REMOTE OFFICE TEST LINE (ROTL)

DESCRIPTION

NO. 2 ELECTRONIC SWITCHING SYSTEM

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

1.01 This section describes the functions and equipment of the remote office test line (ROTL) for the No. 2 Electronic Switching System (ESS).

1.02 This section is reissued to incorporate corrections to Issue 1.

1.03 ROTL is a feature that allows interoffice trunk testing automatically from a centralized automatic reporting on trunks (CAROT) system. The CAROT system is a computerized system that automatically accesses and tests trunks in up to 14 offices simultaneously. Manual trunk testing may be performed locally or remotely using a manually controlled interrogator and ROTL control unit equipment combination (MCI/RCU) (Fig. 1) or a ROTL system test set (H-310-150) (Fig. 2).

1.04 The No. 2 ESS can function as a near-end office, a far-end office or both. The equipment necessary to support the different office functions is mounted on a single frame.

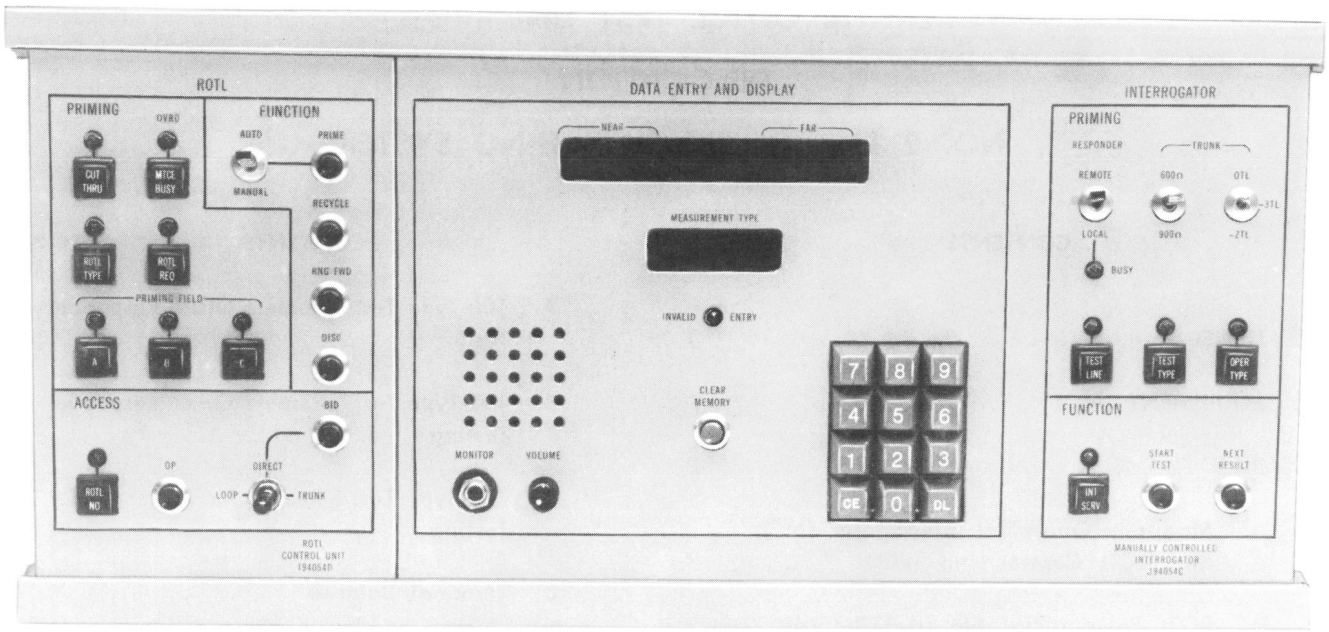

Fig. 1—RCU and MCI Control Panel

1.05 The basic arrangement of the ROTL appearance is seen as dual input appearances. The arrangement has two ROTL ports (port 0 & port 1) served by the same directory number. A rotary selection routine selects an idle ROTL port dependant upon the last port released. The dual inputs are served alternately.

