

**ROTL (REMOTE OFFICE TEST LINE)  
DESCRIPTION AND THEORY OF OPERATION  
3<sup>ESS\*</sup> SWITCH**

	CONTENTS	PAGE		CONTENTS	PAGE
1.	<b>GENERAL</b>	2	E.	Trunk Status Request	8
2.	<b>PHYSICAL DESCRIPTION</b>	3	F.	Security Callback	8
3.	<b>FUNCTIONAL DESCRIPTION</b>	3	G.	<b>BALT (Balance and Long-Term) Tests</b>	9
	<b>INTRODUCTION</b>	3			
	<b>ROTL FEATURES</b>	4		<b>ROTL FUNCTIONS</b>	9
A.	Trunk Transmission Tests	4		<b>ROTL INTERFACES</b>	10
B.	Connection Appraisal Tests	4	A.	Trunk Connections	10
C.	Hit Detection	4	B.	Connection Appraisal	10
D.	Balance Testing	4	C.	Message Channel	10
E.	Remote Trunk Make-Busy and Restore	4		<b>MINI-RTTU INTERFACES</b>	11
	<b>CAROT Control</b>	5	A.	Standard Priming Function	11
	<b>Manual Control</b>	5	B.	Continuous Tone Sequence	11
F.	Security Callback Unlock	5	C.	Near-End Responder	11
G.	Trunk Make-Busy Status Request	5	D.	Return Loss Measurements	11
	<b>ROTL COMMUNICATION</b>	5	E.	Message Channel and Control	12
A.	Test Initiation	6		<b>ROTL SOFTWARE</b>	12
B.	Transmission Tests	6	4.	<b>CALL SETUP SEQUENCES</b>	12
C.	Connection Appraisal Tests	7		<b>INTRODUCTION</b>	12
D.	Trunk Make-Busy and Restoral	7		<b>INCOMING ROTL CALL</b>	12
			A.	Trunk Test Sequence	13
			B.	BALT Test Sequence	14

\* Trademark of AT&T Technologies.

CONTENTS	PAGE
C. Connection Appraisal Test Sequence . . . . .	15
D. Security Callback Sequence . . . . .	15
E. Make-Busy or Restore Sequence . . . . .	15
F. Trunk-Busy Status Request Sequence . . . . .	15
G. Timing, Recycle, and Monitor Functions . . . . .	16
105-TYPE TEST LINE CALL . . . . .	16
5. POWER . . . . .	17
6. MAINTENANCE . . . . .	17
MINI-ROTL DIAGNOSTIC SEQUENCE . . . . .	17
7. ABBREVIATIONS AND ACRONYMS . . . . .	17

**Figures**

1. ROTL Application for Offices Equipped With the 3ESS Switch . . . . .	28
2. Front Panel View of Mini-ROTL . . . . .	29
3. Circuit Pack Locations for Mini-ROTL . . . . .	30
4. Digit Format for ROTL—Test Priming Information . . . . .	31
5. ROTL Functional Diagram . . . . .	32
6. ASCII Character Format . . . . .	33
7. TTY Channel Data Block Message Format . . . . .	34

**Tables**

A. ROTL Features . . . . .	19
B. Division of ROTL Functions Between 3ESS Switch and Mini-ROTL . . . . .	20
C. Messages Transmitted From Mini-ROTL to 3A CC . . . . .	21

CONTENTS	PAGE
D. Data Block Messages Transmitted From Mini-ROTL to 3A CC (DBLK) . . . . .	21
E. Messages Transmitted From 3A CC to Mini-ROTL . . . . .	22
F. Error Messages Returned on Receipt of Ring Forward Signal . . . . .	24
G. Messages Transmitted From Mini-ROTL to Mini-RTTU . . . . .	25
H. Messages Transmitted From Mini-RTTU to Mini-ROTL . . . . .	26
I. Data Block Messages Transmitted From Mini-ROTL to Mini-RTTU . . . . .	27
J. Data Block Messages Transmitted From Mini-RTTU to Mini-ROTL . . . . .	27

**1. GENERAL**

**1.01** This practice describes, in physical and functional terms, the equipment and operation of the ROTL (remote office test line) unit for offices equipped with the 3ESS switch. The functions which the ROTL can provide and the interfaces between ROTL, the 3ESS switch, and the control center are described. A description of the communications sequence and expected responses for each type of ROTL function is also given.

**1.02** This practice is being reissued to add information on the mini-RTTU (mini-remote trunk test unit) interface. Revision arrows are used to emphasize the more significant changes. Equipment test lists are not affected.

**1.03** The ROTL is a feature provided for most types of switching systems. It is used in a trunk maintenance program in conjunction with a CAROT (centralized automatic reporting on trunks) system. The CAROT is a computerized system which automatically controls trunk testing in a number of remote offices simultaneously. The ROTL performs the trunk access and conditioning function in the switching offices. The basic ROTL function is to set up a connection on a specified trunk to a FETL (far-end test line), report call setup progress, and connect

near-end measuring equipment, all under the direction of the CAROT controller (Fig. 1).

**1.04** The ROTL unit may function as a near-end office, a far-end office, or both. As a near-end office, the ROTL can selectively test any outgoing or 2-way trunk in the office. This testing consists of performing transmission tests which are initiated by CAROT and which are configured by the ROTL hardware, the ROTL software in the 3ESS switching office, and the 3ESS switching equipment. ♦ Optionally, local manual control may be exercised by accessing the ROTL on a dialup basis via a local MCI/RCU (manually controlled interrogator/ROTL control unit), a ROTL system test set (H-310-150), or a 92A control unit (Fig. 1). ♦ As a far-end office, ROTL provides two 105-type test line terminations for testing incoming trunks.

♦ **1.05** The ROTL may optionally be associated with a microprocessor-based mini-RTTU (mini-remote trunk test unit) which will perform return loss measurements in conjunction with the ROTL and will perform various line and trunk tests using the ROTL responder or its interface to the trunk and line test panel. ♦

**1.06** The ROTL for offices equipped with the 3ESS switch differs considerably from the traditional equipment configurations for large office ROTLs. All the equipment necessary to support the various test functions is self-contained in a single unit occupying 8 inches of panel space (Fig. 2). The ROTL for offices equipped with the 3ESS switch utilizes a consolidated microprocessor design which combines with the software for the 3ESS switch and the switching equipment to provide the required basic ROTL responder, tone detector, and 105-type terminating test line functions. The microprocessor-based mini-remote office test line hardware package will be referred to in this practice as mini-ROTL.

## 2. PHYSICAL DESCRIPTION

**2.01** Equipment, wiring, and apparatus for the mini-ROTL are concentrated on a single 8-inch panel, to provide a unit 8 inches high and 10 inches deep for mounting in a 23-inch wide frame. Mounting bracket adapters are provided for mount-

ing the unit in a 25-inch wide frame for an ESS switch. Circuit pack locations are shown in Fig. 3.

**2.02** Circuit packs for the mini-ROTL (including two -48 volt dc-to-dc power converters) are contained in three apparatus mounting units: a 98C and a 104C apparatus housing for interconnections of FASTECH\* backplanes and a 58B apparatus mounting for standard edgeboard interconnections. The two -48 volt power converters (208B and 208G power units) are AR-type PWB cards and plug into the 58B apparatus mounting. A -48 volt power fuse panel is provided on the frame in which the mini-ROTL is mounted. An office alarm circuit closure is also provided when the fuse opens. Presence of each of the six operating voltages ( $\pm 5$ ,  $\pm 12$ , and  $\pm 15$ ) is indicated by individual LEDs (light-emitting diodes) contained on the circuit pack adjacent to the 208G power unit. This circuit pack also contains a power ON/OFF switch. The area of the mounting panel above the 58B apparatus mounting contains a miscellaneous jack panel with two EIA (Electronic Industries Association) compatible connectors, two 238A jacks, a 274L holding inductor, and a 761A loudspeaker. Space for future growth of the mini-ROTL is provided in the 98C apparatus housing. ♦ When associated with a mini-RTTU, an additional circuit pack is required (Fig. 3). In addition, the new CPU and memory packs are also required. ♦

## 3. FUNCTIONAL DESCRIPTION

### INTRODUCTION

**3.01** The ROTL is accessible via dialed-up connections. A regular DN (directory number) is assigned as the ROTL access number. The test center (Fig. 1) initiates a test by originating a call to the ROTL office via the DDD (direct distance dialing) network or local switching machine. The call is processed by the central office switching equipment in the same manner as for 100-type and 102-type test lines in offices equipped with the 3ESS switch. After successfully accessing the ROTL, the test center can request a number of different test configurations by sending MF priming as shown in Fig. 4.

\* Registered trademark of AT&T Technologies.

**ROTL FEATURES**

**3.02** The general features (summarized in Table A) provided in the ROTL for the 3ESS switch are as follows:

- (a) Trunk transmission tests to new 100-type (combined milliwatt and balanced termination), 102-type, and 105-type test lines
- (b) Connection appraisal tests to new 100-type, 102-type, and 105-type test lines
- (c) Hit detection during tests to new 100-type and 105-type test lines
- (d) BALT (balance and long-term) test
- (e) Remote trunk make-busy and restore
- (f) Security callback unlock
- (g) Trunk make-busy status request.

**Note:** No provision is made for testing to operational test lines.

**A. Trunk Transmission Tests**

**3.03** The ROTL is capable of making transmission measurements to new 100-type, 102-type, and 105-type far-end transmission test lines. The transmission measuring circuits perform loss and noise measurements and self-checks on an originating and terminating basis in a manner similar to the J94052A (52A) responder. Far-to-near transmission loss and near-end noise measurements are made in conjunction with the new 100-type test line. Only far-to-near loss measurements are made with the 102-type test lines. The 105-type test line provides for 2-way transmission loss and noise measurements, noise with tone, gain slope, and class 5 office return loss sequence measurements.

**3.04** Loss measurements are made of 1004 Hz (0 dBm0) and at 404, 1004, and 2804 Hz (-16 dBm0) with an accuracy of ±0.1 dB. Noise is measured with C-message weighting and also with C-notched weighting in the presence of a -16 dBm0 1004-Hz tone. Accuracy of noise measurements is ±1.0 dB.

**B. Connection Appraisal Tests**

**3.05** The connection appraisal feature provides for conducting a transmission test on a connection set up from the 3ESS switch to the distant test line with normal routing and trunk selection. The directory number of the far-end transmission test line is included in the priming information (described in paragraph 3.13). When priming is complete, an originating line circuit is seized and a test line in a far-end office is dialed up. When the test line is seized, the test sequence proceeds in a manner similar to a routine transmission test.

