if any of the 15 wire test verticals are out of service, then no action is taken.

3.198 There are three alternate entry points to this subroutine. The remove wire test vertical, check junctor test vertical states (WTV_OOS) entry point attempts to remove a wire test vertical from service, depending upon the states of the 15 junctor test verticals. The remove junctor test vertical, ignore wire test vertical states (JTV_JOOS) do not check to see if any of the other 15 wire test verticals are out of service. The remove wire test verticals, ignore junctor test vertical states (WTV_JOOS) do not check to see if any of the other 15 junctor test verticals are out of service.

Check Other Test Vertical Test Multiple States (TM_OOS)

3.199 This subroutine attempts to remove the specified test vertical test multiple from service. If the specified test vertical test multiple is already out of service or operator busy or if any of the other three test vertical test multiples are out of service, then no action is taken.

3.200 The ignore other test vertical test multiple states (TM_JOOS) entry point is an alternate entry point that does not check to see if any of the other three test vertical test multiples are out of service.

Restore Test Vertical (RST_TV)

3.201 This subroutine handles the **RST:TV** † TTY input messages. The default case will place a single junctor test vertical, wire test vertical, test vertical test circuit, or test vertical test multiple in the in-service (active) idle state on the condition that the diagnostic (test vertical test circuit only) for this circuit passes. There are no options for a junctor test vertical, wire test vertical, or test

vertical test multiple. Refer to IM-3H300 for a description of these input TTY messages.

3.202 The restore test vertical test circuit unconditionally (TRST_UCL) entry point is an alternate entry point that attempts to unconditionally restore a test vertical test circuit to service.

Restore Junctor Test Vertical (JTV_ACT)

3.203 This subroutine attempts to restore the specified junctor test vertical to service. No action is taken if the specified junctor test vertical is not out of service.

3.204 There are three alternate entry points to this subroutine. The restore wire test vertical (WTV_ACT) entry point attempts to restore a wire test vertical to service. The restore test vertical test circuit (TC_ACT) entry point attempts to restore a test vertical test circuit to service. The restore test vertical test multiple (TM_ACT) entry point attempts to restore a test vertical test multiple to service.

H. Maintenance Audits (MAUD)

Basic Information

3.205 The purpose of MAUD is to provide a check on those counters, bits, and maps that may, through normal maintenance functions, become incorrect as a result of errors encountered. If a counter, bit, or map being checked by MAUD is found to be incorrect, the audit performing the check will correct the counter, bit, or map in error and/or issue a TTY message describing the problem found or corrected. A list of the counters, bits, and maps that are audited by MAUD is found in Table A.

3.206 The MAUD routine can be invoked either automatically or manually by a TTY inut message. When invoked automatically, MAUD will perform all of the maintenance audits.

3.207 The MAUD routine can be manually requested by a TTY message. The manual request may ask to perform all of the maintenance audits or a specific audit listed in Table A, depending upon the input TTY message. The TTY message **AU:MAINT!** will ask to perform all of the maintenance audits. Refer to the No. 3 ESS Input Message Manual (IM-3H300) for a description of this TTY

message and the input messages necessary to request a specific audit.

Program Organization

3.208 The MAUD routine is divided into four separate and distinct audits:

- (1) Trunk and service circuit out-of-service counters audit
- (2) Power alarm and miscellaneous scan point ignore bit audit
- (3) Equipped peripheral decoder (PD) map audit
- (4) Plug-up and line timing table audit.

Trunk and Service Circuit Out-Of-Service Counters Audit

3.209 The entry point for this routine is MAUDPE1. If the routine is requested manually, the TTY input message **AU:MAINT TSV!** is used.

3.210 This audit determines whether the maintenance trunk and service circuit out-of-service counters are correct or incorrect. The routine performs an audit on the following counters.

- (a) TSVLIM—These are the trunk and service circuit out-of-service limit counters which hold the current number of trunk and service circuit groups that have reached or exceeded their circuit out-of-service limit.
- (b) TRKOOSC—These are the trunk out-of-service counters which hold the current total number of trunks that are marked out-of-service.
- (c) SVCOOSC—This is the service circuit out-of-service counter which holds the current total number of service circuits that are marked out-of-service.
- (d) MBC—This is the maintenance busy counter. The counter has the current number of circuits in a group that is out-of-service. There is a maintenance busy counter for each group.
- (c) NIS—This is the not-in-service bit for a group and indicates that all the circuits of a group are out of service.

3.211 To determine whether the counters stated in paragraph 3.210 are correct, the audit must redetermine each count and compare it to the current count of each counter. This is accomplished by examining the state (paragraph 3.212) of each trunk and service circuit. If the circuit is in one of the out-of-service states, the appropriate audit count is incremented. Once all the trunks and service circuits have been checked and appropriate audit counts incremented, the audit counts are compared to the current counter count. Then, if any of the current counts differ from the audit counts, the current count is changed and a TTY output message describing the counter in error is issued. For TTY output messages generated by MAUD, see the No. 3 ESS Output Message Manual (OM-3H300) for a description and explanation of the TTY output messages.

3.212 The state of a circuit is defined by the values of the two terminal status bits, the selection bit, and the ignore and last look bits. The circuit states are:

- (1) Invalid
- (2) HAW—High and Wet
- (3) DSA—Disabled
- (4) LKO Busy—Locked-Out Busy
- (5) LKO Idle—Locked-Out Idle
- (6) ACT Busy—Active Busy
- (7) ACT Idle—Active Idle.

States 1 through 5 are the out-of-service states.

3.213 The invalid state indicates that the bits used to define a circuit state cannot be resolved. If this state is encountered when the state of a circuit is being checked, the audit will issue a TTY output message describing the circuit in the invalid state and attempt to put that circuit in the active idle state. If the attempt to idle the circuit fails, a TTY output message describing the failure is issued.

Power Alarm and Miscellaneous Scan Point Ignore Bit Audit

3.214 The entry point for this routine is MAUDPE2. If the routine is requested manually, the TTY input message **AU:MAINT PAIG!** is used.

3.215 This audit determines if the maintenance power alarm counters and miscellaneous scan point ignore bits are correct. The routine performs an audit on the following counters.

- (a) P24VPWRS—Plus 24 volts power state
- (b) MISPWR—Maintenance power alarm counters
 - Word 0 = Major power alarm count
 - Word 1 = Minor power alarm count
 - Word 2 = Fuse alarm count
- (c) MSCAN—Miscellaneous scan point ignore bits.

3.216 To verify the counts of the power alarm counters and +24 volt power state, this audit must redetermine the +24 volt power state and each of the power alarm counts. Then the audit counts and power state are compared to the current power alarm counts and power state. If any of the current power alarm counts or the +24 volt power state is found to be incorrect, the audit will correct that counter or power state and issue a TTY output message describing the counter or power state in error.

3.217 To redetermine the power alarm counts and +24 volt power state, this audit compares the last-look bit of each power alarm scan point to its normal state. If the last-look bit is not equal to the normal state, an audit power alarm count is incremented that reflects the type of power alarm that has been found. A TTY output message is also issued that describes the power alarm scan point which was found to be off normal.

3.218 Because the power alarm scan points needed to determine the power alarm counts are part of the miscellaneous scan points and the ignore bits of all the miscellaneous scan points are also being audited, the audit checks the ignore bit of a scan point before determining if that scan point is

a power alarm scan point. This check is performed to conduct the ignore bit audit and to ensure that the power alarm count audit will be correct. If the ignore bit of a power alarm scan point is incorrect, it is possible that the power alarm scan point being checked was not checked by normal maintenance functions which count power alarms. Therefore, if any ignore bit error is encountered, the power alarm audit is inhibited, and only the ignore bits are checked thereafter. For each ignore bit error found, a TTY output message describing the scan point will be issued. When all ignore bits have been checked, a real-time break is taken so that the scan points can be updated. Upon reentry to this audit, the power alarm counter audit is restarted.

Equipped Peripheral Decoder (PD) Map Audit

3.219 The entry point for this routine is MAUDPE3. If the routine is requested manually, the TTY input message **AU:MAINT PDM!** is used.

3.220 The audit performs a check of the equipped PD map to determine if the map reflects the hardware supplied. Specifically, the number of vertical matrix packs (FC206) supplied in the peripheral control frame are counted.

3.221 The equipped PD map (EQPT_PD) is 32 words long with 16 bits per word. Each word represents a vertical (matrix pack) of the peripheral pulse distributor (PPD) selection matrix and each bit of a vertical represents a horizontal. Therefore, if a vertical word has one or more bits set, the corresponding matrix pack must be supplied in the counter frame. Words 0 through 15 represent verticals 0 through 15 (matrix packs) on control frame 0, and words 16 through 31 represent verticals 0 through 15 on control frame 1.

3.222 To verify the equipped PD map, the audit examines each vertical word in the map and tests to determine if the vertical is zero. If the vertical is zero, the audit sends a zero to a PD selected by the vertical in question. If the response from the PPD is a valid reply, a vertical pack is present that is not reflected in the map. The audit issues a TTY output message describing the vertical word of the map in error. If the response is not a valid reply, there is no vertical pack present and the map is correct.

Plug-Up and Line Timing Table Audit

3.223 The entry point for this audit is MAUDPE4.

If the routine is requested manually, the TTY input message **AU:MAINT PULT!** is used.

3.224 The audit performs a check on each entry in both the plug-up and line timing tables to ensure each entry (TEN) is in the maintenance busy (MB) state. If an entry is found that is not in the MB state, it is removed from the table and a TTY message is printed indicating the TEN removed.

3.225 The plug-up and line timing table audit will only be available in Issue 4 or above of the SO-2 generic.

I. Network Grid Removal Routines (GRDUTL)

3.226 The GRDUTL program is used to remove from service or restore to service network grids. The program is nonresident because it is infrequently used. GRDUTL can only be activated manually by the **RMV:GRID α** or **RST:GRID α** TTY input messages.

3.227 These input messages handle the removal from service and the restoral to service of 15A (first stage), 15B (second stage), and 15C (third stage) network grids. When removing a network grid from service, a busy path is camp-on for 5 minutes. The grid path part is removed from service if it becomes idle during this time period.

CAUTION: *When removing a network grid from service, care should be taken to avoid the removal during busy hours because blocking can be increased drastically, and removing a first stage network grid directly affects customer service.*

3.228 Refer to the Input Message Manual (IM-3H300) for a complete description of **RMV:GRID α** and **RST:GRD α** TTY input messages.

J. Network Grid (NWGRID)

3.229 The purpose of the NWGRID program is to process the **ORD:NW** TTY input message. This causes a specific network order sequence to be sent to the off-line network controller (NWC). The network orders are applied to a specified path

in the network fabric. Each terminal/link of the specified path must be removed from service before the request will be accepted. Each terminal/link should be restored to its previous state upon completion of the test. A more detailed description of the input message **ORD:NW** and its variable field is in the Input Message Manual (IM-3H300).

CAUTION: *Sending an order sequence in the REPEAT mode can block network orders from call processing for more than 25 percent of each base level loop. Avoid testing in the REPEAT mode during high traffic periods. Also, use the lowest numbered sequence suitable for the test since higher numbered sequences take more time per base level loop.*

3.230 Check IM-3H300 for the input messages **CLR:RPT:STEP** or **ABT:MSF** to cancel the request.

3.231 The network order sequences are designed to be nonscrubbing; ie, a crosspoint is never closed twice in succession without an intervening open. In each order sequence, the one underlined network order is considered the **primary order** of the sequence. The other orders are necessary to prevent scrubbing. One of 14 order sequences (Table G) may be selected.

3.232 Each of the first 11 order sequences has a unique **primary order** corresponding to each of the 11 possible different network orders. In each of these 11 order sequences, the **primary order** is within the repeatable portion of the order sequence which allows repetitive execution of the **primary order**. These order sequences may be used to repetitively execute a particular network order or repetitively open or close a particular crosspoint.

3.233 The last three order sequences have no network orders within the repeatable portion of the order sequence. This allows the specified network path to be held closed for a period of time in either the REPEAT or STEP mode. These order sequences may be used to set up a tip and ring path and manually check for continuity or a short.

3.234 The network orders may be sent in the following modes:

(a) Unconditional (UCL) Mode—In the UCL mode, the orders are sent with the off-line network controller in the group check bypass state. Any group check failures are ignored and will not cause orders to fail. This mode may also be run repetitively by specifying UCL, RPT or UCL, STEP.

(b) REPEAT Mode—In the REPEAT mode, the latter portion of the specified order sequence, including the time-break, is run repetitively until cleared by an input message. A message is generated by the first failure; thereafter, a printout is generated only if the result changes. The status is displayed by the PASS/FAIL lamps on the system status panel. The repetition may be stopped by depressing the EXECUTE key on the system status panel and may be restarted by depressing the EXECUTE key again.

(c) STEP Mode—The STEP mode is the same as the REPEAT mode except that the execution stops after the first run. Thereafter, the latter portion is repeated once each time the EXECUTE key is depressed.

3.235 In the REPEAT or STEP modes of operation, the exercise will abort itself after generating 50 failure messages.

K. Trunk and Line Test Panel Control (TLTPC) for the SO-2 Generic

Basic Information

3.236 For a description of the TLTPC for the 3E3 generic and later, see paragraphs 3.252 through 3.266.

3.237 The TLTPC program is a nonresident program which interfaces with manual actions via the trunk and line test panel (TLTP). The TLTP can be used to test trunks, service circuits, lines, and junctions. This program monitors key and switch controlled scan points of the panel in order to interpret the requests, make connections via the network, and control peripheral decoder points which light and extinguish lamps as signals.

3.238 Originations from the TLTP are handled by call processing routines which detect

the origination at the line ferrod, select a TOUCH-TONE receiver, prepare the associated TCR for digit collection, and turn on dial tone. After this is accomplished, base level processing of information input to the panel is under control of the TLTPC program, although many call processing subroutines are used to obtain the necessary translations and control peripheral equipment.

3.239 Since originations and calls terminating to the TLTP are processed in call processing TCRs, the TLTPC program assumes control at the appropriate time by setting the base level progress mark to MAINT. The MAINT progress mark, when invoked, reports the status of the base level action bit by changing the progress mark to MAINT2 or MAINT3, and resets the TCR timing word to 10 minutes. This reduces processing time when the requests to the TLTP are not inputted and keeps the TCR active and under control of the TLTPC program.

3.240 The MAINT progress mark is a base level progress mark used by maintenance programs and is activated by resident programs when call processing type code work is completed.

3.241 The TLTPC program is capable of being temporarily suspended or "rolled out" to allow execution of some higher priority nonresident programs. When this occurs, the data contained in the TLTPS CSECT is saved and the higher priority programs enter the paging buffer. When that program has been executed, the TLTPC program is again paged in and execution resumes.

3.242 The power and alarm scan (PWSC) program monitors the ON key of the TLTP. When the ON key is depressed, the nonresident TLTPC program is requested. The multiscan function controller (MSFC) determines that the program can be loaded from magnetic tape to temporary store. When the key is initially depressed, the PWSC operates the peripheral decoder (PD) point in the TLTP. Flashing of the ON lamp (at 60 ipm) comes from interrupts in RT plant to indicate that the request is being acted upon. When the TLTPC program is loaded in memory, routines in TLTPC cause the ON lamp to be lighted (steady). If the request is denied, PWSC routines will operate PD points in the TLTP which set the flashing rate to 120 ipm.

3.243 The TLTP has access to the network via access trunk 1 (AT-1) and access trunk 2 (AT-2). Each base level entry, the TLTPC program determines the changes in key positions and trunk status to interpret and implement the directions to the program.

3.244 An interface diagram of the TLTP function for the SO-2 generic is shown in Fig. 21. Normal call processing and network control programs are used to connect paths through the network as directed by TLTPC operations. A progress or error (P_E) lamp indicates when direction is needed from the panel or when an action is progressing or in error. When the P_E lamp is lighted (steady), the request is successfully completed. If the lamp goes momentarily off, the new request is recognized and successfully completed when the lamp lights steady again. If the lamp is flashing at 60 ipm, there is an error in attempting to perform a valid request. If the lamp is flashing at 120 ipm, there is an error in input information.

Program Organization

3.245 The MSFC will enter the TLTPC program each base level at the TLTPON entry point. The initial entry is with the bit 1 in MSF ENT_CODE (R0) set and branches to TLTPINIT. The program flow diagram for the TLTP program is shown in Fig. 22. This initial entry clears the control blocks for the program and determines that the access trunks are defined. This entry also changes the 60-ipm flash of the ON lamp to a steady ON condition.

3.246 The PER_SCAN routine is then entered. All subsequent entries (except abort) use this routine not only to determine but also to implement the needed functions.

3.247 On each nonaborting entry from the MSFC, the PER_SCAN routine checks on the status of the scan points by using the GET_SCAN macro. The GET_SCAN macro uses the RSCAN routine in the PWSC program to scan the TLTP switch monitor ferroids and returns the status of the 16 TLTP scan points in R1. This routine reads the status of the scan points in the master scanner each base level loop and updates the status of the scan points in storage.

3.248 An area within the TLTPC program named TLTP_MRY is reserved for the last-look

status of the scan of the TLTP scan points. The TLTPC program compares the state of the PD group action scan point (MLTB), the ringing control scan point (RING), the out-of-service request scan point (BUSI), the active idle request scan point (IDLE), and the circuit status control scan point (EXEC) with their respective last-look memory bits. If a control key has been released, an update of the last-look memory to nonoperated is performed and relays XREL and PREL are released.

3.249 If the call of GET_SCAN fails, control is returned to the MSFC. If the call for GET_SCAN fails on two successive per scan entries, the TLTPC program is aborted.

3.250 When no failure is detected, access trunk 1 (AT-1) status is checked and the proper routine is entered to service the trunk. Table H is a list of test progress index (TPI) states and routines entered. After AT-1 is serviced, AT-2 is serviced. The TPI for AT-2 causes the same routines to be entered as for AT-1.

3.251 After the trunks are serviced, the TLTPC program will return control to MSFC. When system initialization occurs or the ON key is reoperated after initial operation, an abort code causes TLTPC to enter the ABORT routine. All network connections are restored, and the TLTP panel lamps will be extinguished. The MSFC does not return control to the TLTPC program after this entry.

L. Trunk and Line Test Panel Control (TLTPC) for the 3E3 Generic

3.252 For a description of the TLTPC for the SO-2 generic, see paragraphs 2.236 through 2.251.

Basic Information

3.253 The TLTPC program is a resident program which interfaces with manual actions via the TLTP. The TLTP can be used to test trunks, service circuits, lines, and junctors. This program monitors key and switch-controlled scan points of the panel in order to interpret the requests, make connection via the network, and control peripheral decoder points which light and extinguish lamps as signals.