1.06 The near-end office receives information from a local or remote MCI/RCU, ROTL System Test set, or remote CAROT system. This information indicates the type of test, the identity of the trunk to be tested, and the directory number of the far-end test line.

1.07 The type of tests which can be made by ROTL are:

(a) Automatic and manual tests to a 100-type test line (1000 Hz followed by quiet termination)

(b) Automatic and manual tests to a 102-type test line (1000 Hz)

(c) Responder to responder testing to a 105-type test line.

Note: The EF-1 or later generic program must be installed in a No. 2 ESS office to obtain the near-end feature. Also, translation changes are required for the ROTL feature. The far-end operation can be obtained with any generic program.

All measurement results from all tests on the trunk under test (TUT) are sent back to the test center in the form of frequency-shift data signals: guard band of 1200 Hz, data 2200 Hz (the duration of the data signal being proportional to the measurement for the TUT), and a final trailing guard band of 1200 Hz.

1.08 The ROTL frame provides for transmission testing via a 52A responder in the remote (near-end) office. The 52A responder unit in the ROTL frame performs the measurements at the near-end office via multifrequency (MF) commands from the test center. The responder relays the data (measurements on the tested trunk) to the test center. Tests can be requested to far-end 100-, 102-, and 105-type test lines from a test center external to the ROTL office or from a MCI/RCU or H-310-150 test set within the ROTL office. An arrangement for testing from a test center accessing a ROTL office and testing to a

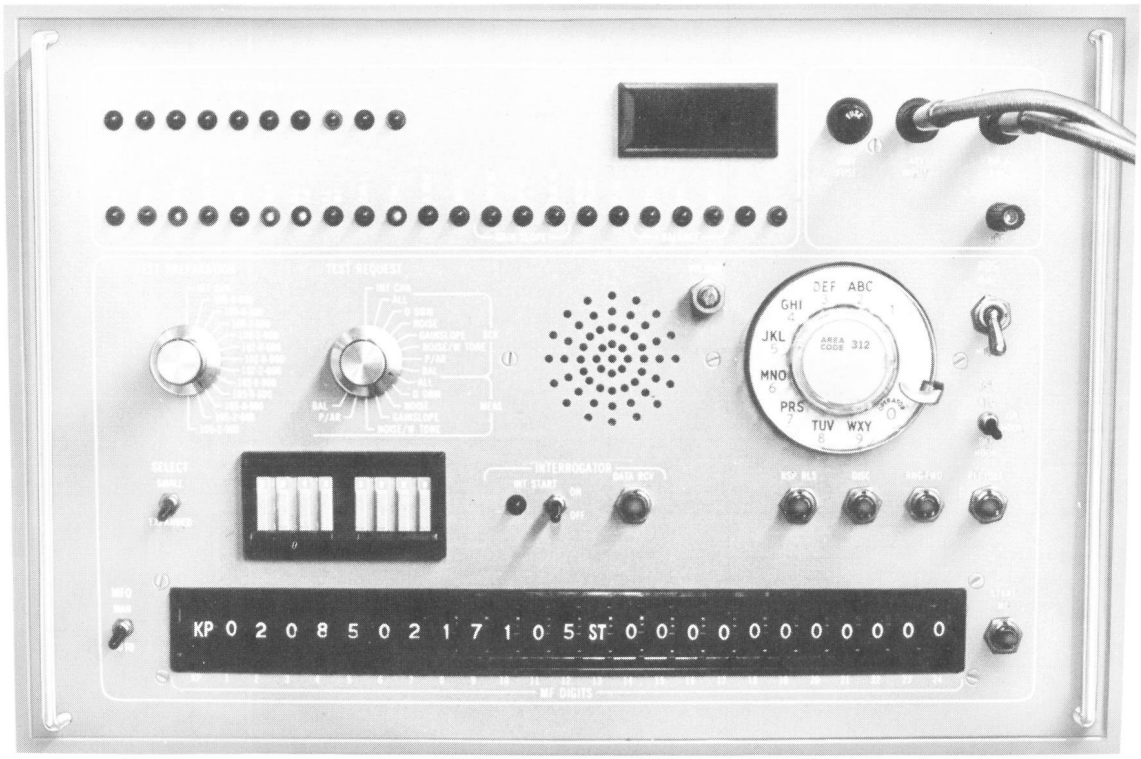

Fig. 2—ROTL System Test Set (H-310-150)