**C. Hit Detection**

**3.06** During transmission tests to new 100-type or 105-type test lines, the occurrence of supervisory hits is detected and noted, but testing is continued until ROTL receives a recycle command. If a supervisory hit is detected, ROTL returns a 60-IPM (interruptions per minute) low tone in response to the recycle command and waits for a second recycle command. The ROTL then recycles normally.

**D. Balance Testing**

**3.07** The BALT test feature provides those functions required at the originating (outgoing, class 5) office end of a trunk which permit certain manual measurements to be made at the terminating end of the trunk, normally a class 4 office. After the ROTL obtains a connection over the desired trunk to the class 4 office and receives a signal from it, the ROTL provides 10 seconds of 1-kHz tone followed by a quiet termination. This sequence permits a measurement of 1-way loss and the measurement and adjustment of terminal balance in the class 4 office. For the first minute of the quiet termination, the control location may request ROTL recycle or disconnect. After that time, the 3ESS switch connects the incoming ROTL BALT test call to a high-tone trunk until it disconnects. Two simultaneous BALT call connections are permitted, one connected to each of the two quiet termination circuits provided in a 3ESS switch. The second connection can be established after the first minute of quiet termination of the first call.

**E. Remote Trunk Make-Busy and Restore**

**3.08** The ROTL provides a means for making busy and restoring to service the trunks to which it

provides test access. The term "make-busy" means to place the trunk in the "locked-out idle" state. The term "restored" means the trunk has been returned to the "active-idle" state. Only trunks in the "active-idle" state can be remotely placed in the "locked-out idle" state. Only trunks in the "locked-out idle" state can be remotely restored to the "active-idle" state. To prevent unauthorized remote locations from taking trunks out of service, security provisions (paragraph 3.11) require an unlock procedure to enable use of the make-busy and restore function. The make-busy and restore operations may be initiated by CAROT control or by manual control.

#### **CAROT Control**

**3.09** When certain failures are detected by CAROT during the course of routine automatic transmission tests, CAROT may request the ROTL to place that trunk in the maintenance-busy state. A verification that the requested make-busy action has occurred is normally returned to CAROT. If the requested action would cause the allowable number of made-busy trunks in the group to be exceeded, the action is denied by the ROTL and a distinctive indication is returned to CAROT.

#### **Manual Control**

**3.10** In the ROTL, provision is made for trunk make-busy and restoral to service upon request from an authorized manual position as verified by callback (paragraph 3.11). Verification of either make-busy or restoral is returned to the requesting point. Manual requests for make-busy are processed even if the allowable number of made-busy trunks in a group is exceeded. A distinctive indication that this has occurred, however, is returned to the requesting point.

#### **F. Security Callback Unlock**

**3.11** The ROTL provides security against unauthorized use to make trunks busy or restore trunks to service. Prior to attempting to condition a trunk, the test center must request that the ROTL perform a security callback. Upon receipt of a make-busy and restore authorization (security callback) request containing a user identification digit, the ROTL will originate a callback connection. From tables in memory, the 3ESS switch obtains the directory number corresponding to this user, places a DDD call to the user location, and connects the call

to the mini-ROTL for call disposition analysis. The 3ESS switch also remembers if the user is authorized to just reach the make-busy limit in a trunk group or to exceed the limit. The ROTL will not take a make-busy or restore action unless a special unlocking signal is received over this callback connection. Only one security callback routine is required during the time a user is connected to the ROTL.

#### **G. Trunk Make-Busy Status Request**

**3.12** In addition to conditioning trunks, any test center can request the maintenance busy status of either a single trunk or a trunk group. A trunk is considered maintenance busy if it is in any of the following states: locked-out idle, locked-out busy, high and wet, or disabled. A single trunk request is followed by the trunk identity (trunk group and member numbers) and it asks if that trunk is currently available to customer traffic. A group request asks if any trunk in the group is maintenance busy and if so, if there are more trunks made-busy than the automatic maintenance limit permits in the group.

#### **ROTL COMMUNICATION**

**3.13** Communication between the ROTL and the test center involves the transfer of information from the test center to control the ROTL, and the transfer of status information and test results from ROTL to the test center. The ROTL priming information is sent by 2-out-of-6 MF signals and includes the following information:

- (a) Type of test to be made (transmission tests, trunk status request, connection appraisal, etc.)
- (b) Trunk identity
- (c) Terminating test line number.

**3.14** The priming information format for ROTL is shown in Fig. 4. In addition to the MF control signals, a 1300-Hz recycle command signal (1.0 to 1.2 seconds) is also used. Status information sent from ROTL to control to indicate call setup progress includes the following signals:

- (a) 2225-Hz TPT (test progress tone) (0.5 second minimum duration)

- (b) Two-burst TPT (each tone and quiet separation interval of  $520 \pm 80$  ms)
- (c) 60-IPM low tone (busy)
- (d) 120-IPM low tone (reorder).

◆3.15 When equipped, communication between the ROTL and mini-RTTU is through a dedicated current loop interface. Return loss measurement results are passed from RTTU to ROTL, and special tones and responder tests are provided for RTTU by the ROTL. In addition, relays are provided to transfer the ROTL T-R bus and tone bus to the mini-RTTU.◆

#### A. Test Initiation

3.16 In general, signaling begins when the test center is connected to the ROTL. When successfully accessed, the ROTL will return TPT after a minimum delay of 300 ms. Duration of the TPT is 15 seconds on initial ROTL seizure and 0.5 second after ROTL recycle (minimum) or until ROTL is ready to receive priming information. Removal of TPT is an indication to the test center to initiate tests on any trunk that ROTL can access. The test center initiates a test by sending ROTL a stream of MF digits which specifies the required information (Fig. 4). After receiving the priming information, ROTL proceeds to establish the connections required for the requested test.

3.17 Specific responses are required at key points in the call setup process. Trunk measurements are begun only after all of the required connection confirmation signals have been received at the test center. If ROTL returns a signal which indicates that its progress has been blocked, the test center will normally send a recycle signal to ROTL. After ROTL recycles, another test can be requested by the test center. The ROTL testing is terminated when the access trunk between it and control is released. This also causes ROTL to recycle. All measurements from all tests on the TUT (trunk under test) are sent back to the test center in the form of frequency shift data signals. These signals consist of a guard band of 1200 Hz, followed by a data band of 2200 Hz (the duration of which is proportional to the measurement for the TUT), followed by a trailing guard band of 1200 Hz.

#### B. Transmission Tests

3.18 Upon removal of TPT by ROTL, the control location sends priming information (Fig. 4) specifying the test to be performed. The ROTL then returns one of the following information signals as an indication of its success in identifying and seizing the specified trunk for test:

- (a) **TPT (0.5 Second Minimum):** Trunk is seizable.
- (b) **60-IPM Low Tone (4 Seconds):** Trunk cannot be seized, normally because it is busy for some reason.
- (c) **120-IPM Low Tone (4 Seconds):** Request cannot be processed for one of the following reasons:

- (1) Priming information error (ROTL cannot understand the priming)
- (2) TUT port not defined
- (3) TUT port busy.

3.19 If other than TPT is returned by ROTL, the ROTL waits for receipt of a recycle command at the conclusion of that signal. If 120-IPM low tone is returned, the control location may either send a recycle command to cause ROTL to recycle or send a ring-forward command ( $100 \pm 30$  ms of 1300-Hz tone) in response to which ROTL returns a guard-data-guard signal. The length of the data portion specifies the trouble encountered (see Table F). A recycle command from control then resets the ROTL.

3.20 If the trunk is successfully seized, the ROTL proceeds to set up a connection over the trunk to the specified far-end test line. Indications of the disposition of the far-end test line connection attempt returned by ROTL to the control location are as follows:

- (a) **TPT (0.5 Second Minimum):** Far-end test line has been seized. This means TPT has been received from a 105-type test line or 1000 Hz has been received from a 100-type or 102-type test line. For a 105-type test, removal of TPT indicates that the far-end test line responder is connected.

(b) **60-IPM Low Tone:** Far-end test line is busy.

(c) **120-IPM Low Tone:** Reorder received from far-end office or one of the following ROTL call setup failures:

- (1) No path TUT to TUT port
- (2) No transmitter available
- (3) No transmitter path
- (4) TUT connection hardware failure
- (5) Transient call record not available
- (6) TUT port now busy
- (7) TUT unseizable
- (8) Priming and translation trunk groups differ
- (9) Priming digits unintelligible.

**3.21** If other than TPT is returned by ROTL, the ROTL waits for receipt of a recycle command at the conclusion of that signal. If 120-IPM low tone is returned, the control location may either send a recycle command to cause ROTL to recycle or send a ring-forward command (100  $\pm$ 30 ms of 1300-Hz tone) in response to which ROTL returns a guard-data-guard signal. The length of the data portion specifies the trouble encountered (see Table F). A recycle command from control then resets the ROTL.

**3.22** If the far-end test line is successfully seized, the ROTL sends a report on the near-end responder (after a minimum 500 ms quiet period) as follows:

- (a) **TPT (0.5 Second Minimum):** Responder is available and seizure request has been made. Removal of TPT indicates that the near-end responder is connected.
- (b) **120-IPM Low Tone:** Answer supervision has not been received on the TUT.

**3.23** Normally, at the conclusion of transmission tests on a particular trunk, the control location sends a release command to the responder,

which causes the ROTL to recycle. If the control location desires to make the tested trunk busy, it sends a release-and-make-busy command to the responder. If a supervisory hit has been detected, the ROTL will not respond to a release-and-make-busy command and will not make the trunk busy. Upon receipt of a recycle command, the ROTL returns a 60-IPM low tone and waits for a second recycle command.

### C. Connection Appraisal Tests

**3.24** For a connection appraisal test, the ROTL originates a call in a subscriber-like manner, using digits contained in the priming information sent from the control location. The sequence of signals is identical to that for trunk transmission tests with the following variations:

- (a) The "trunk disposition" response becomes the "originating line disposition" response.
- (b) There is no monitoring for supervisory hits.
- (c) The overall connection, instead of a particular trunk, is measured.
- (d) There is no make-busy capability.