3.254 Originations from the TLTP are handled by call processing routines which detect the origination at the line ferrod, select a TOUCH-TONE receiver, prepare the associated TCR for digit collection, and turn on dial tone. After this is accomplished, base level processing of information input to the panel is under control of the TLTPC program, although many call processing subroutines are used to obtain the necessary translations and control peripheral equipment.

3.255 Since originations and calls terminating to the TLTP are processed in call processing TCRs, the TLTPC program assumes control at the appropriate time by setting the base level progress mark to MAINT. The MAINT progress mark, when invoked, reports the status of the base level action bit by changing the progress mark to MAINT2 or MAINT3, and resets the TCR timing word to 10 minutes. This reduces processing time when the requests to the TLTP are not inputted and keeps the TCR active and under control of the TLTPC program.

3.256 The MAIN progress mark is a base level progress mark used by maintenance programs and is activated by resident programs when call processing type code work is completed.

3.257 The PWSC program monitors the ON key of the TLTP. When the ON key is depressed, activation of the TLTPC program is requested. When the TLTPC program is first activated, routines in TLTPC cause the ON lamp to be lighted (steady).

3.258 The TLTP has access to the network in access trunk 1 (AT-1) and access trunk 2 (AT-2). Each base level entry, the TLTPC program determines the changes in key positions and trunk status to interpret and implement the directions to the program.

3.259 An interface diagram of the TLTP function for the 3E3 generic is shown in Fig. 23. Normal call processing and network control programs are used to connect paths through the network as directed by TLTPC operations. A progress or error (P_E) lamp indicates when direction is needed from the panel or when an action is progressing or in error. When the P_E lamp is lighted (steady), the request is successfully completed. If the lamp goes off momentarily, the new request is recognized and successfully completed when the lamp lights

steady again. If the lamp is flashing at 60 ipm, there was an error in attempting to perform a valid request. If the lamp is flashing at 120 ipm, there was an error in input information.

Program Organization

3.260 The BLMMA will enter the TLTPC program each base level at the TLTPON entry point. The initial entry is with bit 1 in MSF ENT_CODE (R0) set and branches to TLTPINIT. The program flow diagram for the TLTP program is shown in Fig. 22. This initial entry clears the control blocks for the program and determines that the access trunks are defined. This entry also sets the ON lamp to a steady ON condition.

3.261 The PER_SCAN routine is then entered. All subsequent entries (except abort) use this routine not only to determine but also to implement the needed functions.

3.262 On each nonaborting entry from BLMMA, the PER_SCAN routine checks on the status of the scan points by using the GET_SCAN macro. The GET_SCAN macro uses the RSCAN routine in the PWSC program to scan the TLTP switch monitor ferroids and returns the status of the 16 TLTP points in R1. This routine reads the status of the scan points in the master scanner each base level loop and updates the status of the scan points in storage.

3.263 An area within the ATSD program named TLTP_MRY is reserved for the last-look status of the scan of the TLTP scan points. The TLTPC program compares the state of the PD group action scan point (MLTB), the ringing control scan point (RING), the out-of-service request scan point (BUSI), the active idle request scan point (IDLE), and the circuit status control scan point (EXEC) with their respective last-look memory bits. If a control key has been released, an update of the last-look memory to nonoperated is performed and relays XREL and PREL are released.

3.264 If the call of GET_SCAN fails, control is returned to BLMMA. If the call for GET_SCAN fails on two successive per scan entries, the TLTPC program is aborted.

3.265 When no failure is detected, access trunk 1 (AT-1) status is checked and the proper routine is entered to service the trunk. Table H

is a list of test progress index (TPI) states and routines entered. After AT-1 is serviced, AT-2 is serviced. The TPI for AT-2 causes the same routines to be entered as for AT-1.

3.266 After the trunks are serviced, the TLTPC program will return control to BLMMA. When system initialization occurs or the ON key is reoperated after initial operation, an abort code causes TLTPC to enter the ABORT routine. All network connections are restored, and the TLTP panel lamps will be extinguished. The program BLMMA does not return control to the TLTPC program after this entry.♦

M. Office Test Line Control (OFFTL)

3.267 The OFFTL program is a resident program and is used to direct dialed-up connections to the transmission test termination circuit, the milliwatt and transmission environment test circuit, and the busy tone and high tone circuits when generating the systems transmission and operational test lines. Connection to the transmission test termination circuit is made when a dial-up request for the open circuit test termination or short circuit test termination is entered. The milliwatt and transmission environment test circuit has two ports (0 and 1). Each port is capable of providing the ac/dc open circuit termination, balance termination, and milliwatt termination, and together providing the loop-around termination. Connection to port 0 is made for the milliwatt test termination, the ac/dc open circuit test line, and loop-around test termination port 0. Connection to port 1 is made for the balance test termination, synchronous test termination, and loop-around test termination port 1. Requests for the milliwatt test termination and the ac/dc open circuit test line may overflow to port 1 if port 0 is busy. Requests for the balance test termination or synchronous test termination may overflow to port 0 if port 1 is busy. There is no overflow for the loop-around test terminations. Connection to the busy tone circuit and high tone circuit is made whenever a dial-up request is made for the charge test line.

3.268 ♦The **balance test line (100-type)** is used to allow one-way (far-to-near) loss and noise measurements. It uses the milliwatt and transmission environment test circuit to provide 5 seconds of 1004 Hz 0dBm tone followed by a balance (quiet) termination. It provides continuous off-hook supervision when accessed by trunks.

3.269 The **milliwatt test line (102-type)** is used for one-way (far-to-near) transmission measurements. It uses the milliwatt and transmission environment test circuit to provide a 10-second repetitive cycle consisting of 9 seconds of 1004 Hz 0dBm tone and 1 second of balance (quiet) termination. It provides continuous off-hook supervision when accessed by trunks.

3.270 The **loop-around test line** is used to allow near-to-far loss measurements on circuits originating in a connecting office. It uses both ports of the milliwatt and transmission environment test circuit to provide this function. Port 0 of the loop-around test line functions the same as the 102-type test line and allows the connecting office to establish the far-to-near loss on a reference circuit. Port 1 of the loop-around test line functions as a 100-type test line. When connections to both ports of the loop-around test line are made, the circuits are connected together through the milliwatt and transmission environment test circuit. The near-to-far loss of the circuit connected to port 1 may be established by transmitting a signal on that circuit, measuring the loss of that signal at the circuit connected to port 0, and subtracting the loss established for the reference circuit. Continuous off-hook supervision is provided when the test line is used by trunks.

3.271 The **short-circuit test line** is used for making singing margin tests on circuits. The transmission test termination circuit is used to provide an ac short circuit, ie, a capacitor paralleled by an inductor with a series resistor. Continuous off-hook supervision is provided for trunk circuits.

3.272 The **open-circuit test line** is used for making singing margin tests on circuits. The transmission test termination circuit is used to provide a high impedance to ac, ie, an inductor in series with a resistor. Continuous off-hook supervision is provided for trunk circuits.

3.273 The **continuous milliwatt test line** is used to allow one-way (far-to-near) loss measurements. It uses the milliwatt and transmission environment test circuit to provide uninterrupted 1004 Hz 0dBm tone. It also provides continuous off-hook supervision for trunks.

3.274 The **synchronous test line** is used to test the response of trunks to supervisory changes. It provides one complete cycle of audible

ring followed by a series of off-hook and on-hook pulses on the trunk while terminated in a balance termination at the milliwatt and transmission environment test circuit. After the final on-hook signal, the connection is timed for 30 seconds before a forced disconnect. The synchronous test line is for interoffice access only.

3.275 The charge test line is used to test the capability of billing equipment. It terminates to a busy tone circuit to provide 14 seconds of busy tone with an initial period of 7 seconds on-hook followed by 7 seconds of off-hook. It then terminates to a high tone circuit and provides continuous high tone accompanied by cycles of 0.5 seconds on-hook and 1.5 seconds off-hook until disconnect. This test line is for interoffice access only.

3.276 The ac/dc open circuit test line is used to test a subscriber loop for foreign potentials while outside the office. It uses the milliwatt and transmission environment test circuit to provide an initial 5 seconds of 1004 Hz 0dBm tone. It then puts the junctor circuit in the open state to provide a dry termination for 60 seconds. Finally, the test circuit is put in the balance termination state and the junctor circuit is set to supervise the line for disconnect. This test line is for intraoffice access only.♦

3.277 When a directory number assigned to the test terminations mentioned in paragraph 3.267 is dialed, its translation is requested by the completion of incoming and intraoffice calls (TERM) program. The directory number is handled as a route index in translations, such that once the translation is obtained, the TERM program branches to ROUTE in the digit interpretation progress marks (DNTRP) program. DNTRP then obtains the destination code for the dialed number from translations and branches to the indicated routine in OFFTL.

3.278 The DNTRP program uses the destination code extracted from translations as an entry into a branch table. The destination codes used by the test terminations are all branches to entry point OFFTL in the OFFTL program. The destination code is passed in R0. The destination codes used by the OFFTL program are assigned sequentially in translations, and the first entry used by the OFFTL program is given the value OFFTLST in the branch table in the DNTRP

program. A zero reference for the destination codes used by the OFFTL program is established by subtracting the value of the first test termination code from that passed in R0. A flag is set in the TCR to designate the type of termination being used, and a branch is made to select the circuits required by the test termination. The address of the TCR used in the call is passed from the DNTRP program in RA0.

N. Remote Office Test Line (ROTL)

Basic Information

3.279 The ROTL is only associated with the 3E3 generic. The ROTL may be used in conjunction with a Centralized Automatic Reporting On Trunks (CAROT) system to test central office trunks automatically from a remote location. Under the direction of CAROT, the basic function of a ROTL is to set up a connection via a specified trunk to a far-end test line, report call setup progress, and connect near-end measuring equipment (Fig. 24). Testing may also be done from a test location using a manually controlled interrogator/ROTL control unit, or a ROTL system test set.

3.280 In the No. 3 ESS ROTL implementation, the ROTL circuitry is provided in a self-contained unit called a Mini-ROTL. This microprocessor-based unit provides the necessary responder and tone detector functions. Establishing and controlling connections to the Mini-ROTL, as directed by CAROT, is the function of the No. 3 ESS ROTL program. The features provided by the No. 3 ESS ROTL are documented in Feature Document 233-190-205.

3.281 The No. 3 ESS ROTL program is a resident program and is initially available in the 3E3 generic.

System Operation

3.282 The No. 3 ESS Mini-ROTL unit has five terminals on the network and a link to the TTY controller (TTYC) as shown in Fig. 25.

3.283 The two terminals designated as 105-type test lines are used by the Mini-ROTL to process incoming 105-type test line calls. The terminals are defined in translations as lines which are denied origination and which are series completing to each other. The terminal numbers are also

stored in the translation data area definition (TDATA) program at location FETL in order that the ROTL program can determine the identity of those terminals and remove them from service when the Mini-ROTL diagnostic is requested. No special No. 3 ESS code is required to handle the 105-type test lines since the Mini-ROTL is designed to detect ringing, trip it, and release the line when the test is complete. ♦If the Mini-ROTL hardware is provided, 105-type test lines are available.♦

3.284 The terminal designated as the connection appraisal port is used by the Mini-ROTL to dial up connections to test. The terminal is defined as a dial pulse originating line which is denied termination. It requires no special No. 3 ESS code for its application.

3.285 The terminal designated as the ROTL access port is the terminal used for calls directed to ROTL. The directory number translation of the number assigned to ROTL yields a route index with a destination code which indicates special handling for the call. The access port is defined in translations as a tone circuit.

3.286 The terminal designated as the TUT (trunk under test) port is the one used when establishing a connection from the Mini-ROTL for either security callback or trunk transmission testing. It is defined in translations as an autoconnect line ♦with up to six users for security callback. Each user has a telephone number (trigger number) in the office to request security callback. All users access the same port (TEN) and each user has a personal authorization class.♦

3.287 The link from the Mini-ROTL to the TTYC (message channel) is used to pass supervisory and test information between the Mini-ROTL and the No. 3 ESS ROTL program. The EIA link connects to a port on either a dedicated TTYC or a shared TTYC. Tables I and J show the messages which are exchanged with the Mini-ROTL.

3.288 ♦The EIA link is hardwired to port 1 of a dedicated TTYC or to port 2 of the shared TTYC which is TTY Controller 1. The TEN defined in the autoconnect line translations is not used to make the hardwired connection, but is wasted. When the link is to be used, it must be enabled by the ACPRPI subroutine in the ACPOR program.♦

3.289 When a call is determined to be for the ROTL, a connection from the calling party to the Mini-ROTL access port must be established and supervised and the message channel must be activated. Once established, supervision from the access port is reported to the Mini-ROTL which then begins to communicate with the control location using tones via the access port. Instructions from the control location are interpreted by the Mini-ROTL and, when the instructions require action by the No. 3 ESS ROTL program, commands are passed from the Mini-ROTL via the message channel. These commands may indicate that:

- (a) A diagnostic is to be performed on the Mini-ROTL
- (b) A security callback is to be initiated
- (c) The status of a trunk is requested
- (d) A trunk is to be removed or restored to service
- (e) A trunk transmission or balance and long term test is to be performed
- (f) A test connection is to be released
- (g) The incoming call and any test connections are to be released.

The No. 3 ESS ROTL program acknowledges receipt of these commands, takes the appropriate action, and replies to the Mini-ROTL with test results or a request for some further action by the Mini-ROTL. Replies to the Mini-ROTL are repeated 3 seconds after their original transmission if the Mini-ROTL has not acknowledged them.

3.290 If a trunk transmission test or a balance and long term test has been requested, a specific trunk must be selected, a test line number supplied from the control location must be outpulsed, and the trunk under test must be connected to the TUT port for tests by the Mini-ROTL. Once the connection to the trunk under test is established, it is to be maintained until directed to release by a message from the Mini-ROTL, even though the loop connection within the Mini-ROTL at the TUT port may be opened. The trunk under test must be monitored for answer supervision and possibly hits.

3.291 For a balance and long term test, a command from the Mini-ROTL will direct the No. 3 ESS to release the connection from the trunk under test to the TUT port and to connect the trunk under test to a port of the milliwatt and transmission environment test (MWTET) circuit for generation of milliwatt tone and a quiet termination. Some time later the Mini-ROTL may direct the connection of the calling party to the ROTL access port to be released and to connect the calling party to the high tone circuit, releasing the ROTL for service to another user. Supervision of the connection from the calling party to the high tone circuit and from the MWTET to the trunk under test is under control of the calling party but will be automatically released at the expiration of a 30-minute timer.

3.292 Whenever the calling party disconnects from the ROTL, a 2-minute holdover timer is activated to maintain the message channel for that interval. If the timer expires and no new call to the ROTL has arrived, the message channel is released.

ROTL Program

3.293 From the preceding description of the ROTL operation, it is evident that the functions of the ROTL program are logically segregated into three programs (ROTLA, ROTLC, and ROTLT). Each program is related to a TCR associated with a control terminal on the Mini-ROTL.

3.294 One program has the function of establishing and supervising the connections associated with the party establishing the initial connection to the Mini-ROTL access port. The program will be referred to as the ROTL access program (ROTLA). Another program, which will be referred to as the ROTL communications program (ROTLC), has the function of communicating with the Mini-ROTL and initiating and monitoring actions in response to its commands. A third program ROTL test (ROTLT) has the function of establishing and supervising connections associated with the trunk selected for testing.

3.295 Figure 26 shows the interrelation between the three programs and other programs with which they interact. The heavy arrows in the figure indicate flow of control for a connection. The light arrows indicate transfer of information only.

Operation of the ROTL Access Program

3.296 The ROTLA program contains the entry point from the DNTRP program. The ROTLA program seizes the ROTL access port and a path through the network, activates the message channel and initiates the TCR (TCRC) for the ROTLC program, and interrogates the ROTLC program to determine when ROTLC is ready to communicate with the Mini-ROTL. When ROTLC is ready, the ROTLA program connects the calling party to the access port, returns answer supervision if the calling party is a trunk, and directs ROTLC to initiate transmission of a ROTL call connected (RCC) message to the Mini-ROTL.

3.297 After the ROTL access port is connected, its associated TCR (TCRA) goes into a waiting state. In this state a timer is set by the ROTLC program each time a test is completed or a recycle command is received from the Mini-ROTL. If the calling party goes on-hook, it is reported by the input monitor to the ROTLA program. ROTLA prompts the ROTLC program that a disconnect has occurred. TCRA is then passed on to be processed as a transient disconnect from the input monitor.

3.298 If the Mini-ROTL transmits a command indicating that either a diagnostic of the Mini-ROTL is to be performed, high tone is to be sent to the calling party, or the access connection is to be released, the ROTLC program prompts ROTLA with the request. ROTLA sets flags in TCRA (for processing when TCRA is visited during the base level TCR scan) indicating the type of request. Then the interface between the ROTLA program and the ROTLC program is no longer required.

3.299 If a diagnostic is to be performed, ROTLA obtains the terminal equipment numbers of the 105-type test line from location FETL in program TDATA and removes those test lines from service if they are idle. It restores them to service when the calling party goes on-hook. Again, the disconnect of TCRA is processed as a transient disconnect from an input monitor report.

3.300 If connection to high tone is to be performed (the final stage of the balance and long term test), the ROTLA program releases the path of the ROTL access port, frees the access port for another user, and connects the calling party to

high tone for approximately 29 minutes. If TCRA times out or the calling party goes on-hook, the ROTLA program reports that fact to the ROTLT program so that the connection to the trunk under test will be released. TCRA is then processed as a transient disconnect if a time-out occurred, or as a transient disconnect as the result of an input monitor report if the calling party went on-hook.

3.301 If the Mini-ROTL had transmitted a disconnect request or if TCRA times out while waiting for a command from the ROTLC program, the ROTLA program treats the call as a transient disconnect. Time-out of TCRA should not occur in that state since the control timing is done by the Mini-ROTL and the ROTLC program.

Operation of the ROTL Communications Program

3.302 The ROTLC program is used to:

- (a) Collect commands and data transmitted from the Mini-ROTL
- (b) Generate an acknowledgment to defined commands
- (c) Verify that received commands are in the proper sequence
- (d) Interpret and process the command and initiate transmission of the appropriate reply
- (e) Retransmit messages which the Mini-ROTL has not acknowledged.

ROTL C also serves as the task distributor for ROTLA and ROTLT, and reports to the Mini-ROTL changes in supervision of the access connection.