far-end office is shown in Fig. 3 and 4. The ROTL office (near-end) must have a 52A responder. The far-end terminating office must have either a 51B or 52A responder.

1.09 The ROTL program has a trunk conditioning (make-busy or make-idle) capability. This capability can be utilized by the test center sending a special MF request code (refer to Fig. 5) to the No. 2 ESS which is interpreted by the ROTL program. The remote make-busy circuit provides the following capabilities:

(a) Make an outgoing trunk from the ROTL office busy.

(b) Release a trunk that was previously made busy via the remote make-busy feature.

1.10 A regular directory number (DN) is assigned as the ROTL access number. The test center initiates the test by pulsing the telephone number assigned to the near-end ROTL. The return signal to the test center from ROTL that verifies the ROTL seizure is a test progress tone (TPT) of 2225 Hz. Removal of the TPT is an indication for the test center to send test priming digits.

1.11 The test center, after seizing the ROTL, can request a number of different test configurations. For each test the test center sends an MF test request code, a trunk state code, a trunk identity code and up to an 11-digit far-end test line number.

1.12 The format for ROTL test priming digits is shown in Fig. 5. The test codes specified by the second and third digits of the format indicate

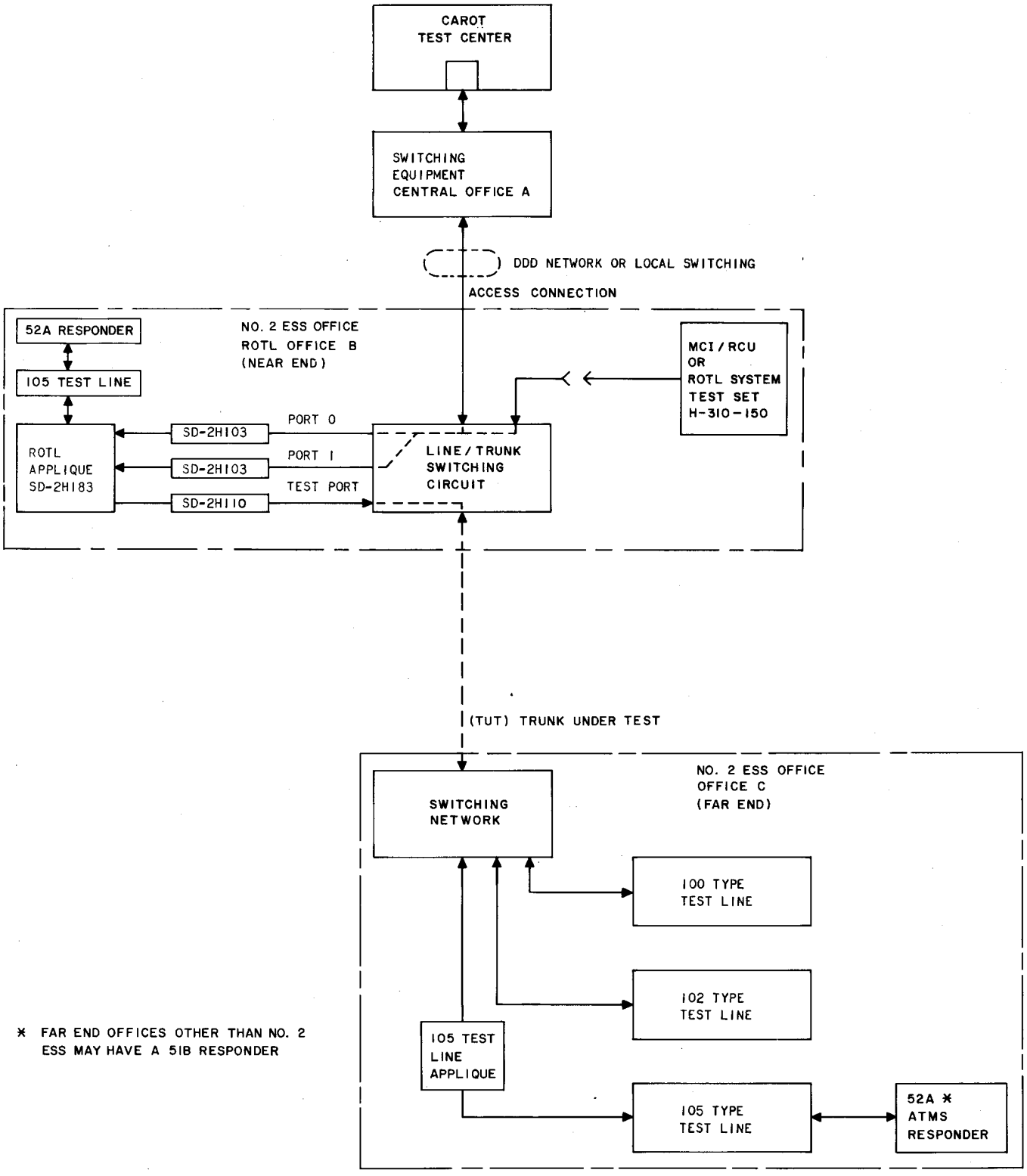

Fig. 3—No. 2 ESS ROTL Application

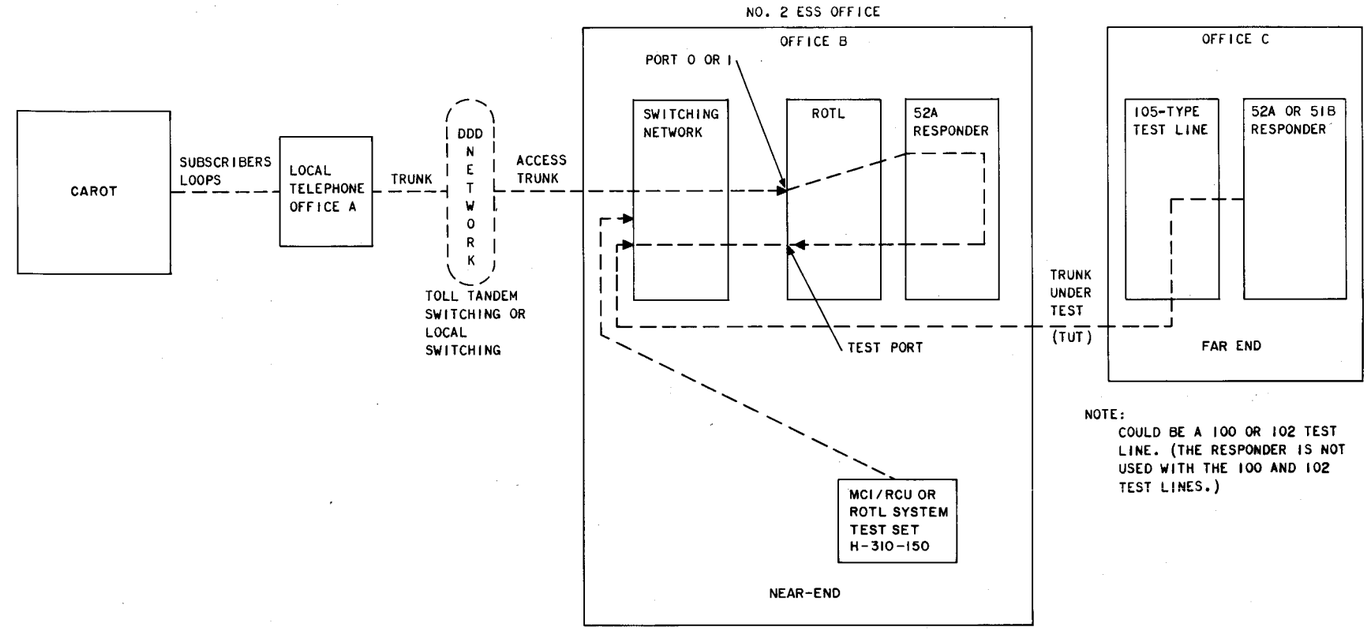

Fig. 4—Responder—Responder Test