### D. Trunk Make-Busy and Restoral

**3.25** When the priming information from the control location specifies a trunk make-busy or restoral function, the ROTL responds with one of the following:

- (a) **TPT (0.5 Second Minimum):** Trunk is now made maintenance busy or maintenance idle (restored).
- (b) **Two-Burst TPT:** Trunk is made maintenance busy and the maintenance-busy limit is now exceeded (response to a manual request only).
- (c) **60-IPM Low Tone:** Request refused for one of the following reasons:
  - (1) Local condition prevents requested action, or
  - (2) Maintenance-busy limit has been reached or exceeded.

(d) **120-IPM Low Tone:** Indicates one of the following conditions:

- (1) Priming information error, or
- (2) Security callback for make-busy authorization has not been made.

**3.26** The trunk make-busy or restoral sequence may also be entered from the transmission test sequence when, at the conclusion of the transmission test, the control location sends a release-and-make-busy command to the near-end responder. The possible ROTL replies are as follows:

- (a) **TPT (0.5 Second Minimum):** Trunk is now maintenance busy.
- (b) **60-IPM Low Tone:** Request refused for one of the following reasons:
  - (1) Local condition prevents requested action, or
  - (2) Maintenance-busy limit has been reached or exceeded.
- (c) **120-IPM Low Tone:** Security callback for make-busy authorization has not been made.
- (d) **Quiet, Then Returns 60-IPM Low Tone for 4 Seconds on Receipt of Recycle Command:** Supervisory hit was detected during transmission test; no action has been taken.

**3.27** In each case, the control location sends a recycle command to enable the ROTL to complete its recycle procedure and return TPT.

#### E. Trunk Status Request

**3.28** When the priming information from the control location specifies a trunk status request, the ROTL is interrogated as to the maintenance-busy status of a specific trunk, or as to the maintenance-busy count status of a trunk group. For an individual trunk, the ROTL responds with one of the following:

- (a) **TPT (0.5 Second Minimum):** The trunk specified is not in the maintenance-busy count.

(b) **60-IPM Low Tone:** The specified trunk is in the maintenance-busy count.

(c) **120-IPM Low Tone:** Priming information error.

**3.29** For a trunk group status request, the ROTL responds with one of the following:

(a) **TPT (0.5 Second Minimum):** No trunks in the specified trunk group are in the maintenance-busy count.

(b) **Two-Burst TPT:** Count of maintenance-busy trunks in the specified trunk group is greater than zero but less than the allowable limit.

(c) **60-IPM Low Tone:** Count of maintenance-busy trunks in the specified trunk group is at or above the limit.

(d) **120-IPM Low Tone:** Priming information error.

#### F. Security Callback

**3.30** When the priming information from the control location requests a security callback (callback unlock request), the ROTL responds with one of the following:

(a) **TPT (0.5 Second Minimum):** ROTL has accepted and is processing the request.

(b) **60-IPM Low Tone:** Caller identification number is not currently valid.

(c) **120-IPM Low Tone:** Priming information error.

**3.31** When the request is accepted, ROTL then originates a call by using the stored callback number corresponding to the caller identifier contained in the priming information. The disposition of this call is reported to the control location as follows:

(a) **TPT (0.5 Second Minimum):** Confirmation signal (1000 Hz) has been received and unlock is completed.

(b) **60-IPM Low Tone:** Callback line is busy at the control location.

(c) **120-IPM Low Tone:** Paths to the callback line at the control location are busy or one of the following conditions:

- (1) TUT port is busy
- (2) TUT port is undefined
- (3) Call setup denied.

**3.32** After receiving a disposition signal, the control location sends a recycle command to the ROTL. The ROTL returns TPT and recycles.

#### G. BALT (Balance and Long-Term) Tests

**3.33** When priming information from the control location specifies a BALT test, the ROTL responds with one of the following:

- (a) **TPT (0.5 Second Minimum):** Trunk has been seized.
- (b) **60-IPM Low Tone:** Trunk is unseizable (usually some form of busy).
- (c) **120-IPM Low Tone:** Request cannot be processed for one of the following reasons:
  - (1) Priming information error
  - (2) TUT port not defined
  - (3) TUT port busy.

**3.34** When the specified trunk has been seized, the ROTL attempts to establish a connection over the designated trunk to the far-end location specified in the priming information and reports the disposition of the attempted call as follows:

- (a) **TPT (0.5 Second Minimum):** 1000-Hz signal received from far-end
- (b) **60-IPM Low Tone:** Far-end is busy
- (c) **120-IPM Low Tone:** Reorder received from far-end office or one of the following ROTL call setup failures:
  - (1) No path TUT to TUT port
  - (2) No transmitter available

(3) No transmitter path

(4) TUT connection hardware failure

(5) Transient call record not available

(6) TUT port now busy

(7) TUT unseizable

(8) Priming and translation trunk groups differ

(9) Priming digits unintelligible.

**3.35** When the call is answered at the far end, the ROTL waits for a 1000-Hz signal (nominally 0 dBm0 for 1 second) from the far end over the TUT as a command to proceed. Upon receipt of the signal from the far end, ROTL applies 1004 Hz at 0 dBm0 for 10 seconds on the TUT, followed by a quiet termination. After the first minute of quiet termination, the ROTL does not accept any commands, including recycle command, over the access connection. A continuous high-tone is returned as an indication of this condition. The TUT connection can be maintained for up to 30 minutes. If ROTL is unable to provide the tone and quiet sequence on receipt of the far-end signal, 120-IPM low tone is returned as an indication of one of the following:

- (a) A tone-and-quiet circuit is not available.
- (b) Answer supervision has not been received on the TUT.
- (c) No path to TUT port.
- (d) TUT connection hardware failure.

#### ROTL FUNCTIONS

**3.36** The ROTL functions required to provide features listed in Table A comprise:

- (a) Those functions implemented in the mini-ROTL circuitry
- (b) Those functions implemented by the ROTL software in the 3ESS switch and by the 3ESS switching equipment.

**3.37** Division of ROTL functions between the two groups is listed in Table B. Interaction of the two functional groups is facilitated by a message channel over which information is exchanged between the mini-ROTL and the 3A CC (central control). This message channel provides the link which joins the mini-ROTL with a part of the software for the 3ESS switch and hardware to form the functional ROTL for the 3ESS switch. A functional block diagram of the ROTL is given in Fig. 5.

#### ROTL INTERFACES

**3.38** A detailed description of the ROTL interfaces is provided in paragraphs 3.39 through 3.45. Interfacing between the 3ESS switch and the mini-ROTL sections of the ROTL (Fig. 5) provide for the following specific functions:

- (a) Trunk connections for transmission tests
- (b) A separate circuit for connection appraisal tests
- (c) A message channel between mini-ROTL and the 3A CC.

#### A. Trunk Connections

**3.39** Separate circuits are provided at the mini-ROTL (Fig. 5) to which the 3ESS switch connects the following:

- Incoming ROTL call
- TUT or security callback call
- Incoming 105-type test line calls.

**3.40** The idle state of circuits for incoming ROTL calls provides resistive continuity of approximately 1500 ohms. When notified that a connection has been made, the mini-ROTL removes the resistive termination. The connection is then generally, though not necessarily always, capacitively coupled. The idle state of the circuit for the TUT or security callback call is an open circuit. When notified that a security callback user ID is valid, mini-ROTL applies a hold coil which remains connected for the remainder of the security callback call. When notified that a TUT connection is about to be made, the mini-ROTL provides resistive continuity of approximately 1500 ohms. When notified that the TUT connection

has (or has not) been made, the mini-ROTL removes the resistive termination and the connection is generally capacitively coupled. Supervision for the TUT connection is provided by the switch portion of the ROTL for the 3ESS switch (Table B). Build-out pads for transmission measurements are provided in the mini-ROTL where required. Incoming 105-type test line calls are connected to the mini-ROTL as a 2-line series completion group arranged for terminating-only service. The mini-ROTL trips ringing and monitors loop current for disconnect. The message channel is not used for incoming 105-type test line calls. No special action by the 3ESS switch is required for 105-type test line calls.

#### B. Connection Appraisal

**3.41** The 3ESS switch provides the mini-ROTL with an outgoing subscriber-type loop (Fig. 5) over which the mini-ROTL can place an outgoing call using dial-pulsing (500-ohms direct current with the loop closed). The idle or on-hook condition is an open circuit. During transmission tests, the mini-ROTL provides a high ac impedance bridge with dc holding.

#### C. Message Channel

**3.42** The message channel (Fig. 5) is a half-duplex standard EIA interface utilizing ASCII (American Standard Code for Information Interchange) characters and connecting to a port on a TTYC (teletypewriter controller). The channel is normally implemented on a shared basis with an existing TTYC operating at 110 baud. To avoid blockages and delays due to competition for TTYC use, however, an additional TTYC exclusively for ROTL usage may be optionally provided. The dedicated arrangement may be optionally specified to operate at 300 baud. The standard EIA/ASCII format between the TTYC and mini-ROTL provides a means of interfacing at that point with a standard terminal for testing the mini-ROTL circuit. Figure 6 specifies the standard 7-bit ASCII code notation.

**3.43** The message channel unites the mini-ROTL with the 3ESS switch sections of the ROTL to form a functional entity. The channel must be initially established by the 3ESS switch. Once the channel is established, messages may be originated by either the mini-ROTL or the 3ESS switch. Most messages exchanged between the mini-ROTL and the 3A CC (via a TTYC) are single-value messages and are

passed as pairs of characters consisting of a character plus its complement. Some messages specifying test requests received by ROTL, as defined in Fig. 4, are sent by mini-ROTL to the 3ESS switch as data blocks. Format of these data blocks is shown in Fig. 7. The actual data bytes are ASCII characters corresponding to the digits received with KP and ST (Fig. 4) deleted. The cyclic redundancy code bytes (CRC1 and CRC2) are computed by the mini-ROTL and sent to the TTYC where they are recomputed. If the computed CRC values are the same as the received ones, it is assumed the message suffered no errors in transmission. If the computed and received CRC values do not agree, it is assumed an error in transmission has occurred, and the message is not acknowledged. Tables C, D, and E define each message by name, ASCII character, and character complement. Table F lists error messages returned on receipt of ring forward signal.

**3.44** The simplified 2-character messages sent from mini-ROTL to the 3A CC (Table C) consist of ASCII characters for capital letters plus their complements (which are numbers and symbols). All of these are printing characters on data terminals. The simplified 2-character messages sent from the 3A CC to mini-ROTL (Table E) consist primarily of numbers and symbols, the complements of which are symbols and capital letters, respectively. A few messages in this category consist of lowercase letters, the complements of which are nonprinting control characters. This arrangement permits use of a data terminal connected to the message channel interface (Fig. 5) for testing purposes.