3.303 The TCR associated with ROTLC acts as a receptacle for messages received from the Mini-ROTL via the Data Administration program (DATADM) and for messages initiated by ROTLC which could be retransmitted to the Mini-ROTL. The TCR also contains a pointer to the section of ROTLC to be executed when an input is received. The TCR also acts as a repository for data to be held regarding the circuit under test.

3.304 Inputs for the ROTLC program are processed primarily by the ROTLMSG base level

progress mark. This progress mark has three principal functions:

- (1) Retransmits messages to the Mini-ROTL which have not been acknowledged
- (2) Filters out for special processing the messages (**DRR, RR, SQZ**) from the Mini-ROTL which may interrupt a test in progress
- (3) Passes other input data to the section of ROTLC as indicated by the pointer in TCRC.

3.305 The TCRC is initiated by the ROTLA program when a call to the ROTL access port is processed. After requesting activation of the message channel using subroutine ACPRPI in program ACPORT and transmitting a message channel connected (MCC) message to the Mini-ROTL to verify that the message channel is working, ROTLC waits for an indication from ROTLA that the access port is connected. Once connected, it transmits a ROTL call connected (**RCC**) message to the Mini-ROTL and, after receiving an acknowledgement (**ACK**), waits for instructions from the Mini-ROTL. The expected instructions are either a diagnostic request or a data block.

3.306 ROTL Diagnostic Request: If the command from the Mini-ROTL indicates a diagnostic request, ROTLC passes the task to the TCRA for processing by the ROTLA program and then activates a 2-minute holdover timer in TCRC to maintain the message channel for a new ROTL user. No further communications with the Mini-ROTL will be processed until the current connection to the access port is released and a new user is attached.

3.307 If the command is a data block, it can be a request for a transmission test, a balance and long term test, a make busy or restore request, a trunk status request, or a callback unlock request. When data contained in a data block is examined and found to be invalid, a "Do Not Understand" message (**DUM**) is transmitted to the Mini-ROTL and the module recycles to wait for new input.

3.308 Security Callback Unlock Request: If the data block is a security callback unlock request, the data indicates which of six users (0 through 5) is making the call. The ROTLC program checks translations to see if the user is defined and responds (**IDI, IDV, DUM**) to

the Mini-ROTL. If the user is defined, the module stores the **authorization class** assigned to that user in TCRC and waits for a reply from the Mini-ROTL that it has closed a loop on the TUT port. ROTLC makes the TUT port busy and passes the user identity digit to subroutine ACPRTS in ACPORT which initiates an autoconnect to a telephone number which is stored in translations and assigned to that user identity. The ROTLC program transmits a success (**TCC**) or failure (**PND**, **TPB**, **CSD**) message to the Mini-ROTL and then recycles to wait for a new data block instruction while the Mini-ROTL supervises the call and determines the call setup success or failure.

Note: The authorization class specifies whether the user may either exceed or only reach the automatic maintenance limit when removing trunks from service.

3.309 Trunk Status Request: If the data block is for a trunk status request, the trunk group and member number is extracted from the data block, the member status is checked, and a reply (**DUM**, **TMB**, **TNB**) is transmitted to the Mini-ROTL. The ROTLC program then recycles to wait for a new data block.

3.310 If the data block is for a trunk group status request, the group number is extracted from the data block and the status of the trunk group is checked. Replies transmitted to the Mini-ROTL may be either **GLB**, **GZB**, or **GSB** before recycling to wait for a new data block.

3.311 Trunk Removal and Restoral: If the data block is for a trunk removal or restoral (the Mini-ROTL has already verified that a security callback unlock has been performed), the ROTLC program extracts the group and member number from the data block. The trunk group data is then checked to verify that the specified circuit is a trunk which can outpulse. If so, the circuit status is tested.

3.312 Only trunks which are in the locked-out idle state will be restored to service. If the restoral is successful or if the trunk is in the active (idle or busy) state, ROTLC responds to the Mini-ROTL with a restored to idle (**RTI**) message. The refused because of trunk state (**RTS**) message is sent to the Mini-ROTL if the trunk is in the high and wet, disabled, or locked-out busy state.

3.313 Only trunks which are idle will be removed from service and placed in the locked-out state. If removal of the trunk from service would reach or exceed the automatic maintenance limit (AML), the authorization class which was established by the security callback unlock is examined to determine if the user is authorized to exceed the AML. If so, the trunk is unconditionally removed from service. The Mini-ROTL is then notified of the final state of the trunk. If the trunk is locked out and below the AML, the maintenance busy (MBY) message is sent to the Mini-ROTL. If the trunk is locked out and at or above the AML, the maintenance busy exceeded (**MBX**) message is sent. If the trunk is high and wet (HAW) or disabled (DSA), the refused because of trunk state (**RTS**) message is sent. If the trunk is active busy, the refused-service busy (**RSB**) message is transmitted.

3.314 Trunk Outpulsing: If the data block is for a trunk transmission test or a balance and long term test, the ROTLC program tests the status of the TUT port of the Mini-ROTL and the status of the trunk to be tested. If the TUT port is undefined or unseizable or if the trunk is not an outpulsing trunk or is not idle, then a **PND**, **TPB**, **DUM**, or **TUN** message is sent to the Mini-ROTL. The ROTLC program then recycles to accept new data. Otherwise a **TUS** message is sent and ROTLC waits for a **CRS** message from the Mini-ROTL which indicates that a continuity loop has been closed on the TUT port. On receipt of the **CRS** message, the ROTLC program initiates selection, by the ROTLT program, of TCRT and other facilities necessary for outpulsing. If one of the required facilities is not available, a message specifying the failure (**TCN**, **TPB**, **DUM**, **TUN**, **NXA**, **NXP**, **NPA**, **TGD**) is sent to the Mini-ROTL and the ROTLC program recycles to wait for a new data block. If facilities are available, control of the TCR (TCRT) for the ROTLT program is passed to ROTLENT in OUTCAL and ROTLC proceeds to monitor the terminal memory record (TMR) of the TUT port to trunk under test connection. If the test connection TMR "evaporates" or does not go stable in 30 seconds, ROTLC generates a **THF** message for the Mini-ROTL and waits for a new data block. When the test connection does go stable, ROTLC initiates a new TCR for the test connection in order to give supervisory control of the connection to the test module, and generates the **TCC** message for the Mini-ROTL.

3.315 Trunk Transmission Tests: On transmission tests after the test connection

is established, the Mini-ROTL requests a report of the trunk supervisory status. The ROTLC program interrogates TCRT to determine if answer supervision has been reported by the ROTLT program. If not, release of TCRT is initiated. The status of answer supervision, **ASN** or **ASR**, is reported to the Mini-ROTL.

3.316 On transmission tests to 100-type and 105-type test lines, after receiving the report that answer supervision has been received, the Mini-ROTL requests that the trunk under test be monitored for hits. ROTLC primes TCRT so that ROTLT will scan the trunk for hits.

3.317 Trunk Release: Release of the trunk under test may be initiated by a **HRR**, **RMB**, **RR**, or **DRR** command from the Mini-ROTL. The **HRR** command is a request to release the trunk and report if a hit has been detected. On receipt of the command, the ROTLC program interrogates the ROTLT program for a report of any hits, primes it for disconnect and release of the test connection, transmits **THD** or **THN** to the Mini-ROTL, and recycles for a new data block.

3.318 The **RMB** command is a request to release the test connection and make the trunk busy unless a hit was detected. The ROTLC program interrogates the ROTLT program for a report of any hits and primes it for disconnect of the test connection and release of the trunk if a hit was detected. If no hit was detected, ROTLC interrogates the ROTLT periodically until the connection is released and then proceeds as a trunk removal request. Responses to the Mini-ROTL are **THD** or the group of responses generated by the removal routine.

3.319 The **RR** command instructs ROTLC to release the connection to the trunk under test. The **DRR** command is like the **RR** command but, in addition, the access connection to the Mini-ROTL is to be released. The **RR** and **DRR** commands may be received at any point in a test sequence. On receipt of the **DRR** command, ROTLC primes ROTLA for release of the access connection and then, as for receipt of the **RR** command, it primes ROTLT for release of the test connection. No return information is sent to the Mini-ROTL for those commands.

3.320 Balance and Long Term Test: When, after outpulsing, the **CTQ** command is

received from the Mini-ROTL, it is an indication that the balance and long term connection is to be made. The trunk under test is to be disconnected from the TUT port of the Mini-ROTL and is to be connected to a port of the MWTET circuit. The ROTLC program requests the ROTLT program to ascertain if answer supervision had been received on the trunk under test and if not, release it. Otherwise, ROTLT is to select a port of the MWTET and a path from the TUT to it and start to reconfigure the connection to the TUT. If answer has not been received or if a MWTET port or network path were not available, a reply (**ASN**, **TQB**, **NPA**) is sent to the Mini-ROTL. Otherwise, ROTLC periodically interrogates ROTLT to determine the success or failure of the connection of the TUT to the MWTET and transmits a message (**TQC**, **THF**) to the Mini-ROTL. The ROTLC program then waits for the command **CHT** to connect the calling party to high tone. On receipt of that command, ROTLC primes ROTLA with data which will cause ROTLA to select and connect the high tone circuit to the calling party and link supervision of TCRA of ROTLA to TCRT of ROTLT. No further communication to the Mini-ROTL is initiated and ROTLC recycles to wait for a new data block. (If an **RR** or **DRR** command is received from the Mini-ROTL before the **CHT** command is received, the TUT connection is released.)

3.321 If the ROTLA program detects an on-hook from the calling party, it passes that information to the ROTLC program and then proceeds to release the access connection. ROTLC reports the disconnect to the Mini-ROTL (**RCD**) and primes the test module for release of any test connection.

3.322 Holdover Timer: When the access connection is released either as a result of calling party disconnect or a disconnect and reset request (**DRR**) from the Mini-ROTL, ROTLC begins a 2-minute timing interval. The purpose of the timing is to maintain control of the shared TTY controller in the event the Mini-ROTL is re seized. If the ROTL is not re seized before time-out, the message channel is released and TCRC is cleared.

Operation of the ROTL Test Program

3.323 The ROTLT program is used whenever a connection is made to the trunk under test. ROTLT selects the necessary facilities, records answer supervision, scans the TUT for hits, handles

the connection for the TUT portion of the balance and long term tests, and processes the disconnect of the TUT.

3.324 The TCR associated with ROTLT (TCRT) is first selected when the ROTLC program directs ROTL to seize a particular trunk for test and prepare to outpulse. ROTLT selects the TCR, trunk, TUT port, talk path, transmitter and associated path if required, prepares the TCR for outpulsing the digits, and passes the TCR address and other pertinent data back to the ROTLC program for eventual processing by the OUTCAL program.

3.325 After outpulsing is completed, the TCR which was selected originally is cleared. The ROTLC program directs the ROTLT program to select and initialize a new TCRT to supervise and hold the test connection. ROTLT then monitors the trunk under test for answer and waits for instructions from ROTLC.

3.326 Instructions from the ROTLC program are of two types. The first type requests some action: begin hit monitoring, connect to the tone/quiet termination, or disconnect. The second type requests a report of the results of some action: report answer supervision, report hit scan results, report if the connection to the tone/quiet termination is completed, or report if disconnect is completed. If an action is requested, flags are set in TCRT for processing of the request when the TCR is next visited during the base level TCR scan or after an in-progress peripheral action is completed. If a report is requested, test results or progress flags in TCRT are examined and the results are reported immediately.

3.327 When a request to monitor the TUT for hits is made, the ROTLT program scans the TUT supervisory scan point every base level loop for an on-hook. Any on-hook which is detected is registered in TCRT as a hit except if it occurs within 400 ms of a disconnect request from the ROTLC program. The results of the hit monitoring are reported to ROTLC when the TUT release request is received.

3.328 When a request to connect the TUT to the MWTET port (tone/quiet termination) for the balance and long term test is received, ROTLT reserves a port of the MWTET and a path from the TUT to it. Then, when TCRT is processed

at its turn in the base level TCR scan, the TUT port of the Mini-ROTL to TUT connection is released and subsequently the TUT to MWTET connection is made. Flags in TCRT are set when the action is complete and are used as the basis for the report to the ROTLC program when ROTLT is interrogated by ROTLC to determine when the connection is complete and whether it succeeded or failed. After completion of the connection, ROTLT puts the MWTET port in the milliwatt tone state for 10 seconds and then in the balance termination state for 30 minutes while waiting for a request to disconnect. The disconnect request can come either from the input monitor (which is a result of the TUT going on-hook), the ROTLC program (which is a result of a DRR or RR message or the calling party going on-hook), or from the ROTLA program (which is a result of the calling party going on-hook after the high tone connection has been established).

3.329 When the TUT is to be disconnected, ROTLT releases the TUT relays and disconnects and idles the network path and the connected circuit. It then waits 10 seconds for an on-hook report from the trunk at the far end. If a release and make busy request prompted the disconnect, a flag is set in TCRT when the far-end trunk goes on-hook to indicate that the disconnect is complete when interrogated by the ROTLC program. Otherwise, ROTLT does 750-ms delay idle timing, then releases the trunk and idles TCRT.♦

M. ♦Remreed Network Fault Isolation Utilities

3.330 The remreed network fault isolation utilities software isolates transient fabric faults and pulse path matrix problems in the remreed network. This software aids the maintenance personnel in the location of a single concealed fault that affects a large portion of the network.

3.331 The software involved is divided into two areas as follows:

- (a) **Grid Error Count Routines:** Determines and tabulates the number of network orders that failed when accessing a particular grid
- (b) **Remreed Pattern Analysis:** Attempts to isolate a fault by sending out network controller orders and analyzing the group check data results.

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3.332 For a more detailed description of the remreed network fault isolation utilities refer to Section 233-153-145.♦

4. GLOSSARY

4.01 The following terms and definitions are used frequently in this section.

A-link—One of the 2-wire network paths between the first and second stages of switching in the network.

B-Link—One of the 2-wire network paths between the second and third stages of switching in the network that does not contain a junctor circuit. Also referred to as a wire B-link.

Base Level Loop—Major software loop including all functions not performed during interrupt level.

Interoffice Call—A call switched between different central offices.

Intraoffice Call—A call from one subscriber assigned to a central office to another subscriber within the same office.

Junctor—A circuit associated with the switching network which provides a path for a call through the network.

Line—Anything that connects to a network terminal that is not classified as a trunk or service circuit. Usually a pair of wires that serves to connect a customer telephone to a terminal on the network.

Nonresident Programs—Those programs housed outside the main store and called into memory by the system when needed. These programs are stored on the tape cartridge.

Off-Hook—The condition indicating that a telephone is in use (line loop closed).

On-Hook—The condition indicating that a telephone is idle (line loop open).

Outputting—Transferring information from the internal storage of a computer to output devices or external storage.

Resident Programs—Programs contained in main store.

Scratch Area—An informal term referring to or designating a unique internal storage area, designed to be reserved for intermediate results, various notations, or working areas. It is quickly erasable main storage.

Service Circuit—A circuit that connects to a network terminal and provides one of several specialized functions such as digit reception and transmission, alerting, coin control, and others. A service circuit communicates with the system control via scan points and peripheral decoders.

Showering Line—A showering line may be caused by a dc leakage which causes the line to look off-hook at the line scan point, but look on-hook at the less sensitive digit receiver scan point. This condition results in repeated continuity failures. A showering line may also be caused by ac power on the line which is too low to be recognized as a power cross failure, yet high enough to cause repeated originations.

Trunk—A channel connecting switching centers or exchanges. An interface circuit for transmission purposes.

5. ABBREVIATIONS

5.01 The following abbreviations and definitions are used frequently in this section.

3A CC	3A Central Control
ACP_ALM	Accept Alarm
ACT	Active
ALIT	Automatic Line Insulation Test
ALW_BLDG	Allow Building Alarm
AML	♦Automatic Maintenance Limit♦
AMSF	Active Multiscan Function
ANI	Automatic Number Identification
ANIS	Automatic Number Identification Start Failure
ATSD	Application Temporary Store Definition

AU_MAINT	Maintenance Audits	GRDUTL	Network Grid Removal Routines
BASEPM	Base Progress Mark	HAW	High and Wet
BLMMA	Application Portion of the Base Level Monitor Program	INH_BLDG	Inhibit Building Alarms
CAMA	Centralized Automatic Message Accounting	IPM	◆Impulse Per Minute◆
CAROT	◆Centralized Automatic Reporting On Trunks◆	JRMV_CDL	Conditional Junctor Removal
CBLM	Common Base Level Monitor Program	JRST_CDL	Conditional Junctor Restoral
CDPR	Customer Dial Pulse Receiver	JTV_ACT	Restore Junctor Test Vertical
CLC	Coin Line Circuit Failure	JTV_OOS	Remove Junctor Test Vertical, Check Wire Test Vertical States
CONT	Continuity Failure	KP	Key Pulse
CSECT	Control Section	LCO	Line Cutoff Failure
CTAPH	Common Tape Handler Program	LCRV	Line Circuit Restore-Verify Failure
CUTIL	Common Utilities	LINE_OOS	Line Out-Of-Service
DATADM	◆Data Administration Program◆	LKO	Locked-Out
DISCON	Disconnect Progress Marks	LKO_CDL	Locked-Out Conditional Removal
DNTRP	Digit Interpretation Progress Marks	LLR	Low Leakage Resistance Error
DP	Dial Pulse	LRMV	Line Removal
DSA	Disabled	LRST	Line Restoral
DTA	Distributor Triplet Address	LTD	Local Test Desk
DTA_HUNT	Distributor Triplet Address Hunt	LTDH	Local Test Desk Handler
EDP	Excessive Dial Pulses Error	LTDHPE	Local Test Desk Handler Per Scan Entry
EQPT_PD	Equipped Peripheral Decoder Map	MAINT	Maintenance
ESS	Electronic Switching System	MAS	Main Store
FCG	False Cross and Ground Failure	MAUD	Maintenance Audits
FEMF	Foreign Electromotive Force	MB	◆Maintenance Busy◆
		MBC	Maintenance Busy Counter