either a transmission test, a balance test, a make-busy or restore, a trunk status request, a call back unlock request, or a connection appraisal. Since each switching system has individual requirements for trunk identity (including special items such as test class, access mode), the number of digits in the field (digit 4 to digit 20) will vary. The relative positions of the trunk identity code and far-end test line number are the same.

2. EQUIPMENT

ROTL FRAME

2.01 The equipment required to provide near-end and far-end capabilities can be mounted in a single ROTL frame. This equipment, mounting location, and application is detailed in Fig. 6.

A. Manually Controlled Interrogator (MCI) and ROTL Control Unit (RCU)

2.02 The MCI/RCU is optional equipment that provides a central office or remote location with a manual means of performing the CAROT functions of initialing transmission tests on outgoing or 2-way trunks. These tests are conducted using a ROTL at the near-end office and a 100-, 102-, or 105-type test line at the far end. Section 103-251-110 describes operation of the MCI/RCU.

2.03 An Interrogator Test Controller (ITC) is required to operate the MCI/RCU. This unit can be mounted on any miscellaneous frame that does not require interconnecting cables between the MCI/RCU and ITC to exceed 1000 feet in length. The ITC may be shared with up to three other MCI/RCUs.

B. ROTL System Test Set (H-310-150)

2.04 An alternate means of manually controlling ROTL is with the H-310-150 ROTL system test set. This test set is a portable test set designed to send priming information to ROTL. It works in conjunction with the 52A responder to perform transmission tests and display the results. Section 100-175-101 provides a description and describes the operation of the H-310-150 test set.

C. ROTL Responder Unit 52A