**3.45** The protocol for message exchange on the message channel is as follows. A 2-character message of acknowledgment is returned by the entity receiving a message which satisfies the complementary relationship. The actual content of data block type messages is examined later by the 3ESS switch as the ROTL sequence proceeds. If a 2-character message which does not have the complementary relationship, or a data block having an unacceptable format, is received, no message is returned. After waiting approximately 2 or 3 seconds for an acknowledgment, the message originator repeats the message. If no response is received within 2 or 3 seconds on the second try, the originator assumes the receiving end is not functioning and executes a disconnect and reset routine.

## ◆MINI-RTTU INTERFACES

**3.46** A detailed description of the mini-RTTU interfaces is provided in paragraphs 3.47 through 3.51. The interface between the ROTL and the mini-RTTU provides for the following specific functions:

- Standard priming function
- Continuous tone sequence
- Near-end responder
- Return loss measurement
- A message and control channel.

### A. Standard Priming Function

**3.47** The mini-RTTU initiates a call over its originating line to the ROTL directory number as per paragraph 3.01. After receipt of TPT, mini-RTTU primes the ROTL in 2-out-of-6 MF tones as indicated in paragraph 3.13. Results of the tests are returned to mini-RTTU as detailed under the ROTL communication section of this practice.

### B. Continuous Tone Sequence

**3.48** If the mini-RTTU requests a continuous tone sequence, the mini-ROTL will send continuous milliwatt at 0 or -16 dBm, gain slope at 404 Hz or 2804 Hz as directed, over the tone bus to the mini-RTTU.

### C. Near-End Responder

**3.49** In this configuration, mini-RTTU seizes the trunk, sends the responder digit, and uses the mini-ROTL responder to obtain test results.

### D. Return Loss Measurements

**3.50** Whenever the mini-ROTL receives a responder digit which requests a return loss measurement or self-check, a request is sent to mini-RTTU over the communication interface. The mini-RTTU does the requested test and returns the results in the data block format to ROTL, which converts the result and passes it to the control.

## E. Message Channel and Control

**3.51** The message channel (Fig. 5) is a current loop interface, operating at 300 baud and utilizing ASCII characters. The communication protocol utilizes the simplified 2-character message format and the data block construction employed in the communication between ROTL and 3A CC. Tables G and H describe the 2-character messages, and Tables I and J describe the data block messages. The control lines are used to give mini-RTTU access to the ROTL tone bus and tip-ring bus for various testing functions.♦

## ROTL SOFTWARE

**3.52** The ROTL software, initially available in the 3E3 Generic, is a resident program. When call processing routines have determined that an incoming call is for the ROTL, control is passed to ROTL program which seizes the message channel, seizes the ROTL terminal appearance, and connects the incoming call to the ROTL terminal appearance. After the connection is established, the ROTL program notifies the mini-ROTL via the message channel and supervises the call for disconnect.

**3.53** Requests for trunk status, trunk make-busy and restoral, connection of ROTL for security callback requests, connection of ROTL to a TUT, and all such related requests are passed from the mini-ROTL via the message channel for execution by the ROTL program. After executing the request, an appropriate reply is passed to the mini-ROTL via the message channel to indicate either successful execution or the reason for failure.

**3.54** Terminating calls to 105-type test lines are handled by normal call processing routines.

**3.55** When a call terminating to the ROTL is released, a holdover timer for the message channel will be initiated to keep the channel available for reseizure of ROTL in a 2-minute interval.

## 4. CALL SETUP SEQUENCES

### INTRODUCTION

**4.01** The sequences for various types of ROTL action are described in this part. In general, an incoming ROTL or 105-type test line call is first established. For an incoming ROTL call (Fig. 5), the mini-ROTL receives and processes the required in-

formation, which is then passed to the 3ESS switch via the message channel. The 3ESS switch takes the required action and returns progress messages to the mini-ROTL. When a trunk is to be tested, the 3ESS switch connects the trunk to the mini-ROTL after successful outpulsing. The mini-ROTL diagnoses the call disposition, returns appropriate responses to control, and conducts measurements as directed by control. The 3ESS switch provides a 2-line series completion group for incoming 105-type test line calls. When the call is connected, mini-ROTL is notified via ringing signal over the seized line.

### INCOMING ROTL CALL

**4.02** A ROTL call begins when the test center originates a call on one of its subscriber loops to the ROTL office. The call is processed with the central office switching equipment in the same manner as a regular call. If the local office is not the ROTL office, the call is routed to the ROTL via the DDD network or local switching. This call enters the ROTL office on an incoming trunk (Fig. 1). If the ROTL is in the local office, the ROTL office connects the proper receiver to the subscriber loop to collect the DN (directory number). At the ROTL office, the digits are collected and translated and control is passed to the ROTL program for processing the call. The call setup sequence then proceeds in the following steps:

- (1) The 3ESS switch detects that an incoming call is for ROTL.
- (2) The 3ESS switch seizes the ROTL test line appearance. Failure to seize the ROTL test line results in the return of a 60-IPM busy tone until the caller disconnects.
- (3) The 3ESS switch activates the TTY channel to the mini-ROTL if it is not already active. If the channel cannot be successfully established, the 3ESS switch returns a 60-IPM busy tone until the caller disconnects.
- (4) The 3ESS switch tests the ROTL front end (Fig. 5) for continuity and connects the call to the ROTL front end. On a failure of continuity or a failure in connection, 3ESS switch returns 120-IPM reorder tone until the caller disconnects and releases the ROTL test line. [Refer to paragraph 4.09 (2).]

- (5) The 3ESS switch informs mini-ROTL via the message channel that a ROTL call is connected.
- (6) The mini-ROTL applies TPT toward control location and begins monitoring for a recycle or drop access trunk command from control. [Refer to parallel process RDMON, paragraph 4.11 (b).]
- (7) The 3ESS switch monitors for incoming ROTL call disconnect [paragraph 4.09 (1)].
- (8) The mini-ROTL continues application of TPT for a minimum of 15 seconds on initial connection, 0.5 seconds on ROTL recycle, and until the ROTL user is granted service.

**Note:** On initial connection, 15 seconds of TPT is returned and continued until the ROTL user is granted service. During the 15-second period, mini-ROTL looks for the presence of a carrier indicating a diagnostic user. Carrier present for 2 seconds causes mini-ROTL to remove TPT and go into the diagnostic mode.

- (9) The mini-ROTL removes TPT and begins an overall 3-minute timeout [paragraph 4.11 (a)].
- (10) The diagnostic sequence is described in paragraph 6.01. If a diagnostic user is not indicated, mini-ROTL receives priming digits from control location on termination of TPT.
- (11) The mini-ROTL checks validity of the priming information. If priming is invalid, mini-ROTL returns 120-IPM reorder tone and waits for a recycle command [paragraph 4.11 (b)].
- (12) The mini-ROTL interprets the priming information to determine if the request is:
  - A connection appraisal request
  - A security callback request
  - A make-busy or restore request
  - A trunk-busy status request
  - An MF receiver test.

A valid request which is not one of the preceding requests is either a normal transmission test or a

BALT test (Fig. 4), and ROTL proceeds with a trunk test sequence.

**4.03** During the progress of the call setup sequence (Steps 1 through 12, paragraph 4.02), both the mini-ROTL and the 3ESS switch are performing parallel processes to provide overall timing and monitoring functions.

#### A. Trunk Test Sequence

**4.04** When an incoming ROTL call is determined to require a trunk test sequence (from Step 12, paragraph 4.02), the setup proceeds in the following steps:

- (1) The mini-ROTL passes the information received in priming digits from the control location to the 3ESS switch via the message channel. This information specifies:

- (a) Normal seizure or override maintenance busy
- (b) Trunk group and member number
- (c) State of the trunk for test (this value currently must be zero, but the digit is reserved for possible future implementation)
- (d) Far-end test line address digits
- (e) Type of request (100-type, 102-type, or 105-type test lines or BALT).

- (2) The 3ESS switch responds with a status message indicating to the mini-ROTL whether the specified trunk is seizable or unseizable, whether the connection can be made to the TUT port, and whether the mini-ROTL is understood. If the trunk is unseizable or if the connection cannot be made, the mini-ROTL returns proper response to control and waits for recycle [paragraph 4.11 (b)].

- (3) When the trunk is seizable, mini-ROTL returns a burst of TPT to control and places continuity on the TUT front end. The 3ESS switch attempts a call setup on the TUT. If outputting facilities are unavailable, the 3ESS switch sends a call setup failure identification message to mini-ROTL and resets. The mini-ROTL returns proper response to control and waits for recycle [paragraph 4.11 (b)].

(4) The 3ESS switch makes continuity checks and attempts to connect the TUT to mini-ROTL for tone detector monitoring of call disposition. If connection to TUT front end is unsuccessful, the 3ESS switch notifies mini-ROTL of connection failure and resets. The mini-ROTL then removes the continuity condition, returns 120-IPM low tone to control, and waits for recycle command [paragraph 4.11 (b)].

(5) The 3ESS switch notifies the mini-ROTL when connection to the TUT front end has been made. The mini-ROTL then removes the TUT front-end continuity condition and determines whether the test is a BALT test or a normal transmission test. The BALT test sequence continues with paragraph 4.05.

(6) The mini-ROTL returns proper tone responses to control, according to tone detector indications. If the far-end connection is not successful, the mini-ROTL waits for a recycle command [paragraph 4.11 (b)].

(7) When the far-end connection is made, the mini-ROTL requests and receives from the 3ESS switch the supervisory state of the TUT. If answer supervision is not received from the far end, the 3ESS switch resets, and mini-ROTL sends proper tone response to control and waits for a recycle command [paragraph 4.11 (b)].

(8) When answer supervision has been received from the far end, mini-ROTL applies a "responder seized" response to control and tells the 3ESS switch to begin monitoring for supervisory hits on the TUT for calls to 100-type and 105-type test lines.

(9) The control location conducts tests using the responder(s) while the mini-ROTL monitors for a responder release or a release-and-make-trunk-busy command [paragraph 4.11(c)].

## B. BALT Test Sequence

**4.05** At a point in the trunk test sequence (Step 5, paragraph 4.04) when the mini-ROTL deter-

mines that the test is a BALT test, the sequence proceeds from that point as follows:

(1) The mini-ROTL returns proper tone responses to control according to tone detector indications and continues to look for a 1-kHz indication.

(2) When the 1-kHz signal is received, mini-ROTL tells the 3ESS switch to connect TUT to a tone/quiet termination.