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MCLTD	Local Test Desk Call Processing—Maintenance Interface	NSD	No-Start Dial Error
MCNRPN	Maintenance Progress Marks for Nonresident Code	NWC	Network Controller
MCSRT	Station Ringer Test Call Processing—Maintenance Interface	NWGRID	Network Grid
MCSSPS	Maintenance System Status Panel States Administration	OEN	Office Equipment Number
MCSUB	Maintenance Subroutines	OFFTL	Office Test Line Control
MCTSVM	Maintenance Trunk and Service Circuit Monitor	OG	Outgoing
MF	Multifrequency	OOS	Out-of-Service
MFR	Multifrequency Receiver Failure	OOS_HUNT	Out-Of-Service Hunt
MFT	Multifrequency Transmitter Failure	ORD_PPD	Peripheral Pulse Distributor Order
MISPWR	Maintenance Power Alarm Counter	PD	Peripheral Decoder
MMSF	Mini-Multiscan Function	PDG	Peripheral Decoder Group
MNRSUB	Maintenance Nonresident Miscellaneous Subroutines	PDT	Partial Dial Time-Out
MON_P	Monitoring Process	P_E	Progress Error
MON_SCAN	Monitor Scan	PLUGUP	Plugging Up
MREQ_IE	Multiple Request Initial Entry	PPD	Peripheral Pulse Distributor
MSCAN	Miscellaneous Scan Point	PST	Permanent Signal Time-Out
MSF	Multiscan Function	PWSC	Power and Alarm Scan
MSFC	Multiscan Function Controller	PX	Power Cross Failure
MWTET	◆Milliwatt and Transmission Environment Test◆	P24VPWRS	Plus 24-Volt Power State
NCC	No-Coin Controller Error	RC	Ringing Continuity Failure
NFEX	Network Fabric Exercise	REPT_P	Reporting Process
NIS	Not-In-Service Bit	RMV_TV	Remove Test Vertical
		ROTL	◆Remote Office Test Line
		ROTLA	ROTL Access Handler
		ROTL_C	ROTL Communications Handler
		ROTL_T	ROTL Trunk Test Handler◆
		RST_CDL	Conditional Restoral

RST_TV	Restore Test Vertical	TM_OOS	Test Vertical Test Multiple States
RTE_ALM	Route Alarm	TMR	◆Terminal Memory Record
RV	Restore-Verify Failure	TPI	Test Progress Index◆
SCC	System Control Center	TRKOOSC	Trunk Out-Of-Service Counter
SCC	Stuck-Coin Control Error	TST_BB	Battery Boost Test
SRTH	Station Ringer Test Handler	TST_SCC	Test Service Control Center
SSP	System Status Panel	TSVEA	Trunk, Line, Service Circuit, and Network Link Error Analysis
ST	Start	TSVLIM	Trunk and Service Circuit Out-of-Service Limit Counters
STAT_IE	Status Initial Entry	TSVMON	Trunk and Service Circuit Maintenance Aids Program
SVCOOSC	Service Circuit Out-of-Service Counter	TSVNR	Trunk, Line, and Service Circuit Nonresident Routines
TC_ACT	Restore Test Vertical Test Circuit	TT	TOUCH-TONE
TCR	Transient Call Record	TTR	TOUCH-TONE Receiver Failure
TCRA	◆TCR for the ROTLA Program	TTT	◆Transmission Test Termination Circuit◆
TCRC	TCR for the ROTLC Program◆	TTYAPP	Application Teletype Compatibility Program
TCRN	Transient Call Record Number	TTYC	◆TTY Controller
TDATA	◆Translation Data Area Definition◆	TUT	Trunk Under Test◆
TEN	Terminal Equipment Number	UCL	Unconditional
TERM	Completion of Incoming and Intraoffice Calls	USERCD	User Code
TKSBLK	Task Status Block	UTILBS	Base Level Utility Scan
TLTP	Trunk and Line Test Panel	UTILON/UTILOF	Activate or Deactivate Application Utility
TLTPC	Trunk and Line Test Panel Control		

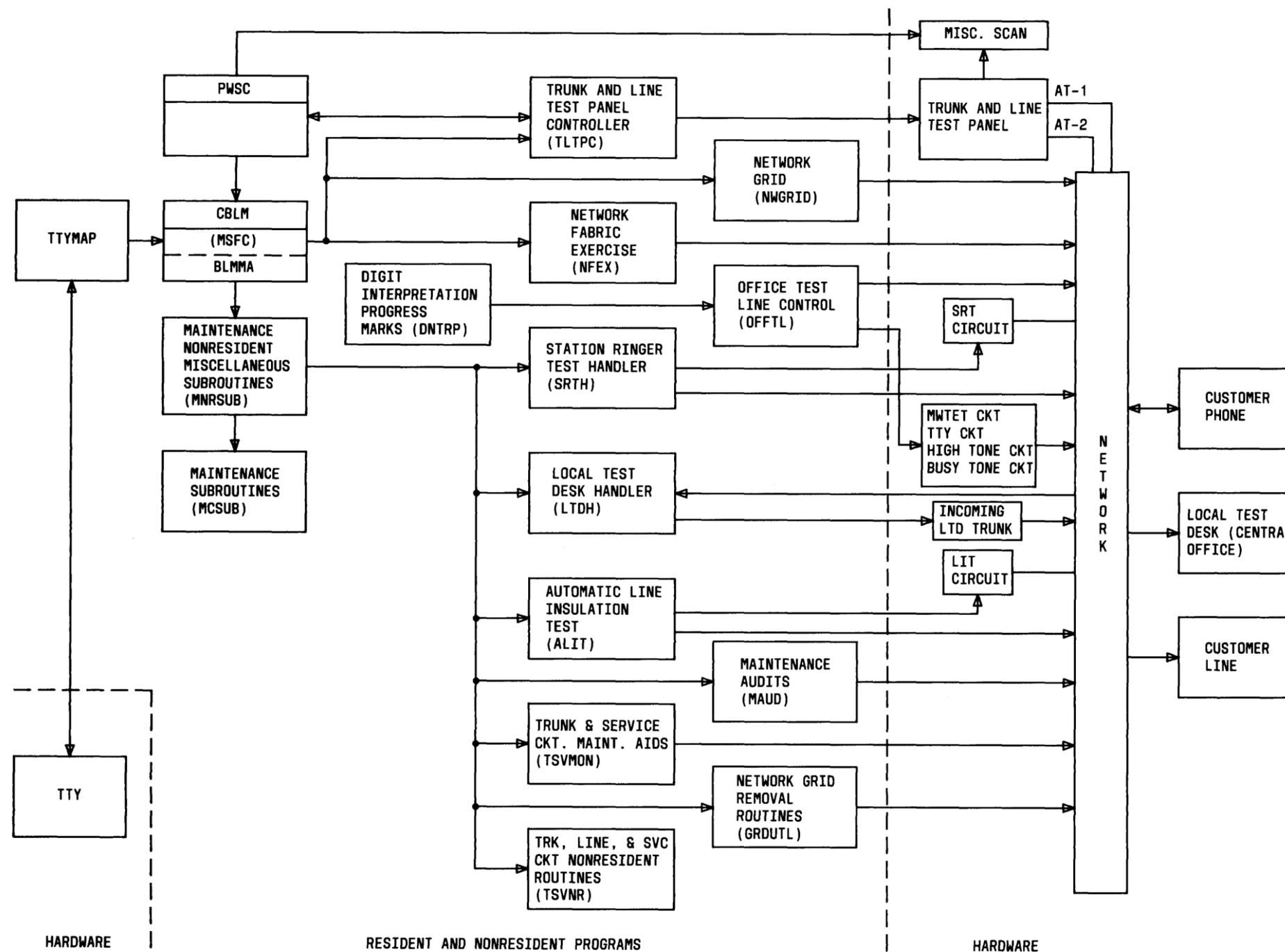


Fig. 1—Programmed Maintenance Aids, Resident and Nonresident Programs for the SO-2 Generic

PIDENT	PROGRAM NO.	TITLE
ALIT	PR-3H310	AUTOMATIC LINE INSULATION TEST
AUDITS	PR-3H002	AUDIT MONITOR, AUDIT SUBROUTINES, AND SOME AUDIT PROGRAMS
BLMMA	PR-3H004	APPLICATION PORTION OF THE BASE LEVEL MONITOR
CBLM	PR-1C950	COMMON BASE LEVEL MONITOR
CMMON	PR-1C963	ESS COMMON SYSTEM MAINTENANCE MONITOR
CNRUTL	PR-1C954	COMMON NONRESIDENT UTILITIES
DCON	PR-3H266	DIAGNOSTIC CONTROL
DNTRP	PR-3H155	DIGIT INTERPRETATION PROGRESS MARKS
GRDUTL	PR-3H321	NETWORK GRID REMOVAL ROUTINES
LTDH	PR-3H311	LOCAL TEST DESK HANDLER
MASACS	PR-3H014	MAIN STORE ACCESS ROUTINES
MAUD	PR-3H314	MAINTENANCE AUDITS
MCSUB	PR-3H251	MAINTENANCE SUBROUTINES
MNRSUB	PR-3H312	MAINTENANCE NONRESIDENT MISCELLANEOUS SUBROUTINES
NFEX	PR-3H313	NETWORK FABRIC EXERCISE
NWGRID	PR-3H320	NETWORK GRID
OFFTL	PR-3H253	OFFICE TEST LINE CONTROL
PWSC	PR-3H255	POWER AND ALARM SCAN
SRTH	PR-3H316	STATION RINGER TEST HANDLER
TLTPC	PR-3H317	TRUNK AND LINE TEST PANEL CONTROLLER
TRAFIC	PR-3H008	TRAFFIC
TSVEA	PR-3H256	TRUNK, LINE, SERVICE CIRCUIT, AND NETWORK LINK ERROR ANALYSIS
TSVMON	PR-3H318	TRUNK AND SERVICE CIRCUIT MAINTENANCE AIDS
TSVNR	PR-3H319	TRUNK, LINE, AND SERVICE CIRCUIT NONRESIDENT ROUTINES
TTYMAP	PR-3H259	TTY MESSAGE ADMINISTRATION
	PR-1C910 THRU PC-1C935	CONTROL UNIT DIAGNOSTICS

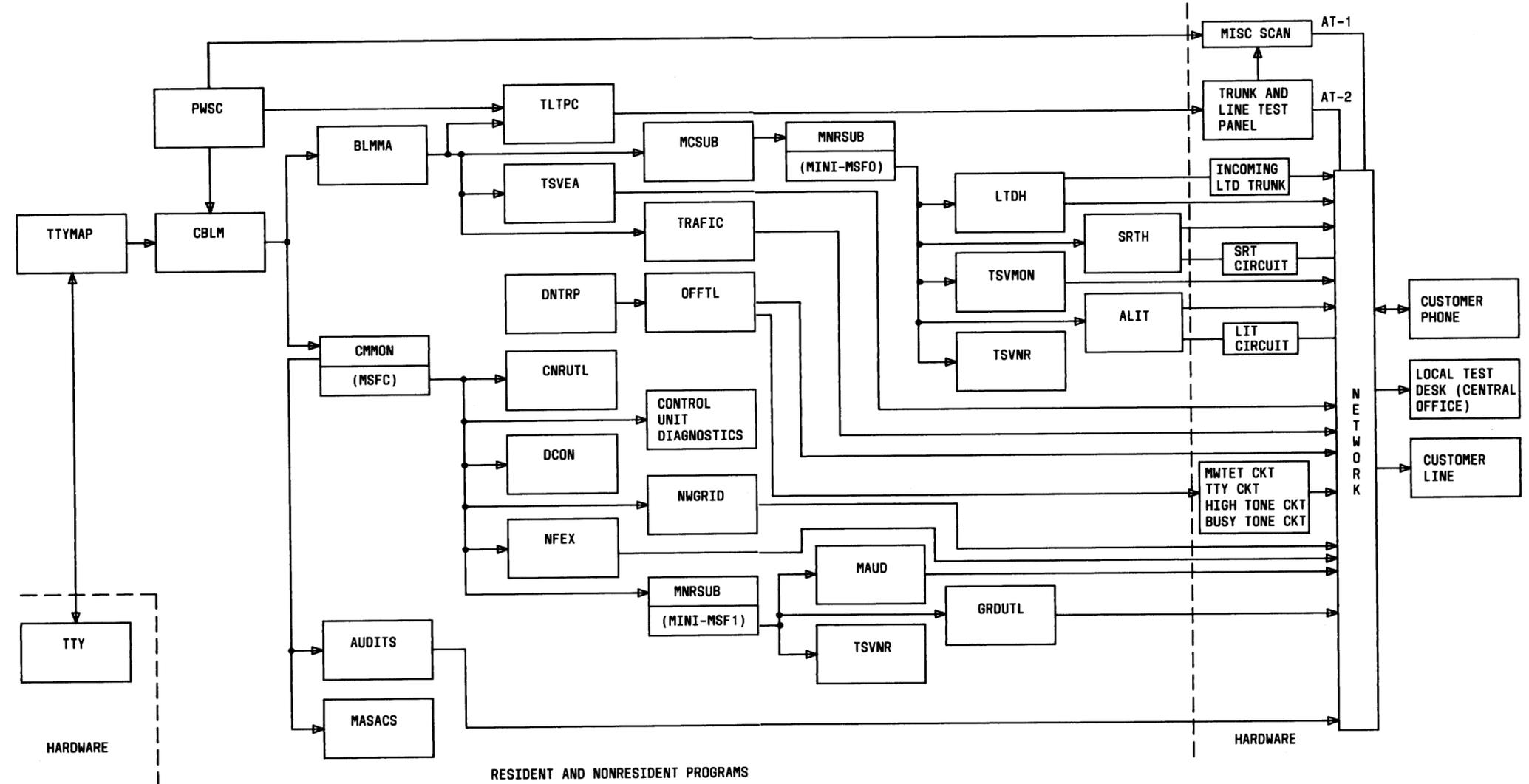


Fig. 2—Program Maintenance Aids, Resident and Nonresident Programs for the 3E3 Generic



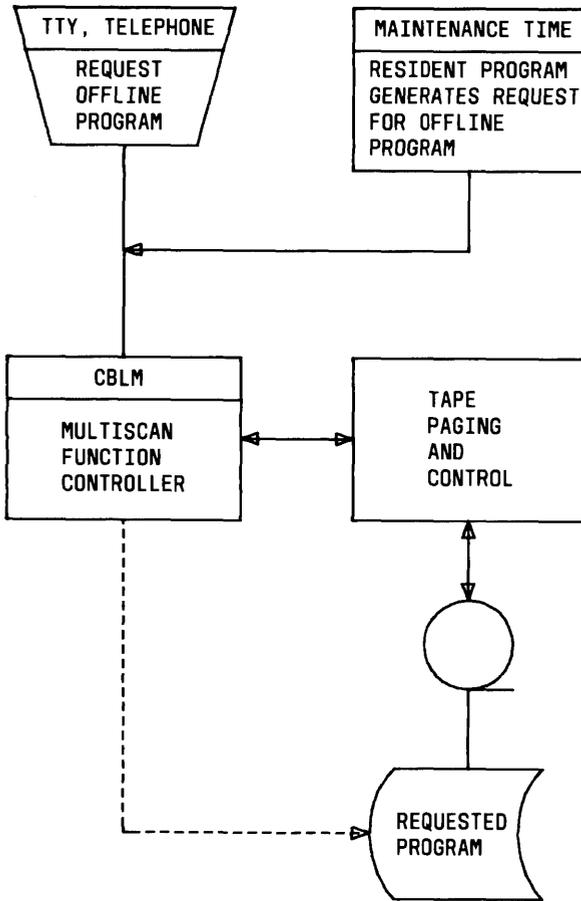


Fig. 3—Loading of Off-Line Function (Magnetic Tape) to On-Line Memory (Temporary Store)