2.05 The 52A responder in No. 2 ESS is common to both near-end and far-end ROTL applications. It is comprised of a test line interface, MF receiver, 52A transmitter, 52A receiver, and a timing circuit. The test center accesses the responder via MF commands. An MF command consists of two of a set of six frequencies: 700, 900, 1100, 1300, 1500 and 1700 Hz. This gives a total of 15 different possible MF commands. The MF commands tell the responder which test or self-check is to be performed. The description and operation of the 52A responder is given in Section 103-252-100. This unit (the responder) is used for remote office responder testing to 100-, 102-, and 105-type test lines. The ROTL 52A responder unit is normally shared by two 105-type test lines located within the same ROTL frame in the ROTL office.

D. Tone Detectors

2.06 The 8A tone detector, required for ROTL application, monitors the trunk under test (TUT) via the ROTL test port and monitors the ROTL access port. The detector monitoring the TUT recognizes far-end test line seizures and call disposition (control) tones. The detector monitoring the access port recognizes two commands from the test center. The L1 or L3 tone detector monitors the TUT for any of the following:

(a) Busy tone (60 IPM)

(b) Reorder tone (120 IPM)

(c) 1000-Hz tone

(d) 2225-Hz TPT

(e) Recorded voice announcement.

The L2 tone detector monitors the access connection to the ROTL from the test center. This tone detector detects 1.1 seconds of 1300-Hz tone (ROTL recycle) which is sent by the remote location or test center. The 1300-Hz recycle command tells ROTL to drop the trunk under test and prepare to receive testing information for another trunk. The 2.1 seconds of Hz-drop access trunk (DAT) command is an indication for ROTL to drop the access trunk connection.