(3) The 3ESS switch attempts to connect TUT to a tone/quiet termination circuit. If the connection attempt is not successful, or if answer supervision has not been received on the TUT, the 3ESS switch notifies the mini-ROTL, resets and drops the TUT. The mini-ROTL then returns 120-IPM low tone to control and waits for a recycle command [paragraph 4.11 (b)].

(4) The 3ESS switch notifies mini-ROTL of successful connection and begins a 30-minute timeout. The TUT is disconnected on receipt of a recycle command or a disconnect on the ROTL access connection, on loss of answer supervision from the TUT, or at expiration of the 30-minute timeout.

(5) The mini-ROTL begins a 1.2 minute timer and is alert to recycle commands or ROTL call disconnect messages from the 3ESS switch during this interval.

(6) At expiration of the 1.2 minute timeout, the mini-ROTL sends a control-transfer message to the 3ESS switch and resets all ROTL port conditions. The 3ESS switch assumes control of the ROTL call and attempts to connect the call to a high-tone trunk. If connection to the high-tone trunk is not successful, the 3ESS switch sends 120-IPM low tone on the ROTL connection and allows normal call processing to control the connection. This action results finally in disconnect. [Refer to paragraph 4.10 (b).]

(7) When the high-tone trunk connection is made, the 3ESS switch frees the ROTL access port for another incoming ROTL call and continues to monitor the present incoming connection for disconnect. On receipt of disconnect, the associated TUT is also disconnected.

**C. Connection Appraisal Test Sequence**

**4.06** When the incoming ROTL call is determined to be a connection appraisal request (from Step 12, paragraph 4.02), the incoming ROTL call setup proceeds in the following steps:

- (1) The 3ESS switch performs only caller disconnect (ROTL) detection during this type of test.
- (2) The mini-ROTL originates a call on an originating line just as a normal subscriber (by going off-hook and dial pulsing). The 3ESS switch handles this as a normal call.
- (3) The mini-ROTL performs connection appraisal tests without additional action by the 3ESS switch.
- (4) The mini-ROTL terminates the call by going on-hook on the originating line in response to a recycle command from the control location [paragraph 4.11 (b)].

**D. Security Callback Sequence**

**4.07** When the incoming ROTL call is determined to be a security callback request (from Step 12, paragraph 4.02), the incoming ROTL call setup proceeds as follows:

- (1) The mini-ROTL informs the 3ESS switch that it has a security callback request and specifies the caller identification digit.
- (2) The 3ESS switch checks the current validity of the caller identification digit. If the digit is not currently valid, the 3ESS switch informs the mini-ROTL. The mini-ROTL returns 60-IPM low tone to control and waits for a recycle command [paragraph 4.11 (b)].
- (3) The 3ESS switch marks the current ROTL user as authorized to reach or to exceed a trunk group maintenance-busy limit and retains this mark until the ROTL user disconnects.
- (4) The 3ESS switch informs mini-ROTL that the caller identification is valid and mini-ROTL returns a burst of TPT to control.

(5) The mini-ROTL places the hold coil across the TUT port and notifies the 3ESS switch that continuity conditions are established.

(6) The mini-ROTL enables the tone detector to monitor the callback call disposition.

(7) The 3ESS switch looks up a directory number corresponding to the caller identification digit and attempts to originate a call to that number.

(8) The mini-ROTL monitors disposition of the callback call, sends appropriate responses to the control location, and waits for a recycle command [paragraph 4.11 (b)].

**E. Make-Busy or Restore Sequence**

**4.08** When the incoming ROTL call is determined to be a make-busy or restore request (from Step 12, paragraph 4.02), the call setup proceeds as follows:

- (1) The mini-ROTL determines whether make-busy authorization has been established via a security callback call during the time the using control location has been connected to the ROTL. If authorization has not been established, the mini-ROTL sends 120-IPM low tone to the control location and waits for a recycle command [paragraph 4.11 (b)].
- (2) If authorization has been established, mini-ROTL passes the trunk identification and the action request (make trunk busy or restore trunk) to the 3ESS switch.
- (3) The 3ESS switch takes appropriate action, returns a disposition message to the mini-ROTL, and resets.
- (4) The mini-ROTL returns a proper tone response to the control location and waits for a recycle command [paragraph 4.11 (b)].

**F. Trunk-Busy Status Request Sequence**

**4.09** When the incoming ROTL call is determined to be a trunk-busy status request (from Step

12, paragraph 4.02), the call setup proceeds as follows:

- (1) The mini-ROTL informs the 3ESS switch that this is a status request for a trunk or trunk group and passes the trunk or trunk group identification.
- (2) The 3ESS switch passes the requested trunk status information to the mini-ROTL and resets.
- (3) The mini-ROTL sends a proper tone response to the control location and waits for a recycle command [paragraph 4.11 (b)].

#### G. Timing, Recycle, and Monitor Functions

**4.10** During the progress of an incoming ROTL call, the ROTL for the 3ESS switch performs various timing and monitoring functions for each phase of the call setup sequence. Those functions provided by the 3ESS switch are as follows:

- (a) **ROTL Disconnect Monitor (RDM):** The 3ESS switch monitors the incoming ROTL call for disconnect. When disconnect occurs, the 3ESS switch sends a disconnect message to the mini-ROTL and mini-ROTL resets all ROTL port conditions.
- (b) **Disconnect Timeout (HOLD):** When a ROTL call disconnect occurs, the 3ESS switch begins a 2-minute timeout before releasing the TTY channel. If another ROTL call comes in, the 2-minute timer is cleared and a new call setup sequence begins. If the 2-minute timeout occurs before another incoming ROTL call, the 3ESS switch clears the timer and releases the TTY channel.

**4.11** During the call setup progress of an incoming ROTL call and the subsequent tests conducted by the control location, the mini-ROTL performs timing and monitor functions as follows:

- (a) **Mini-ROTL Overall Timeout (TIME):** Beginning with removal of TPT when a user is granted service (Step 9, paragraph 4.02), the mini-ROTL initiates an overall 3-minute timeout for completion of the call setup and all testing on that particular test connection.

(b) **Recycle or Drop Access Trunk Monitor (RDMON):** Beginning with application of TPT (Step 6, paragraph 4.02) when an incoming ROTL call is connected to the ROTL front end, the mini-ROTL monitors for receipt of a command to recycle (RCY) or to drop the access trunk (DAT).

(c) **Monitor for Responder Release or Release-and-Make-Trunk-Busy (RLMB) Command:** While the control location conducts tests during a trunk test sequence (Step 9, paragraph 4.03), the mini-ROTL monitors for a responder release command or a release-and-make-trunk-busy command. Receipt of a release command results in a normal recycle routine. On receipt of an authorized release and make busy command, where no hits have been detected during a 100-type or 105-type test, the sequence proceeds as in Steps 2 through 4, paragraph 4.08.

#### 105-TYPE TEST LINE CALL

**4.12** Incoming 105-type test line calls to ROTLs in offices equipped with the 3ESS switch are handled by normal call processing routines. Two simultaneous call conditions are possible with 2225-Hz test progress tone returned until a call is granted responder service. A call progresses in the following sequence:

- (1) The 3ESS switch receives an incoming call to a 105-type test line number and applies ringing signal on tip and ring toward the mini-ROTL.
- (2) The mini-ROTL trips ringing and begins to monitor loop current.
- (3) The 3ESS switch then begins a monitor for the incoming 105-type test line call disconnect.
- (4) The mini-ROTL returns TPT for a minimum of 1.0 second, until the responder is connected.
- (5) Upon termination of the TPT, the 105-type test line is used to perform the required tests while the mini-ROTL monitors for either a responder release command, the lack of an MF command during an 18-second responder idle period, or the absence of loop current.
- (6) When either a responder release command has been received or the responder has been idle for 18 seconds without a command, the mini-ROTL

drops the connection on this test line by opening the loop to 3ESS switch.

(7) The mini-ROTL then resets all conditions on this test line front end and assigns the responder to the next user.

## 5. POWER

**5.01** Power is provided for the mini-ROTL via two -48 volt dc-to-dc power converters. The two power converters, types 208B and 208G, are powered from the -48 volt office supply via a single fuse. Circuit packs in the mini-ROTL are supplied with six operating voltages from the -48 volt converters. These are: +5 volts, -5 volts, +12 volts, -12 volts, +15 volts, and -15 volts.

## 6. MAINTENANCE

### MINI-ROTL DIAGNOSTIC SEQUENCE

**6.01** The ROTL for offices equipped with the 3ESS switch is provided with a feature which allows testing the internal working of the mini-ROTL from a data terminal on a dialup or directly connected basis. After the 3ESS switch connects an incoming ROTL call to the mini-ROTL and the mini-ROTL detects that it is a diagnostic request, the mini-ROTL notifies the 3ESS switch. The 3ESS switch in turn makes the two 105-type test lines busy to incoming traffic until the diagnostic user disconnects. If a 105-type test line call is parked at the time of the diagnostic request, the 3ESS switch waits for the call to disconnect and then makes it busy to incoming calls. This procedure is followed because the mini-ROTL cannot independently service 105-type test line calls during a diagnostic sequence. Because a dialup diagnostic request is not recognized until ROTL is given active service, testing on an active 105-type test line would be concluded before the 3ESS switch is notified of a ROTL diagnostic request. A connector is also located on the mini-ROTL (Fig. 5) which allows direct connection of a data terminal using an EIA interface for exercising the mini-ROTL diagnostic sequence. A direct-connection diagnostic request is recognized only when there are no incoming calls connected (ROTL or 105-type test line). The mini-ROTL dialup

diagnostic sequence proceeds (from Step 9, paragraph 4.02) in the following steps:

- (1) The mini-ROTL begins monitoring for continued presence of the carrier and tells the 3ESS switch that this is a diagnostic user.
- (2) The 3ESS switch makes the two 105-type test lines busy to incoming traffic (if idle); and disconnects existing calls and makes the lines busy when they disconnect (if in service). No message is sent to the mini-ROTL at this point. The 3ESS switch proceeds to the HOLD timeout sequence [paragraph 4.10 (b)].
- (3) The mini-ROTL enters a diagnostic mode and expects no communication from the 3ESS switch.
- (4) Upon receipt of a disconnect, the 3ESS switch restores the 105-type test lines to service and resets.
- (5) On loss of diagnostic user carrier, the mini-ROTL resets the ROTL port.

**6.02** A check of the mini-ROTL MF receiver can be made from a manual control device by sending the MF digit string shown for "MF Receiver Test" in Fig. 4. If the digits are received successfully, a burst of TPT is returned. If the digits are not received successfully, a burst of 120-IPM low tone is returned.