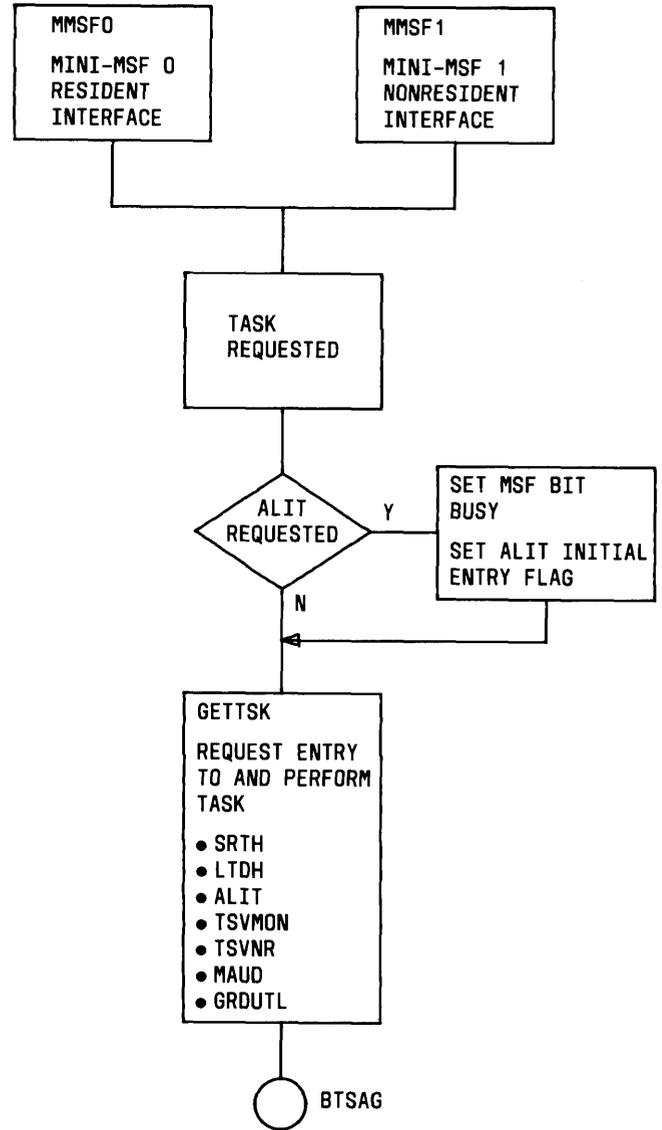


Fig. 4—Mini-MSF Control Flow Diagram

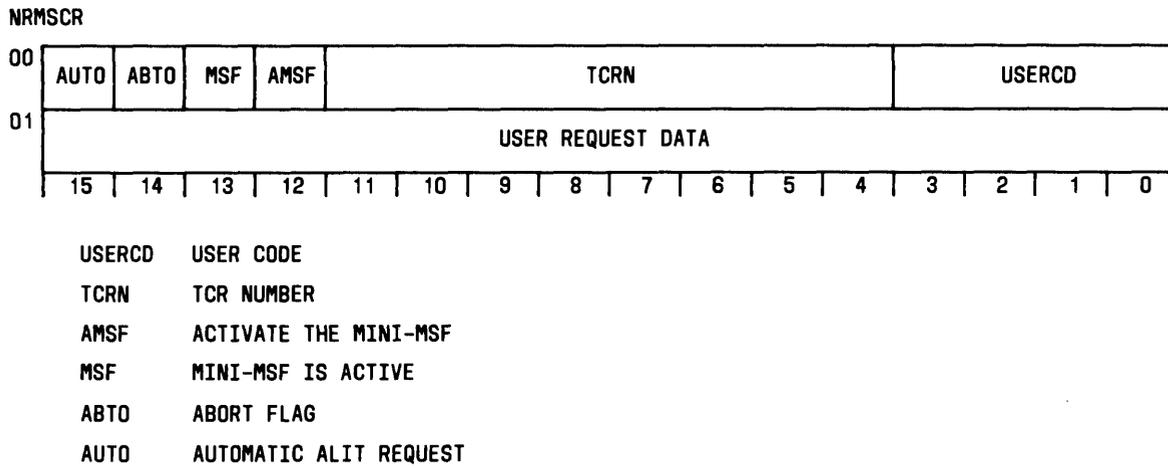


Fig. 5—Nonresident Mini-MSF Request Buffer

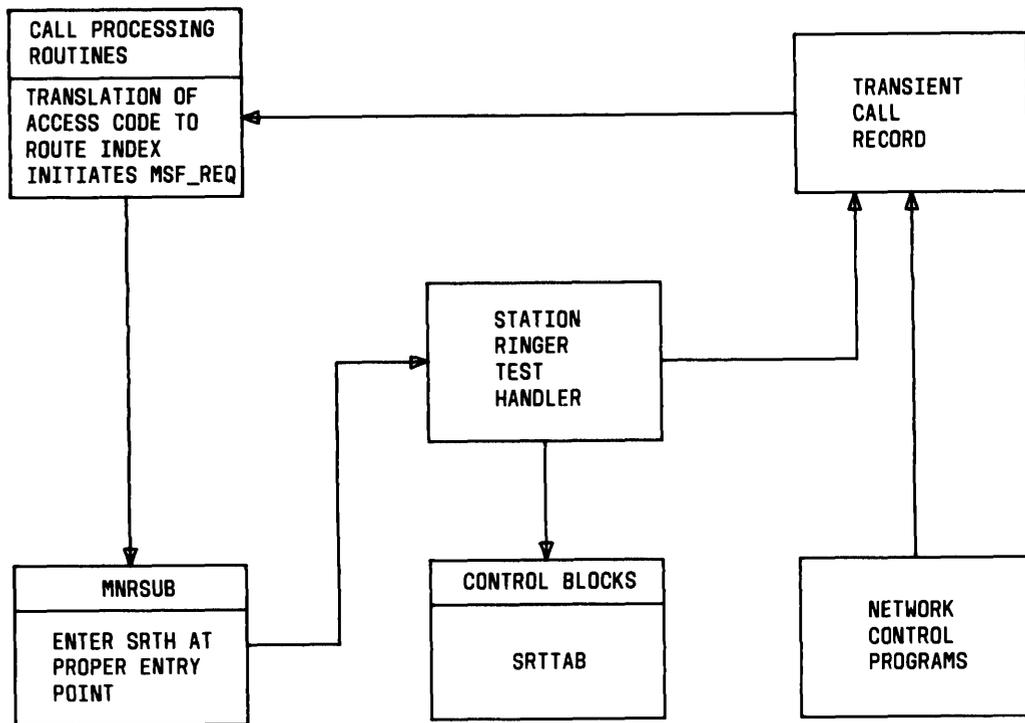


Fig. 6—Station Ringer Test Handler Program Interface

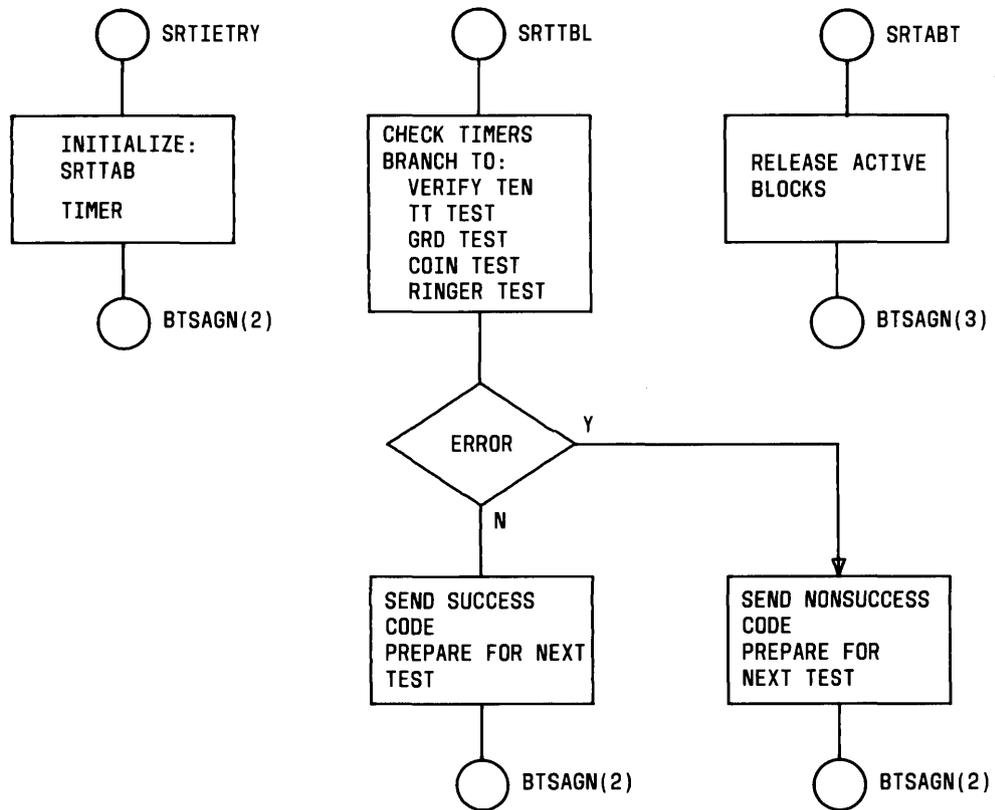


Fig. 7—Station Ringer Test Handler Flow Diagram

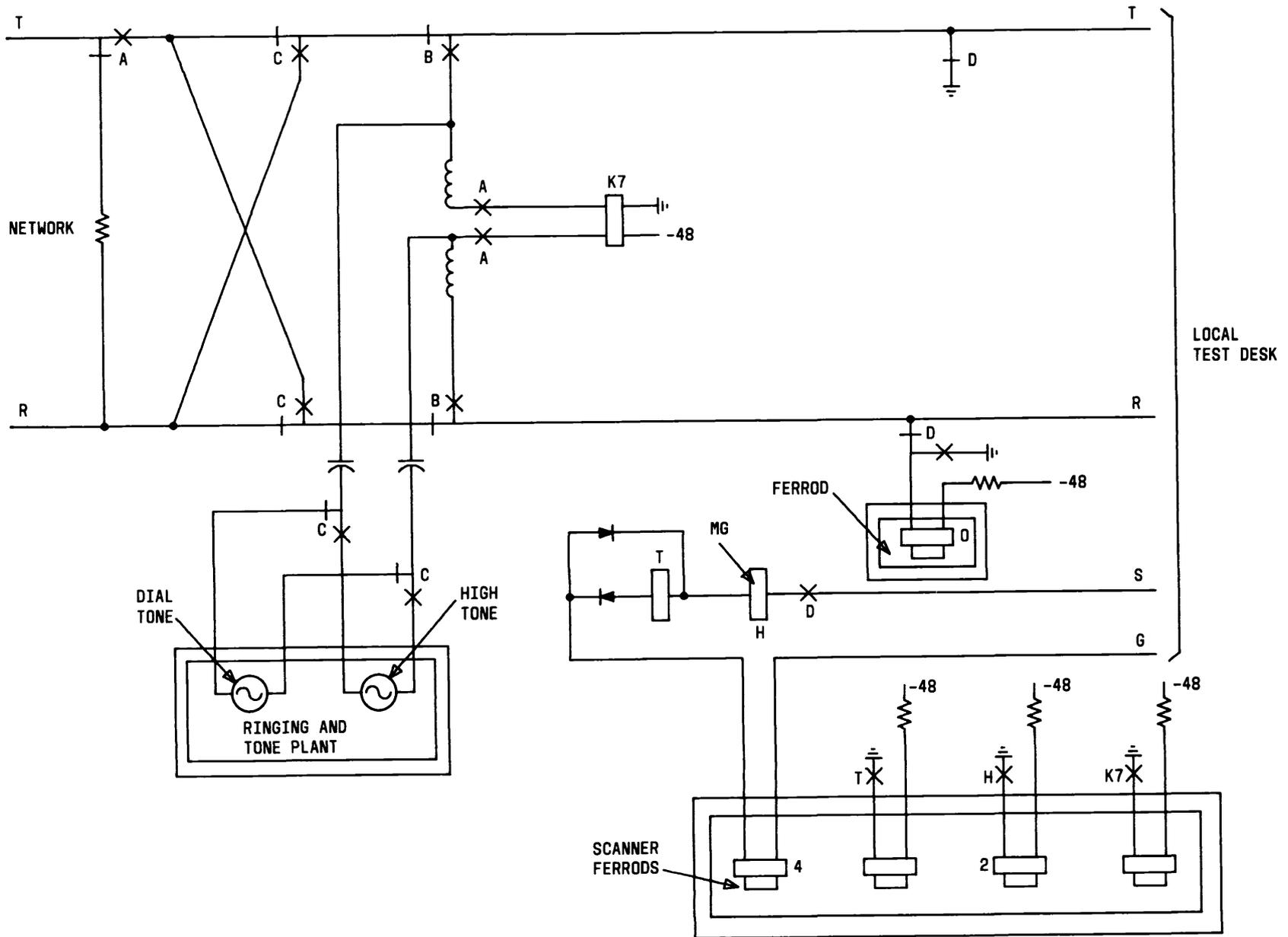


Fig. 8—No. 3 ESS Incoming Local Test Desk Trunk (FB519)