E. ROTL Applique Circuit

2.07 The ROTL applique circuit is required for near-end applications. It provides the interface functions required when switched access

3/18/74

	TEST TYPE	TEST LINE TYPE	DIGITS TRANSMITTED TO ROTL OFFICE																				
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	TRANSMISSION TEST	100 TYPE	KP	0	0	MOD	TRUNK GROUP NO.			TRUNK MEM NO.			FETL (≤ 11)											ST
2		102 TYPE	KP	0	2	MOD																		ST
3		105 TYPE	KP	0	5	MOD																		ST
4	OVERRIDE MADE BUSY	100 TYPE	KP	1	0	MOD																		ST
5		102 TYPE	KP	1	2	MOD																		ST
6		105 TYPE	KP	1	5	MOD																		ST
7	TERMINAL BALANCE TEST		KP	4	0	MOD																		ST
8	OVERRIDE MADE BUSY		KP	4	1	MOD																		ST
9	REMOTE MAKE BUSY		KP	5	0	MOD	TRUNK GROUP NO.			TRUNK MEM NO.			ST											
10	RESTORE TRUNK		KP	5	1	MOD																		
11	TRUNK STATUS INTERROGATION — INDIVIDUAL TRUNK		KP	5	2	MOD																		
12	TRUNK STATUS INTERROGATION — GROUP BY TRUNK		KP	5	3	MOD																		
13	TRUNK STATUS INTERROGATION — GROUP BY GROUP		KP	5	4	MOD							ST											
14	CALL BACK UNLOCK REQUEST		KP	5	5	ID	ST																	
15	CONNECTION APPRAISAL TEST	100 TYPE	KP	6	0	FETL (≤ 12 DIGITS)																		ST
16		102 TYPE	KP	6	2																			ST
17		105 TYPE	KP	6	5																			ST
18	HOME OFFICE TEST LINES	100 TYPE	KP	7	0	TEST LINE DIRECTORY NUMBER																		ST
19		102 TYPE	KP	7	2																			ST
20		105 TYPE	KP	7	5																			ST
21	MOD = TRUNK MODIFIER																							
22	CODE (0, 1 OR 2)																							
23																								
24	ID = TEST CENTER																							
25	IDENTIFIER (0-7)																							
26	FOR CALL BACK																							