## 7. ABBREVIATIONS AND ACRONYMS

**7.01** The following terms and definitions are used in this practice:

TERMS	DEFINITIONS
ASCII	American Standard Code for Information Interchange
BALT	Balance and long-term test
CAROT	Centralized Automatic Reporting on Trunks
CPU	Central processing unit
DDD	Direct distance dialing
DGCAR	Diagnostic carrier

TERMS	DEFINITIONS	TERMS	DEFINITIONS
DN	Directory number	RCU	ROTL control unit
EIA	Electronic Industries Association	RDM	ROTL disconnect monitor
FETL	Far-end test line	ROTL	Remote Office Test Line
IPM	Interruptions per minute	TPT	Test progress tone
LED	Light-emitting diode	TTYC	Teletypewriter controller
MB	Make-busy	TUT	Trunk under test
MF	Multifrequency		
MCI	Manually controlled interrogator	0 dBm0	The signal level which produces a 1-milliwatt (0 dBm) power level at a zero transmission level reference point (0 TLP)
Mini-ROTL	Microprocessor-based remote office test line		
Mini-RTTU	Microprocessor-based remote trunk test unit	3A CC	3A central control.

♦TABLE A♦

## ESS ROTL FEATURES

FEATURE	MEASUREMENT CAPABILITY/DESCRIPTION
Trunk Transmission Tests	New 100-Type Test Line — Far-to-near 1-kHz loss. — Near-end noise. 102-Type Test Line — Far-to-near 1-kHz loss. 105-Type Test Line — Two-way 1-kHz loss (0 dBm0). — Two-way noise. — Noise with tone. — Gain slope (–16 dBm0 loss at 404 Hz, 1004 Hz, and 2804 Hz). — Class 5 office return loss sequence.* — Echo return loss. — Singing return loss. — Singing return loss-HI.**
Connection Appraisal Tests	New 100-Type Test Line — Far-to-near 1-kHz loss. — Near-end noise. 102-Type Test Line — Far-to-near 1-kHz loss. 105-Type Test Line — Two-way 1-kHz loss (0 dBm0). — Two-way noise. — Noise with tone. — Gain slope (–16 dBm0 loss at 404 Hz, 1004 Hz, and 2804 Hz). — Class 5 office return loss sequence.* — Echo return loss. — Singing return loss. — Singing return loss-HI.**
Hit Detection	ROTL monitors for a change in far-end trunk supervision from off-hook to on-hook during tests on outgoing or 2-way trunks to new 100-type and 105-type test lines.
BALT Test	Provides a sequenced 1-kHz tone and quiet termination.
Remote Trunk Make-Busy and Restore	“Made-busy” means the trunk is in the remote maintenance busy condition. “Restored” means the remote maintenance busy condition has been removed from the trunk.
Security Callback Unlock	Provides security against unauthorized use to make trunks busy or restore trunks to service.
Trunk Make-Busy Status Request	Determines the maintenance busy status of a specific trunk, or the maintenance busy count status of a specific trunk group.
<p>*This sequence provides the termination and dialogue required to permit return loss measurements to be conducted by a responder equipped with the return loss measurement option at the other end of the trunk under test. The mini-ROTL performs no actual return loss measurements but instead returns a minimum data measurement signal at the appropriate time.</p> <p>**When mini-RTTU is provided, the full return loss sequence is implemented.</p>	

TABLE B

## DIVISION OF ROTL FUNCTIONS BETWEEN 3ESS SWITCH AND MINI-ROTL

***Functions of 3ESS Switch***

- (a) Provides all call switching functions including trunk under test (TUT) seizure
- (b) Provides all supervisory functions on both incoming and outgoing connections including indication or notification of disconnect
- (c) Establishes message channel
- (d) Provides tones and termination circuit for TUT and high-tone termination for incoming ROTL call during BALT sequence
- (e) Performs security callback using stored directory number identified by single-user digit
- (f) Performs trunk make-busy and restore operation
- (g) Provides 2-line terminating hunt group for incoming 105-type test line calls
- (h) Monitors TUT for supervisory hits on tests to 100-type and 105-type test lines.

***Functions of Mini-ROTL***

- (a) Provides continuity conditions for switch connections
- (b) Receives and decodes MF priming from control
- (c) Receives recycle and disconnect commands from control
- (d) Provides tone detector function for call disposition reporting
- (e) Reports test sequence progress and call disposition to control location
- (f) Provides test progress tone for calls terminated and waiting to be served
- (g) Performs subscriber line call origination functions for connection appraisal
- (h) Performs subscriber line call terminating functions for incoming 105-type test line calls
- (i) Provides diagnostic program for testing itself
- (j) Provides the basic measurement functions in the same format as the 52-type responder.

TABLE C			
MESSAGES TRANSMITTED FROM MINI-ROTL TO 3A CC			
MESSAGE NAME	ASCII CHARACTERS		DEFINITION
	W	W	
ACK	O	Ø	Message received and defined
BHM	M	2	Begins monitoring for supervisory hits
CHT	I	6	Connects incoming BALT call to high-tone circuit and assume control of BALT call
CRS	C	<	Continuity conditions set on TUT front end
CTQ	Q	.	Connects BALT trunk (TUT) to tone-and-quiet termination circuit
DGN	G	8	ROTL request is for diagnostic procedures
DRR	D	;	Disconnects incoming ROTL call and reset
HRR	H	7	Reports hit detection status for TUT and resets ROTL
RMB	B	=	Trunk make-busy request via responder command
RR	R	-	Resets all ROTL test request connections and parameters
SQZ	L	3	Major sequence error—both units clear everything
SSR	S	, (comma)	Reports 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 (W).

TABLE D		
DATA BLOCK MESSAGES TRANSMITTED FROM MINI-ROTL TO 3A CC (DBLK)		
MESSAGE NAME	ASCII CHARACTERS	DEFINITION
MBT	[Data bytes (Fig. 7) consist of ASCII characters corresponding to the digits received (Fig. 4) with KP and ST deleted.]	Trunk make-busy or restore request (trunk data)
SCB		Security callback request (caller ID)
STT		Trunk busy status request (trunk data)
TTT		Trunk test (test data)

**TABLE E**  
**MESSAGES TRANSMITTED FROM 3A CC TO MINI-ROTL**

MESSAGE NAME	ASCII CHARACTERS		DEFINITION (NOTE)
	W	W	
AKK	∅	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 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	Places 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.
THD	6	I	Hit detected on TUT.
TGD	\$	[	Priming trunk group and translations trunk group differ.

**Note:** The mini-ROTL ignores the parity bit on received characters.

TABLE E (Contd)			
MESSAGES TRANSMITTED FROM 3A CC TO MINI-ROTL			
MESSAGE NAME	ASCII CHARACTERS		DEFINITION (NOTE)
	W	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.

**Note:** The mini-ROTL ignores the parity bit on received characters.

TABLE F

## ERROR MESSAGES RETURNED ON RECEIPT OF RING FORWARD SIGNAL

DATA BURST (ms)	NOISE MEASUREMENT VALUE (NOTE)	MESSAGE NAME	DEFINITION
9	18	—	No additional information.
17	22	DUM	Input error (do not understand message).
25	26	WTR	Wrong tone received.
33	30	TUN	TUT is unseizable (busy, etc).
41	34	TPB	TUT port is not available.
49	38	NPA	No path available to TUT port or tone/quiet circuit.
57	42	NXA	No transmitter available.
65	46	NXP	No transmitter path available.
73	50	THF	TUT connection setup hardware failure.
81	54	TQB	Tone and quiet circuit not available.
89	58	ASN	No answer supervision received on TUT.
97	62	PND	TUT port not defined.
105	66	RTS	Request refused because of trunk state.
113	70	TCN	Transient call record not available.
121	74	RSB	Request refused—trunk is service busy.
129	78	NCB	No security callback successfully completed.
137	82	RLM	Refused because busy limit has been reached.
145	86	CSD	Callback setup denied.
153	90	TGD	Priming and translation trunk groups differ.

**Note:** A manual control device can obtain these error messages by sending a “near-end noise measurement request—small ROTL” and receiving these displayed values.

TABLE G			
MESSAGES TRANSMITTED FROM MINI-ROTL TO MINI-RTTU			
MESSAGE NAME	ASCII CHARACTERS		DEFINITION
	W	W	
AKK ATN DUM	O D @	Ø ; ?	Message acknowledged Open channel Do not understand
ER6 SR6 SH6 ER9 SR9 SH9	B C A F G E	= < > 9 8 :	Request for return loss measurement near end Echo return loss — 600Ω Singing return loss — 600Ω Singing-high return loss — 600Ω Echo return loss — 900Ω Singing return loss — 900Ω Singing-high return loss — 900Ω
ESC SCC SHC	R S Q	-- ; .	Request for self-check Echo return loss Singing return loss Singing-high return loss
FE6 FR6 FH6 FE9 FR9 FH9 DAT	J K I N L M Z X	5 4 6 1 3 2 % '	Request for return loss measurement far end Echo return loss — 600Ω Singing return loss — 600Ω Singing-high return loss — 600Ω Echo return loss — 900Ω Singing return loss — 900Ω Singing-high return loss — 900Ω Drop access trunk — unacknowledged

♦TABLE H♦			
MESSAGES TRANSMITTED FROM MINI-RTTU TO MINI-ROTL			
MESSAGE NAME	ASCII CHARACTERS		DEFINITION
	W	W	
ACK	Ø	O	Message acknowledged
CTON	<	C	Continuous tone sequence
GS2	5	J	Sends gain slope 404 Hz
GS4	2	M	Sends gain slope 2804 Hz
MLØ	4	K	Sends milliwatt 0 dBm
ML16	3	L	Sends milliwatt -16 dBm
NRP	;	D	Near-end responder sequence
RCT	+	T	Recycles overall timer
RCY	-	R	Common recycle
STP	>	A	Standard priming sequence
VER	9	F	Version request
XCT	X	'	Execute command

♦TABLE I♦		
DATA BLOCK MESSAGES TRANSMITTED FROM MINI-ROTL TO MINI-RTTU		
MESSAGE NAME	ASCII CHARACTERS	DEFINITION
VER	Data bytes (Fig. 7) consist of micro-code version and issue of firmware	Interrogation of mini-ROTL current firmware version