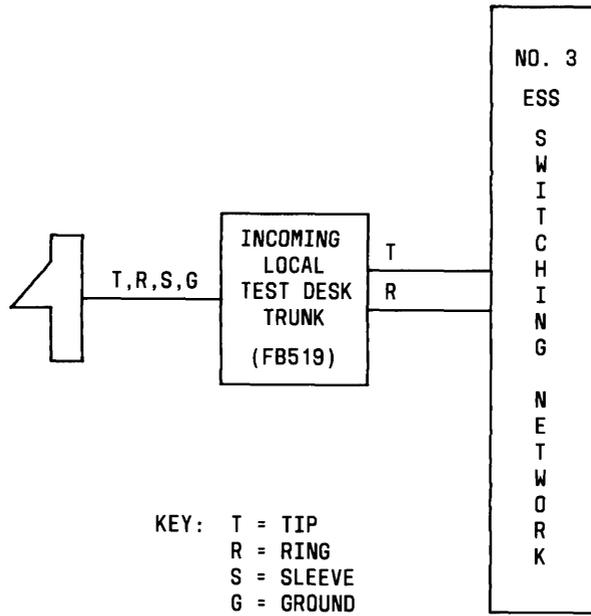


Fig. 9—On-Site Dedicated Local Test Desk

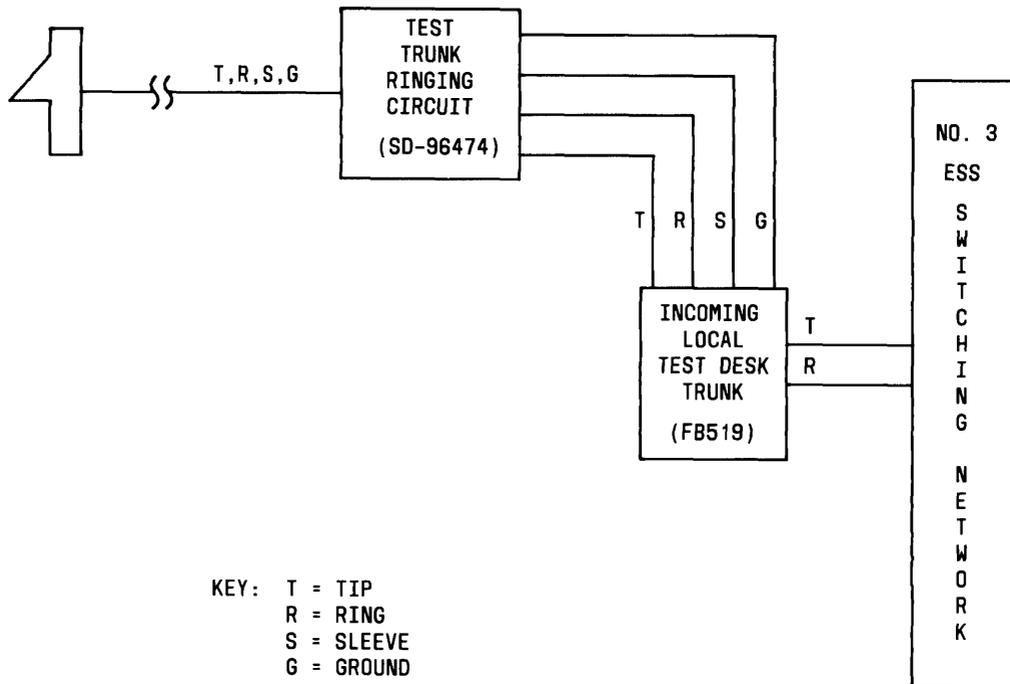


Fig. 10—Remote Dedicated Local Test Desk Within 1500-Ohm Loop

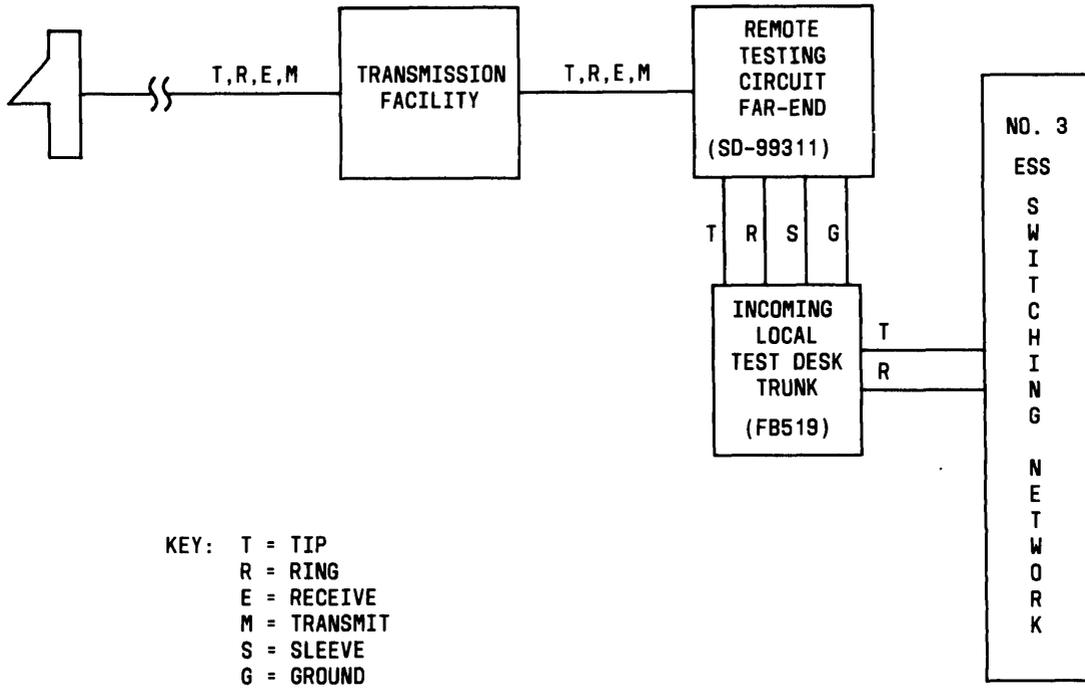


Fig. 11—Remote Dedicated Local Test Desk Beyond 1500-Ohm Loop

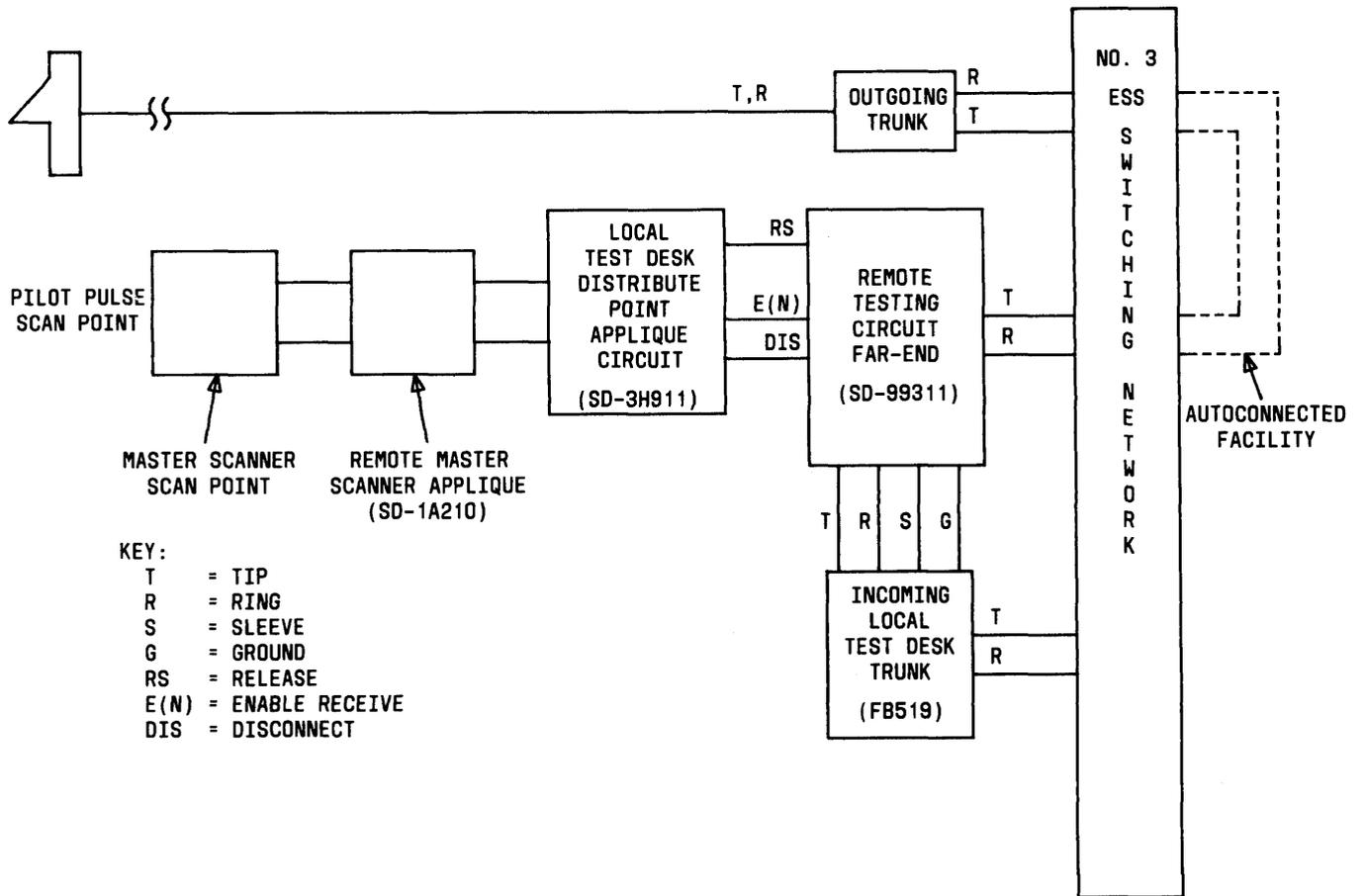
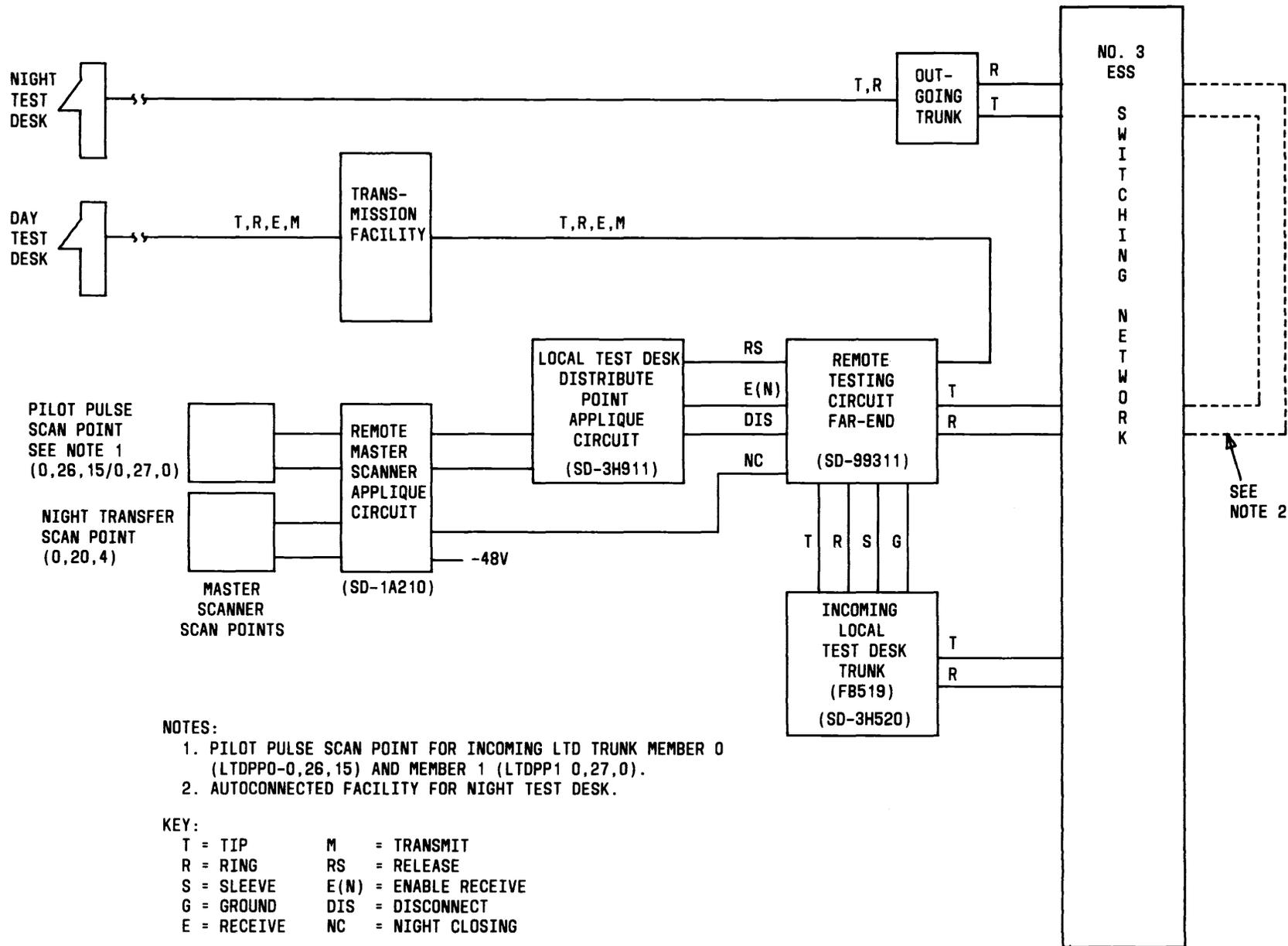


Fig. 12—Remote Nondedicated Local Test Desk



NOTES:

1. PILOT PULSE SCAN POINT FOR INCOMING LTD TRUNK MEMBER 0 (LTDPP0-0,26,15) AND MEMBER 1 (LTDPP1 0,27,0).
2. AUTOCONNECTED FACILITY FOR NIGHT TEST DESK.

KEY:

- | | |
|-------------|-----------------------|
| T = TIP | M = TRANSMIT |
| R = RING | RS = RELEASE |
| S = SLEEVE | E(N) = ENABLE RECEIVE |
| G = GROUND | DIS = DISCONNECT |
| E = RECEIVE | NC = NIGHT CLOSING |

Fig. 13—Remote Dedicated Day/Nondedicated Night Local Test Desk

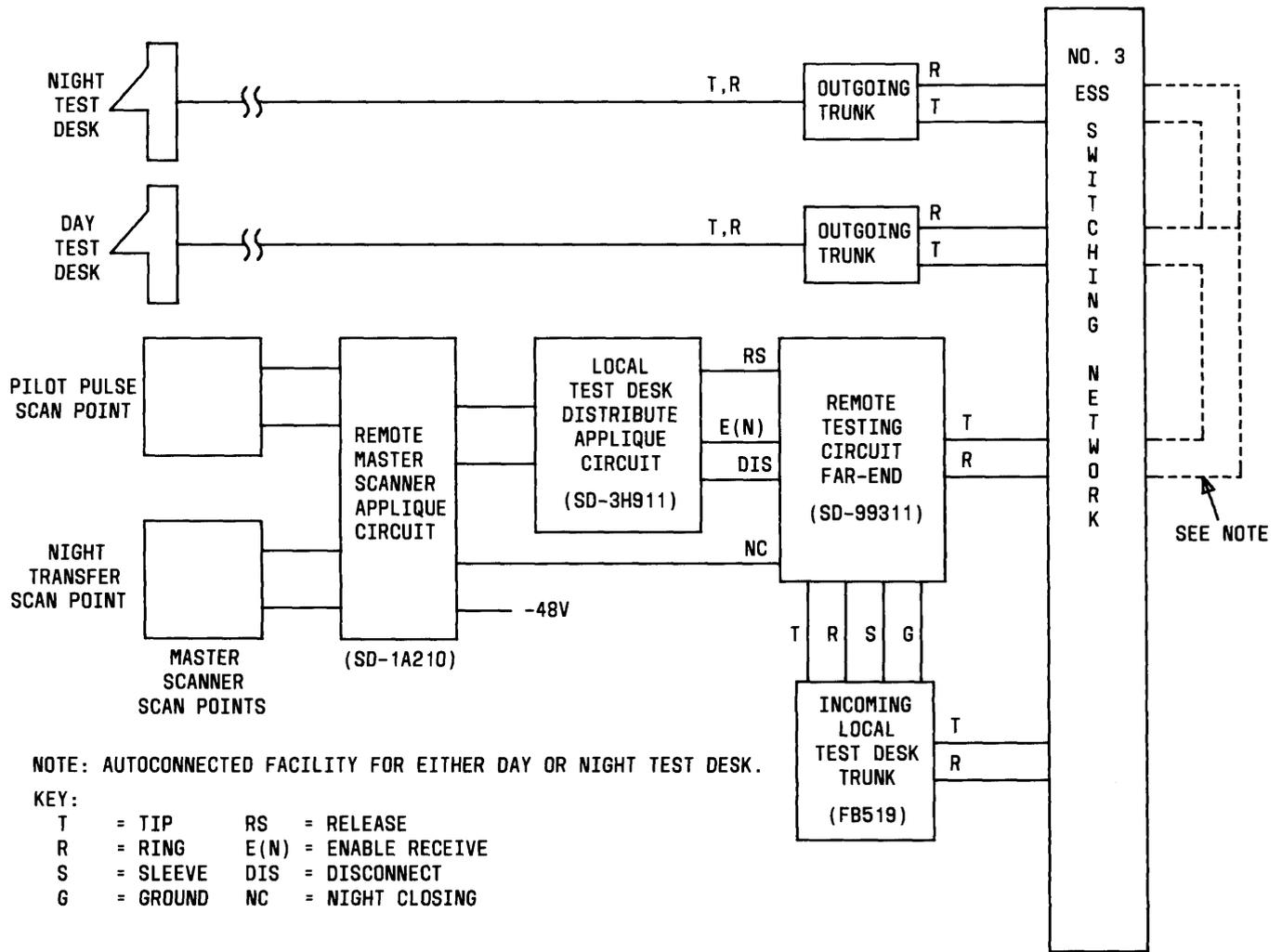
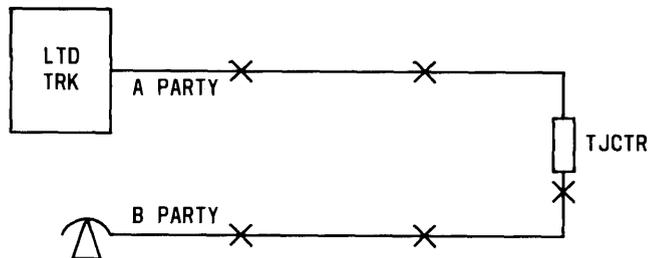
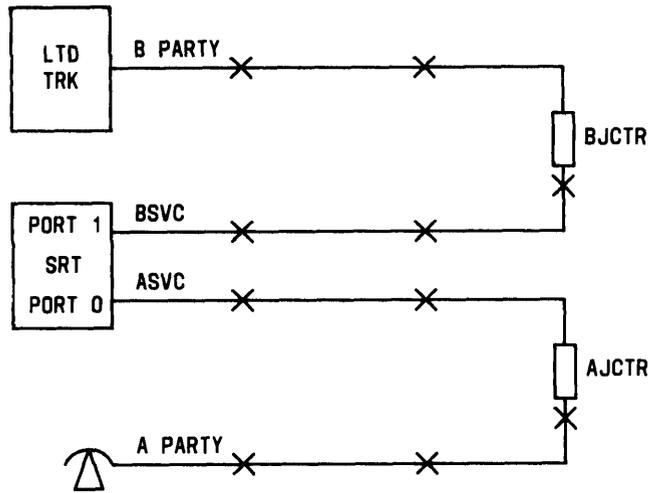


Fig. 14—Remote Nondedicated Day/Nondedicated Night Local Test Desk



NOTE: THE LINE FERROD TEST AND THE TOUCH-TONE TEST USE THE SAME TCR.

Fig. 15—Connections to the Line Under Test for the Line Ferrod Test and Other Metallic Tests



NOTE: THE TOUCH-TONE TEST AND THE LINE FERROD TEST USE THE SAME TCR.

Fig. 16—Connections to the Line Under Test for the TOUCH-TONE Test

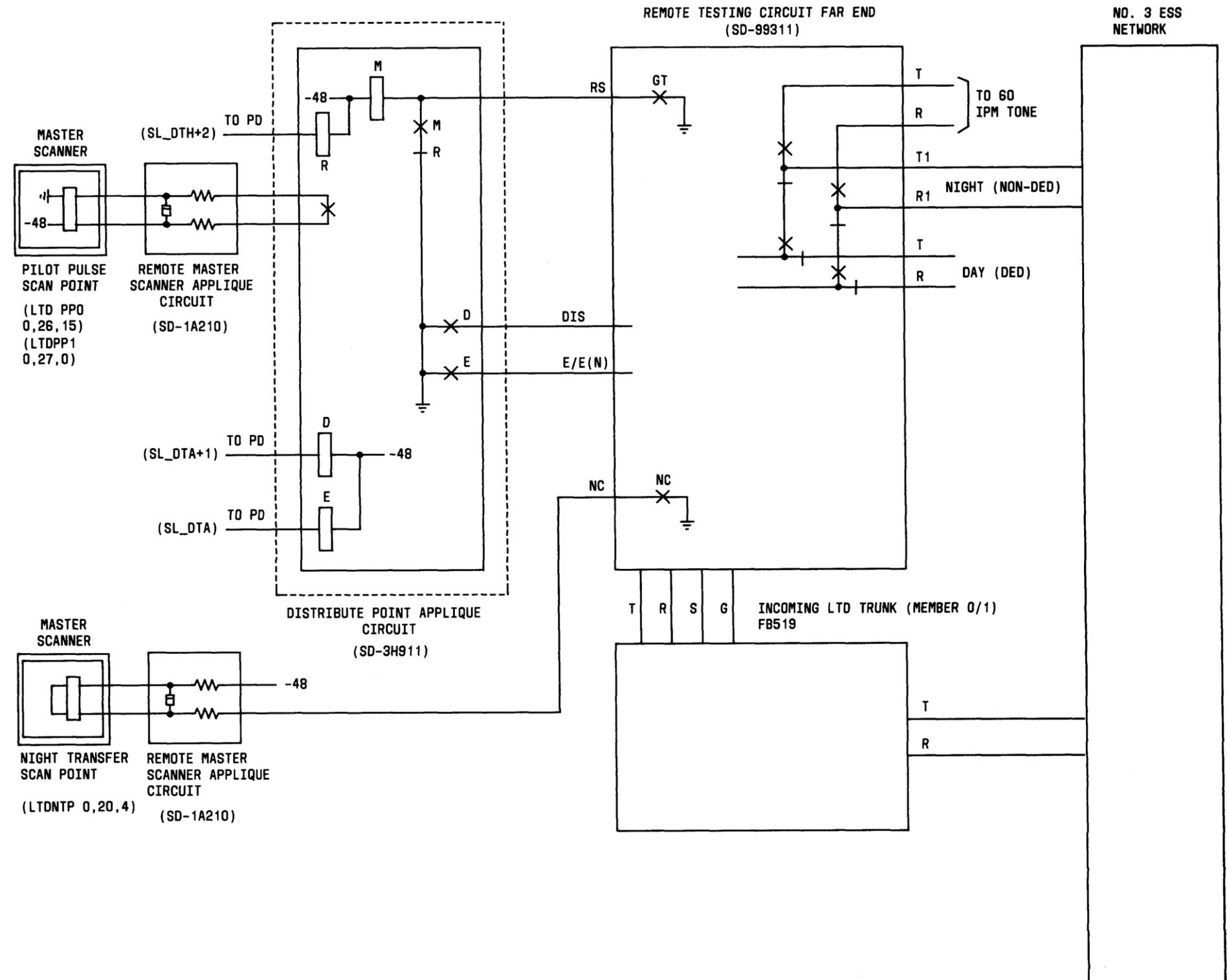


Fig. 17—Pilot Pulse and Night Transfer Scan Points Circuit Connections

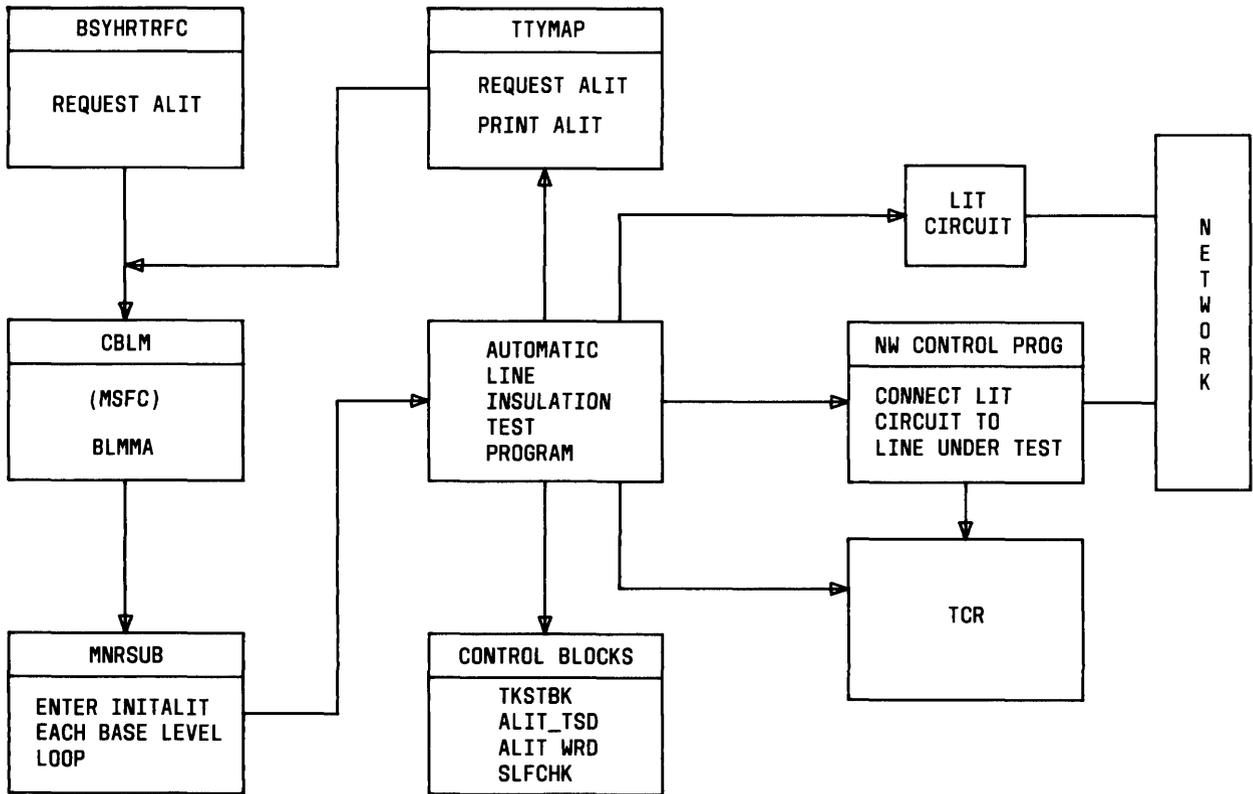


Fig. 18—Automatic Line Insulation Test Program Interface for the SO-2 Generic

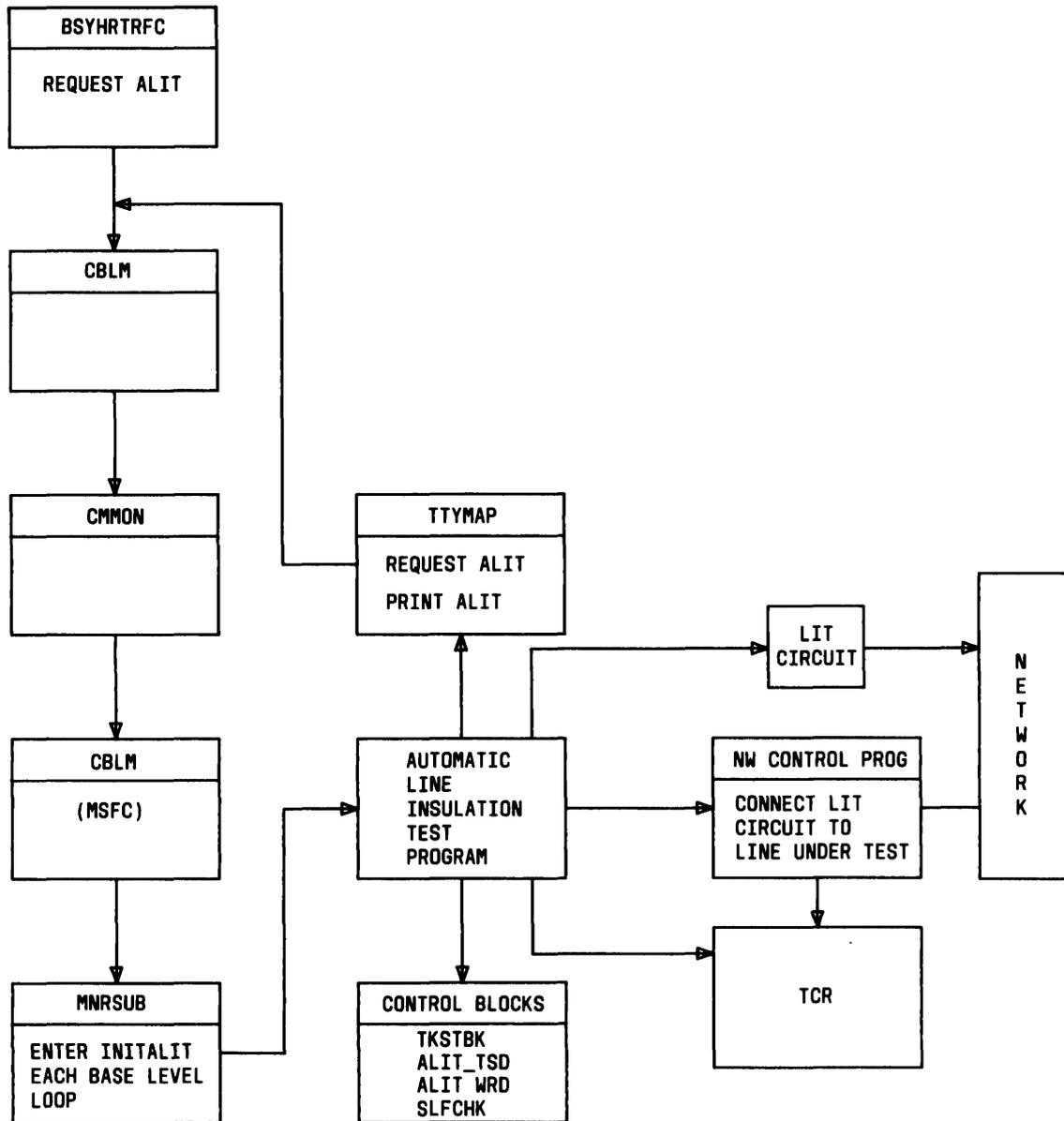


Fig. 19—Automatic Line Insulation Test Program Interface for the 3E3 Generic

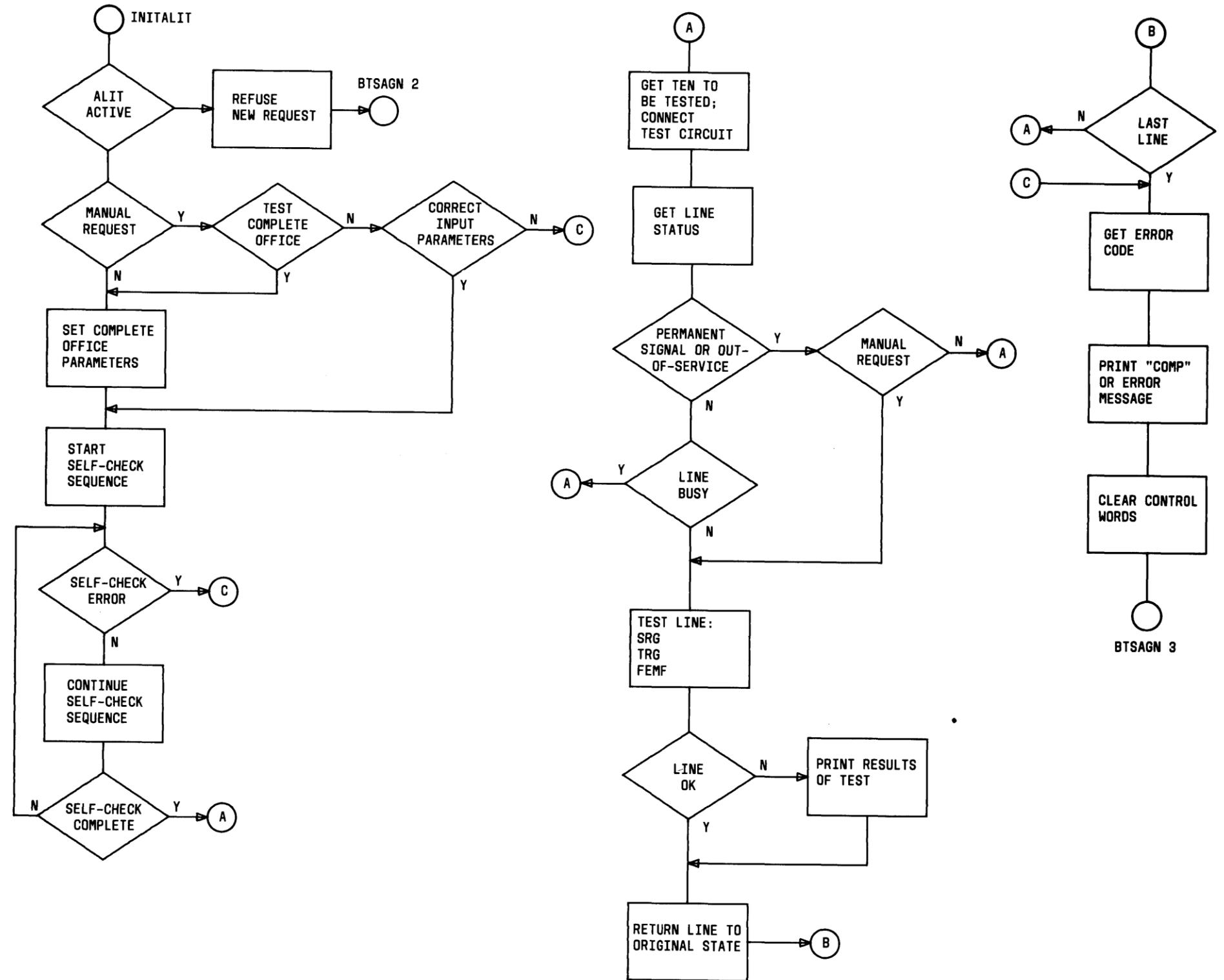


Fig. 20—Automatic Line Insulation Test Program Flow Diagram

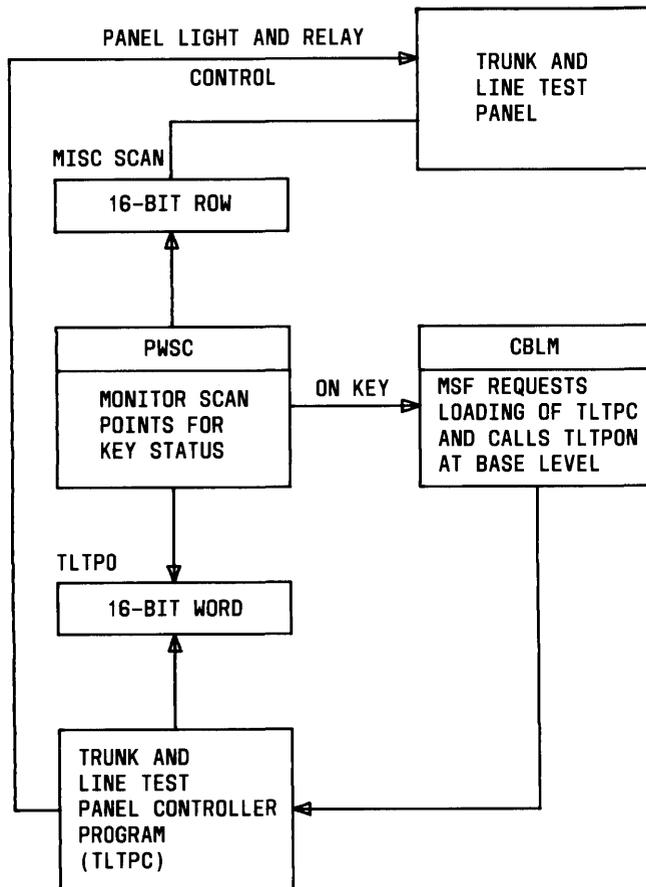


Fig. 21—Trunk and Line Test Panel Controller Interface Diagram for the SO-2 Generic

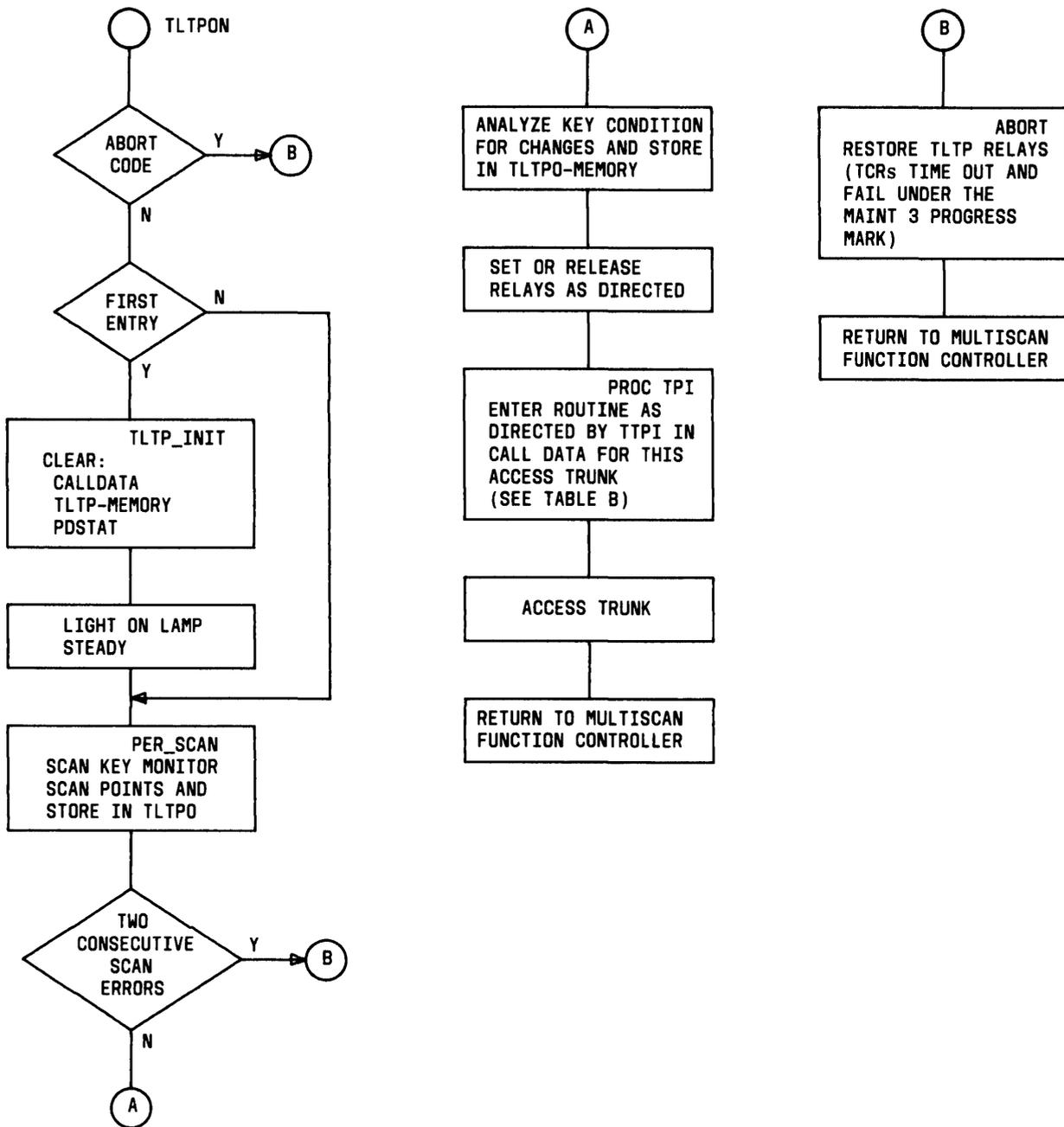


Fig. 22—Trunk and Line Test Panel Flow Diagram for the 3E3 Generic

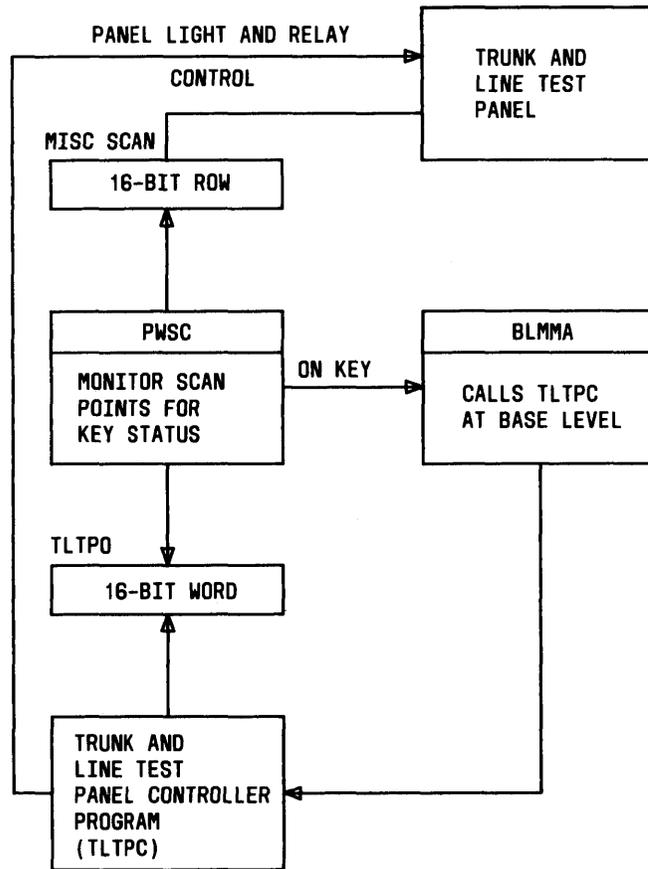


Fig. 23—Trunk and Line Test Panel Controller Interface Diagram for the 3E3 Generic