♦TABLE J♦		
DATA BLOCK MESSAGES TRANSMITTED FROM MINI-RTTU TO MINI-ROTL		
MESSAGE NAME	ASCII CHARACTERS	DEFINITION
RLS	Data bytes (Fig. 7) consist of tens and units value of return loss measurement	Mini-RTTU sends measurement results in milliseconds

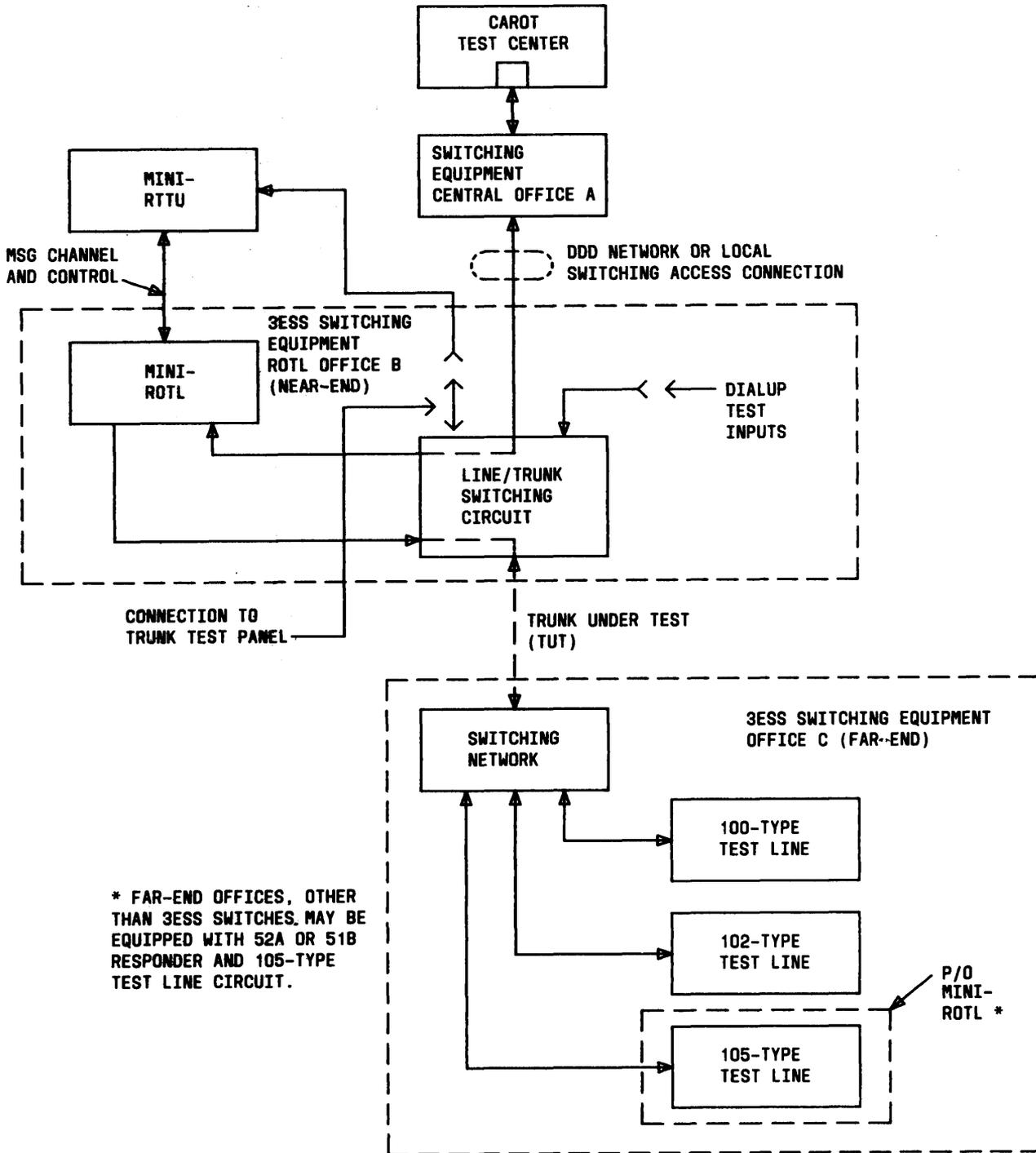


Fig. 1—ROTL Application for Offices Equipped With the 3ESS Switch

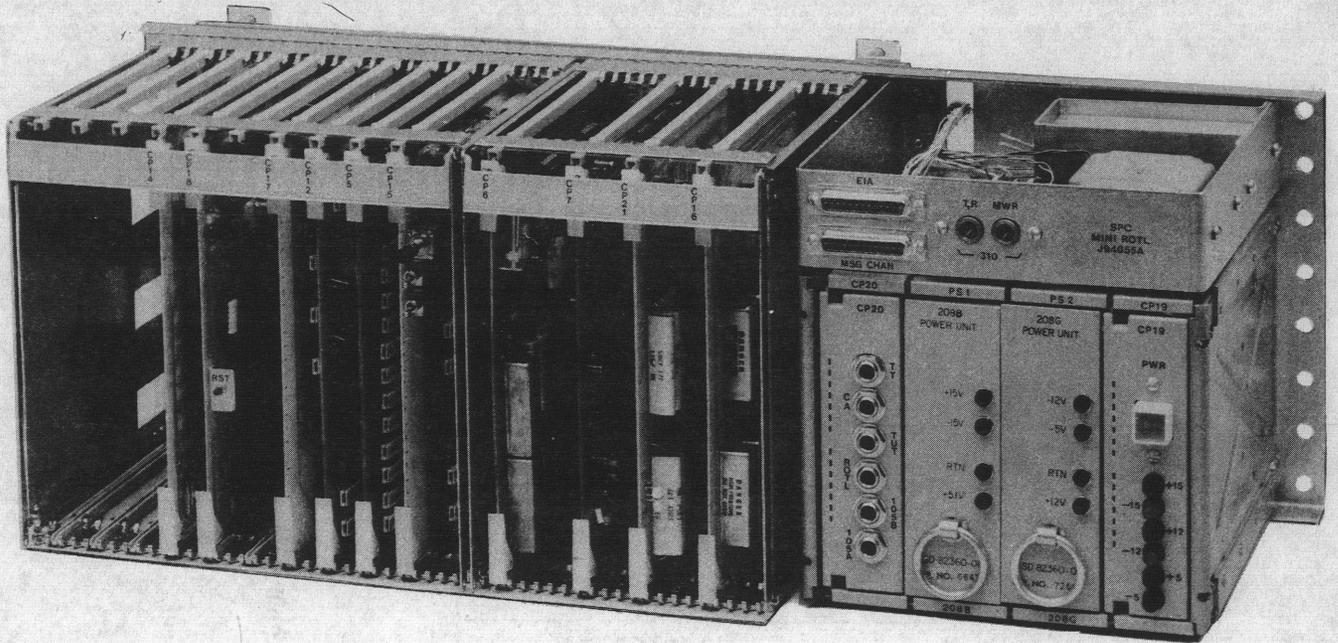


Fig. 2—Front Panel View of Mini-ROTL

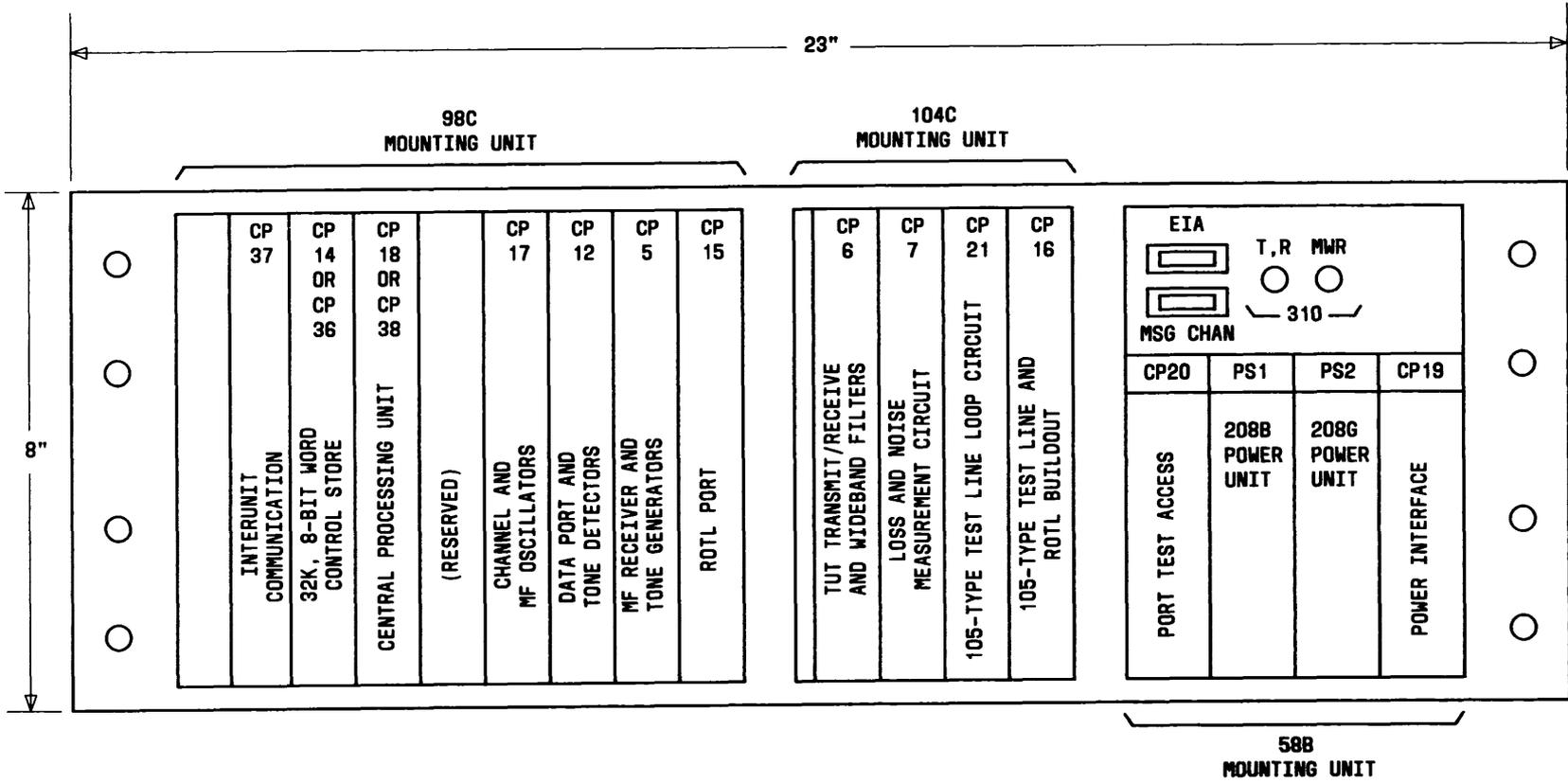


Fig. 3—Circuit Pack Locations for Mini-ROTL

ROTL USAGE				DIGITS TRANSMITTED TO ROTL MF RECEIVER																				
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
TRANSMISSION TESTS	100-TYPE	KP	0	0	* T R U N K  S T A T E	GROUP NUMBER	MEMBER NUMBER	[ FAR-END TEST LINE NUMBER (11 DIGITS MAX) ] [ST]																
		KP	0	2																				
		KP	0	5																				
	OVERRIDE MADE BUSY	100-TYPE	KP	1																			0	
		102-TYPE	KP	1																			2	
		105-TYPE	KP	1																			5	
BALANCE AND LONG-TERM TESTS		KP	4	0																				
	OVERRIDE MADE-BUSY	KP	4	1																				
MAKE BUSY & RESTORE	MAKE TRK REMOTE BUSY	KP	5	0																				
	RESTORE TRUNK REM BUSY	KP	5	1																				
TRUNK STATUS REQUEST	INDIVIDUAL TRUNK	KP	5	2																				
	TRUNK GROUP BY TRUNK	KP	5	3																				
	TRUNK GROUP BY GROUP	KP	5	4																				
CALLBACK UNLOCK REQUEST		KP	5	5	ID	ST																		
CONNECTION APPRAISAL	100-TYPE	KP	6	0	[ FAR-END TEST LINE PROBE NUMBER ] [ST] (12 DIGITS MAX)																			
	102-TYPE	KP	6	2																				
	105-TYPE	KP	6	5																				
MF RECEIVER TEST		KP	7	6	1	2	3	4	5	6	7	8	9	0	ST									
* 0 = LOCAL (CURRENT REQUIRED VALUE) 1 = BYPASS (RESERVED BUT NOT IMPLEMENTED)																								

Fig. 4—Digit Format for ROTL—Test Priming Information

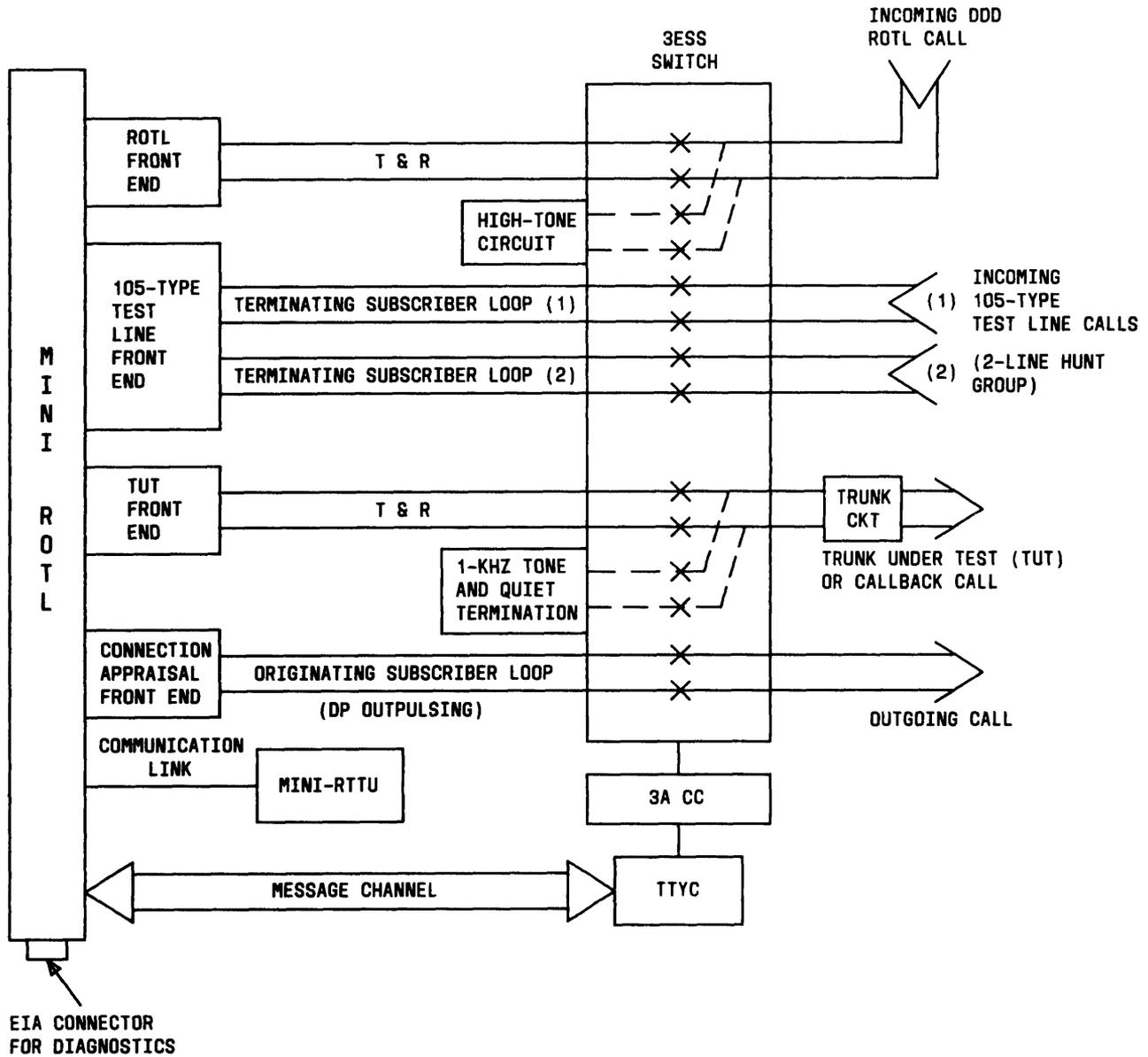


Fig. 5—ROTL Functional Diagram

Most Significant Digit		Least Significant Digit																
		Row	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