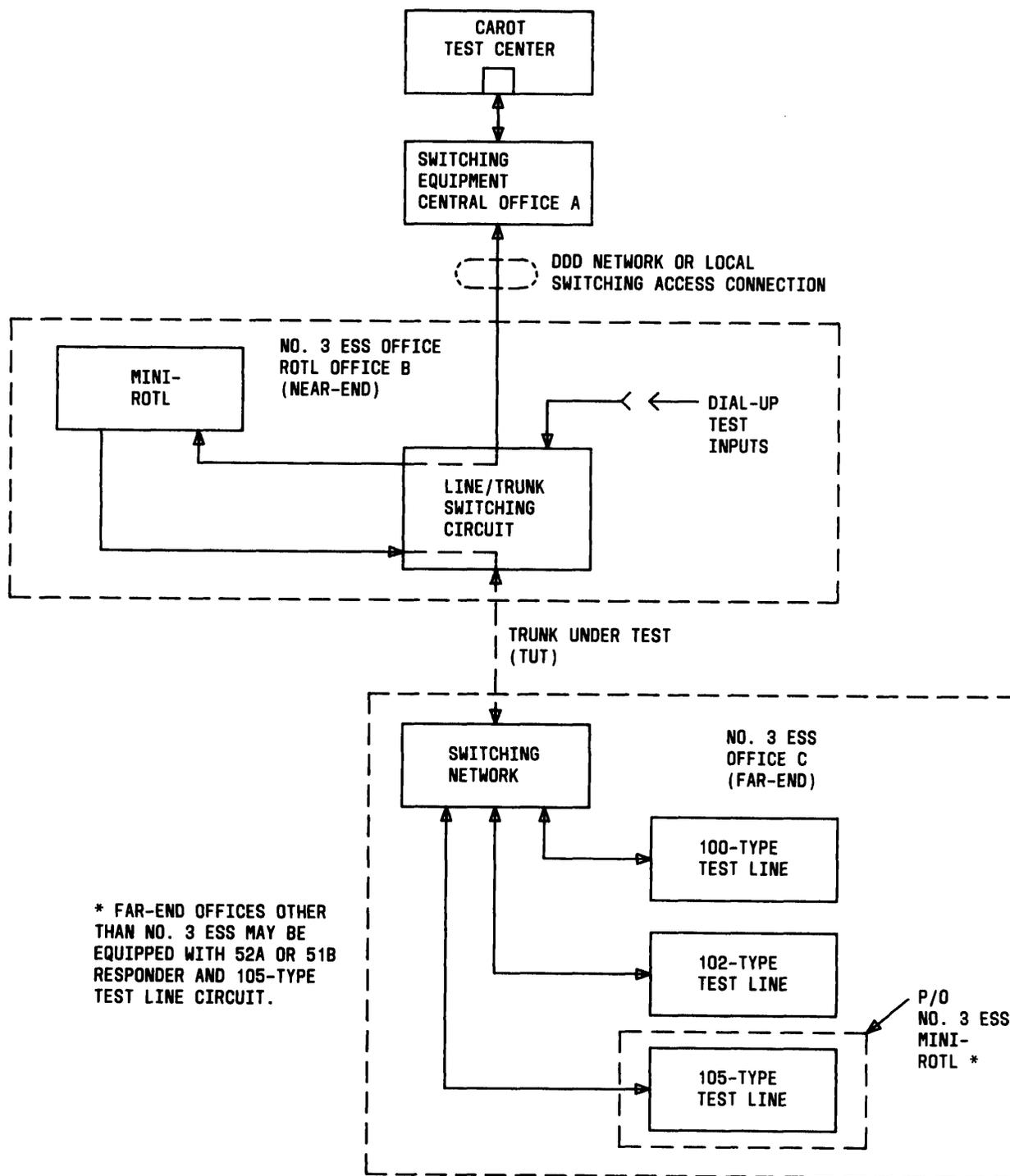


Fig. 24—No. 3 ESS ROTL Application

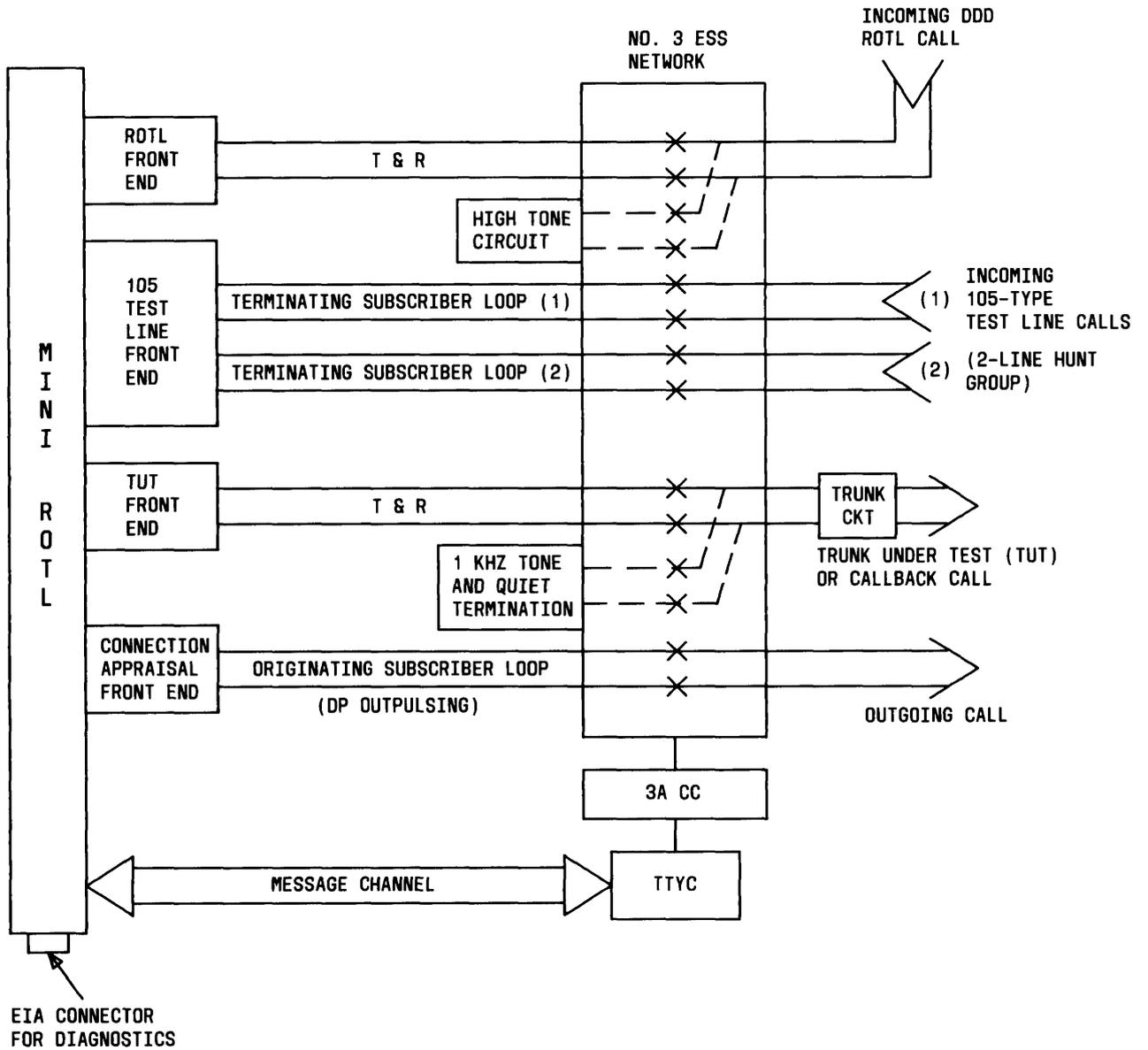


Fig. 25—No. 3 ESS ROTL Functional Diagram

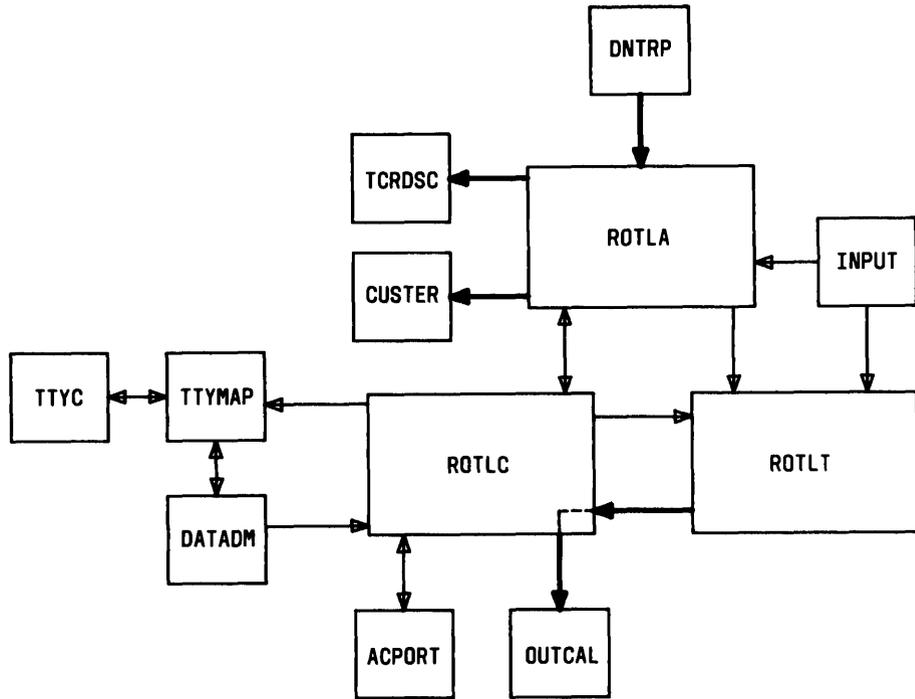


Fig. 26—No. 3 ESS ROTL Program Interactions

TABLE A
MAINTENANCE AUDITS

AUDIT	DEFINITION
TSVLIM	TRKLIM—Total trunk groups that have reached their out-of-service limits SVCLIM—Total service circuit groups that have reached their out-of-service limits
TRKOOOSC	Total trunk circuits out-of-service
SVCOOSC	Total service circuits out-of-service
MBC	Number of circuits in a group out-of-service (Maintenance busy counter)
NIS	Group not in service (maintenance busy) bit
P24VPWRS	Plus 24-volt power state
MISPWR	WORD 0—Major power alarm count WORD 1—Minor power alarm count WORD 2—Fuse alarm count
MSCAN	Miscellaneous scan point ignore bits
EQPT_PD	Equipped peripheral decoder (PD) map
PLGP_TBL	Plug-up list table
LTIM_TBL	Line timing table

TABLE B
MINI-MSF USER CODES

USER CODE	TASK	PROGRAM LISTING
0	Station Ringer Test	SRTH
2	Local Test Desk	LTDH
4	Automatic Line Insulation Test	ALIT
6	Error Monitor/Report	TSVMON
8	Multiple Remove/Restore Requests	TSVNR
10	Multiple Status Requests	TSVNR
12	Maintenance Audits	MAUD
14	Grid Maintenance Utility	GRDUTL

TABLE C
TSVMON ACCESS TTY MESSAGES

MESSAGE	DESCRIPTION
MON:TRK!	Monitor all errors that occur involving the specified trunk. The request may ask to monitor all trunks, a group of trunks, or a specified trunk.
MON:SVC!	Monitor all errors that occur involving the specified service circuit. The request may ask to monitor all service circuits, a group of service circuits, or a specified service circuit.
MON:ALNK!	Monitor all errors that occur involving the specified A-Link. The request may ask to monitor all A-Links , a group of A-Links, or a specified A-Link.
MON:BLNK!	Monitor all errors that occur involving the specified B-Link. The request may ask to monitor all B-Links, a group of B-Links, or a specified B-Link.
MON:LINE!	Monitor all errors that occur involving the specified line. The request may ask to monitor all lines, a group of lines, or a specified line.
MON:JC!	Monitor all errors that occur involving the specified junctor. The request may ask to monitor all junctors, a group of junctors, or a specified junctor.
OP:MON!	Output the current result of the monitoring requested. This condition may only be requested if monitoring is in progress.
REPT:TRBL!	Report on peripheral circuit trouble. The request may ask to report on all peripheral failures or on a specified peripheral failure. A maximum of three specified failures are allowed.
STOP:REPT!	A stop report request will terminate any reporting being performed by TSVMON. CAUTION: The stop report request will terminate the program if reporting is the only function being performed.
STOP:MON!	A stop monitor request will terminate any monitoring being performed by TSVMON. CAUTION: The stop monitor request will terminate the program if monitoring is the only function being performed.

TABLE D
ALIT ERROR CODES AND ERROR

ERROR MESSAGE

†† TST:LINE cg cgs! TN nnn nnnn xxxx ABT yyyy

ERROR CODE yyyy	ERROR
100001	Error in input message field
100002	Fail translations for LIT circuit
100004	PPD error during self-check sequence
100010	LIT error during self-check sequence
100020	Error found in line data during test
100040	PPD error during test mode setup
100100	Error found in line data during RSV
100200	An excess of 128 failures have been found
100400	A manual request was made on a terminal that was not a line
101000	An excess of 256 failures in selecting paths and TCRs
102000	An abort requested by a TTY or the system
104000	A peripheral error during connect or disconnect
110000	Set junctor failure

yyyy = 0; Error code other than self-check

yyyy = 100010; Self-check error

TABLE E
REPORTED ERROR TYPES

ERROR TYPE	ABBREVIATION	PARAGRAPH
Continuity Failure	CONT	3.128
Ringing Continuity Failure	RC	3.132
False Cross and Ground Failure	FCG	3.134
Network Controller Failure	NWC	3.136
Low Leakage Resistance Error	LLR	3.138
Line Cutoff Failure	LCO	3.140
TOUCH-TONE Receiver Failure	TTR	3.142
MF Receiver Failure	MFR	3.144
False Trunk Origination	FTO	3.146
Permanent Signal Time-Out	PST	3.147
Partial Dial Time-Out	PDT	3.149
MF Transmitter Failure	MFT	3.151
No-Start Dial Error	NSD	3.153
Excessive Dial Pulses Error	EDP	3.155
Automatic Number Identification Start Failure	ANIS	3.157
Coin Line Circuit Failure	CLC	3.159
No-Coin Control Error	NCC	3.161
Stuck-Coin Control Error	SCC	3.163
Restore—Verify Failure	RV	3.165
Line Circuit Restore—Verify Failure	LCRV	3.167
Power Cross Failure	PX	3.169

TABLE F

CIRCUIT TYPES INVOLVED IN AN ERROR TYPE

ERROR TYPE	CIRCUIT TYPE					
	LINE	JUNCTOR	B-LINK	A-LINK	SERVICE CIRCUIT	TRUNK
CONT	X	X	X	X	X	X
RC		X	X	X		
FCG	X	X	X	X	X	X
NWC	X	X	X	X	X	X
LLR	X				X	
LCO	X					
TTR	X				X	
MFR					X	X
FTO						X
PST					X	
PDT					X	
MFT					X	
NSD					X	X
EDP						X
ANIS						X
CLC	X					
NCC	X				X	
SCC	X				X	
RUF	X					
LRVF	X					
PX	X					

TABLE G
NETWORK ORDER DEFINITIONS

ORDER SEQUENCE	PRIMARY ORDER	CUTOFF	1ST STAGE	2ND STAGE	TEST VERTICAL	3RD STAGE
1	OCOX	Open	Open			Open
2	OXYOY		Open	Open		
3	OZ					
4	COX	Close	Open			
5	OCXYOT	Open	Close	Close	Open	Close
6	OXYOT		Open	Close	Open	
7	Z					
8	CXYOT	Close	Close	Close	Open	
9	OXYT		Open	Close	Close	
10	OCXYT	Open	Close	Close	Close	
11	CXYT	Close	Close	Close	Close	
12	Hold OCXYT	Open	Close	Close	Close	
13	Hold CXYT	Close	Close	Close	Close	
14	Hold Z					Close

TABLE H

TRUNK AND LINE TEST PANEL CONTROLLER PROGRESS INDEX TABLE

STATE	IDENTIFIER	FUNCTION
0	TL_IDLE	Access trunk is idle, test for off-hook transition
1	ACDTST	Delay cut through to ACD trunk
2	CNFCONV	Verify connection to third port of conference circuit
3	CONN2TV	Verify connection to two test verticals
4	DATC	Disconnect auxiliary test connection (3 port circuits)
5	DGTINT	Interpret received digits in MTCR
6	DISDRV	Verify disconnect of digit receiver before testing service circuit
7	DISLV	Verify disconnect of line before ringing
8	DTC	Verify disconnect of circuit under test
9	ENDRING	Test for request to remove ringing
10	JCTRDY	TTPI for access trunk terminating junctor test call
11	LCO_VFY	Check completion of line cutoff change
12	LOSTCR	The TCR has disappeared as far as the TLTPC program can tell
13	MONDISC	Monitor the test call for the release of the monitor connection
14	MONREQ	Wait for a request to monitor a traffic busy circuit
15	NTCONN	Verify connection to test access vertical
16	OGTPULS	Wait for trunk outpulsing to complete
17	PDWAIT	Wait for PD group removal or restoral
18	RLS_2TV	Test for disconnect of both test verticals
19	RMVWAIT	Wait for unconditional removal request

TABLE H (Contd)

TRUNK AND LINE TEST PANEL CONTROLLER PROGRESS INDEX TABLE

STATE	IDENTIFIER	FUNCTION
20	SET_CO	Open or close line cutoff contacts
21	STABL	A stable test connection is established
22	TESTCON	Test for disconnect of CDPR an connection to circuit under test
23	TRKDISC	Time 10 seconds, waiting for trunk to go on-hook
24	TSTDCOL	Test TCR for digit collection in progress
25	WTMDISC	Wait for monitoring ACCESS TRUNK to go on-hook after monitored circuit has gone on-hook
26-31	SPAREPI0 -5	Entries designated as SPAREPI0 -5 are spare entries for patching

TABLE I

MESSAGES TRANSMITTED FROM MINI-ROTL TO 3A CC

MESSAGE NAME	ASCII CHARACTERS		DEFINITION
	W	\bar{W}	
ACK	O	∅	Message received and defined
BHM	M	2	Begin monitoring for supervisory hits
CHT	I	6	Connect incoming BALT call to high tone circuit and assume control of BALT call
CRS	C	<	Continuity conditions are set on TUT front end
CTQ	Q	.	Connect BALT trunk (TUT) to tone-and-quiet termination circuit
DGN	G	8	ROTL request is for diagnostic procedures
DRR	D	;	Disconnect incoming ROTL call and reset
HRR	H	7	Report hit detection status for TUT and reset ROTL
RMB	B	=	Trunk make-busy request via responder command
RR	R	-	Reset all ROTL test request connections and parameters
SQZ	L	3	Major sequence error—both units clear everything
SSR	S	, (comma)	Report TUT supervisory state

Note: An 8-bit character is used. The eighth bit, normally used for parity, is always “zero” in the character (W) and always “one” in the complement (\bar{W}).

TABLE J

MESSAGES TRANSMITTED FROM 3A CC to MINI-ROTL

MESSAGE NAME	ASCII CHARACTERS		DEFINITION*
	W	W	
AKK	Ø	O	Message acknowledged.
ASN	9	F	No answer supervision (on-hook) received on TUT.
ASR	8	G	Answer supervision (off-hook) received on TUT.
CSD	^	!	Callback setup denied.
DUM	?	@	Input error (do not understand message.)
GLB		(DC3)	Trunk group MB count at or above the limit.
GSB	s	(FF)	Trunk group MB count greater than zero, less than limit.
GZB	z	(ENQ)	No trunks in group are in MB count.
IDI	5	J	User make-busy ID <i>not</i> currently valid.
IDV)	V	User make-busy ID <i>is</i> currently valid.
MBX	x	(BEL)	Trunk has been made maintenance-busy, limit exceeded.
MBY	m	(DC2)	Trunk has been made maintenance-busy.
MCC	<	C	Message channel is connected.
NPA	7	H	No path available from TUT to TUT port or to tone and quiet circuit.
NXA	\	#	No transmitter available.
NXP	[\$	No transmitter path available.
PND	#	\	TUT port not defined.
PTC	4	K	Place continuity on TUT port.
RCC	-	R	ROTL call is connected.
RCD	;	D	ROTL call is disconnected.
RLM	"]	Request refused because limit has been reached.
RSB	e	(SUB)	Trunk is service busy—request refused.
RTI	k	(DC4)	Trunk is restored to idle.
RTS	c	(FS)	Request refused because of trunk state.
SQX	3	L	Major sequence error—both units clear everything with no wait for acknowledgment.
TCC	+	T	TUT port connection is made.
TCN	a	(RS)	Transient call record not available.
TGD	\$	[Priming trunk group and translations trunk group differ.
THD	6	I	Hit detected on TUT.

TABLE J (Contd)

MESSAGES TRANSMITTED FROM 3A CC to MINI-ROTL

MESSAGE NAME	ASCII CHARACTERS		DEFINITION*
	W	\bar{W}	
THF	' (apos.)	X	TUT connection setup hardware failure.
THN	:	E	No hit detected on TUT.
TMB	b	(GS)	Trunk is in MB count.
TNB	i	(SYN)	Trunk is not in MB count.
TPB	&	Y	TUT port is not available (OOS).
TQB	(W	Tone and quiet circuit not available.
TQC	.	Q	BALT TUT is connected to tone and quiet.
TUN	%	Z	TUT is unseizable (busy, etc).
TUS	, (comma)	S	TUT is seized.

* The Mini-ROTL ignores the parity bit on received characters.