		Column	bits 4321	bits 8765														
0	*P000	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI	
1	*P001	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US	
2	*P010	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/	
3	*P011	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	
4	*P100	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
5	*P101	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_	
6	*P110	\	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	
7	*P111	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL	

**NOTES:**

- \*P = EVEN PARITY BIT. VALUE DEPENDS ON OTHER BITS. P = 1 IF SUM OF OTHER BITS IS ODD, IF PARITY IS NOT USED, P = 1 ALWAYS.
- HANDWRITTEN SEQUENCE OF BITS:
 

MSB	LSB	
P	7 6 5 4 3 2 1	(MINI-ROTL TRANSMITTED CHARACTERS USE P = 0 EXCEPT FOR CHARACTER COMPLEMENTS WHERE P = 1)
- TRANSMITTED SEQUENCE (8/11 CODE):
 

LSB	MSBP	
START	1 2 3 4 5 6 7 8	STOP STOP

▶ TIME
- LOGIC 0 = "SPACE", LOGIC 1 = "MARK"
- THE FOLLOWING CONTROL CODES ("FUNCTION" CODES) ARE OPERABLE ON MOST TELETYPEWRITER MODELS:  
 CR CARRIAGE RETURN LF LINE FEED HT HORIZONTAL TAB VT VERTICAL TAB BEL SIGNAL BELL

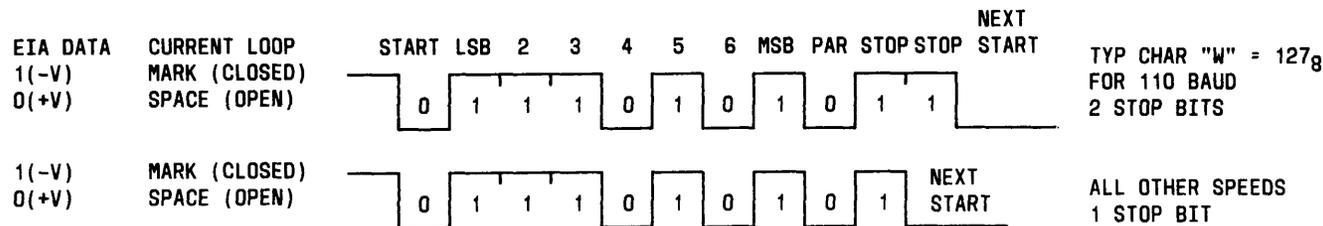
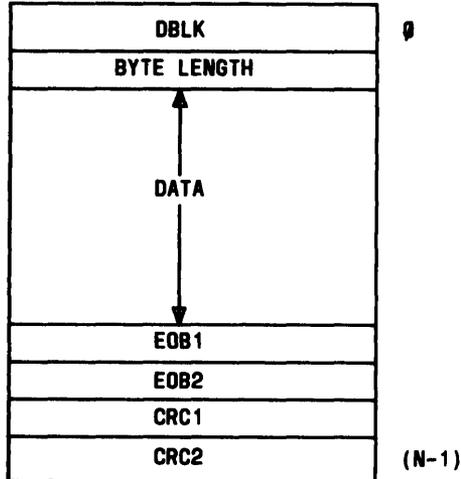


Fig. 6—ASCII Character Format (Notes)



DATA TERMINAL PRINTOUT OF DATA BLOCK MESSAGE APPEARS AS FOLLOWS:

$f$  (BYTE LENGTH)<sup>†</sup> [PRIMING DIGITS] (NUL)\* (RS)\* (CRC 1)<sup>†</sup> CRC 2)<sup>†</sup>

DBLK           = 66 (HEX) - ASCII  $f$

BYTE LENGTH =  $\sim$            - AN 8-BIT BINARY NUMBER SPECIFYING NUMBER OF DATA CHARACTERS PLUS 6 (MAXIMUM 68 BYTES) (MAXIMUM 26 BYTES FOR MINI-ROTL)

DATA           - 7-BIT ASCII VALUES FOR NUMERICAL PRIMING DIGITS WITH PARITY BIT ALWAYS ZERO

EOB1           = 0           - ASCII (NUL)

EOB2           = 1E (HEX) - ASCII (RS)

CRC1           = CYCLIC REDUNDANCY CODE - LOW BYTE

CRC2           = CYCLIC REDUNDANCY CODE - HIGH BYTE

\* INDICATES NONPRINTING CHARACTER  
 † MAY BE PRINTING OR NONPRINTING CHARACTER

Fig. 7—TTY Channel Data Block Message Format