Fig. 5—Format for ROTL Test Priming Information

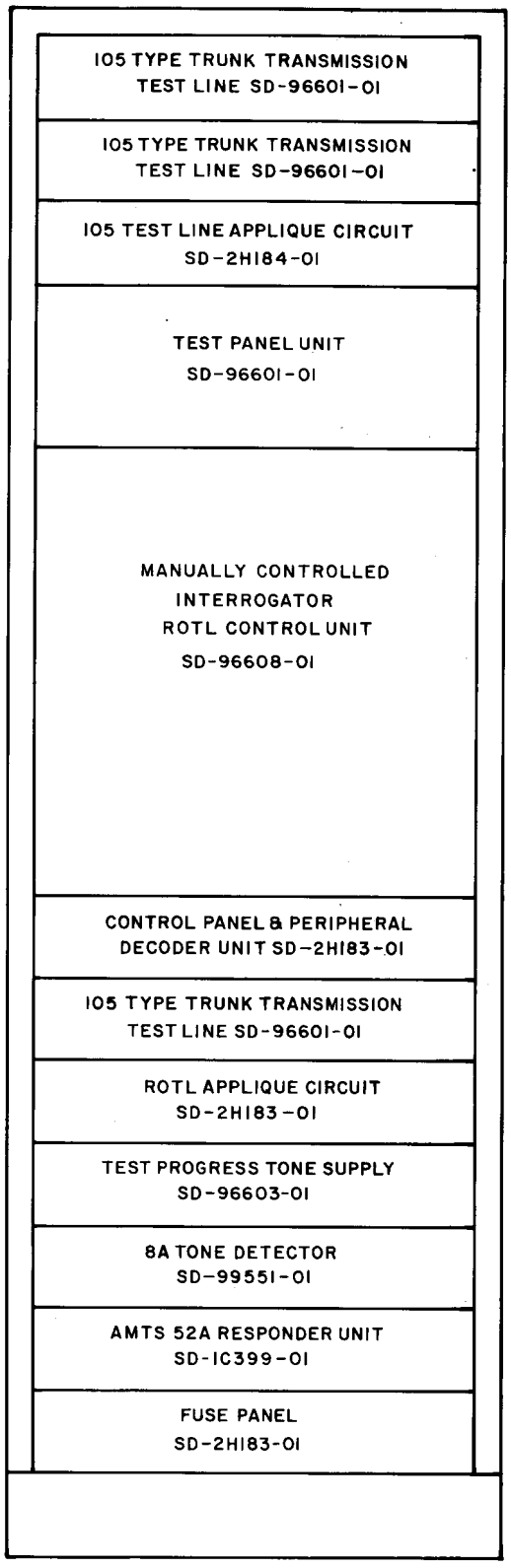

Fig. 6—ROTL Frame

to the test center is made for performing trunk transmission measurements via a dialed-up direct distance dialing (DDD) network or local connection through the No. 2 ESS switching network.

2.08 The ROTL applique circuit, under control of the stored program, will seize the associated SD-2H110 incoming trunk circuit by providing a loop closure across tip and ring. The incoming trunk program will handle this seizure as a normal incoming call into the No. 2 ESS.

2.09 After outpulsing has occurred and the trunk to be tested has been accessed, this circuit will make the required connection to the ROTL 52A responder via a 105-type test line for performing the requested transmission tests.

F. 105 Test Line Applique Circuit

2.10 The 105 test line applique circuit is used in far-end applications. It provides the interface functions required when switched access to the test center is made for performing trunk transmission measurements via a dial-up DDD network or local connection through the No. 2 ESS switching network.

2.11 The 105 test line applique circuit, under control of the stored program, will seize the 105 test line circuit by providing battery and ground. The 105-test line is covered in Sections 103-250-101 and 103-250-702.

G. 105-Type Test Line

2.12 Three 105-type test lines are required for a combined near-end and far-end application. One test line is dedicated to the ROTL office for use during transmission tests. Two test lines provide access to the 52A responder when the office provides the far-end capability for transmission tests.

H. Test Progress Tone Supply and Distribution Circuit

2.13 The test progress tone supply and distribution circuit is common to both near-end and far-end applications. It provides 2225-Hz tones to the testing location as the test configuration is being established. The 2225-Hz tone is an indication to the test location of how the sequential progress of the test configuration is developing.

3. TRUNK CONDITIONING

A. General

3.01 The test center, on an automatic or manual basis can make-busy trunks (via the make-busy feature), release trunks previously made busy by the remote make-busy feature, and request the status of a trunk or group of trunks outgoing from the ROTL office. These functions are requested by the test center via MF commands.

B. Trunk Make-Busy and Restoration Signals

3.02 The response by the ROTL office to indicate action taken on a request to make a trunk "remote maintenance busy" or to restore the trunk to service by removing the "remote maintenance busy" state is described as follows:

Test progress tone (TPT) (2225 Hz) —Trunk made busy

—Trunk restored to service (remote ***maintenance busy (MB)*** removed).

Two-bursts TPT—Trunk made busy and MB limit reached (manual or automatic-tester) or exceeded (manual only)

60 IPM Low Tone—Request refused because trunk MB limit has been reached (manual or automatic-tester) or exceeded (manual only).

—Trunks may be traffic busy

120 IPM Low Tone—Priming information error

—Security call back for ROTL unlock not completed

3.03 When a request is made to make a trunk remote MB or restore it to service and that trunk is already in the state desired, ROTL will return the same indication shown in 3.02.

C. Security Call Back

3.04 To prevent unauthorized remote locations from taking trunks out-of-service, two conditions must be satisfied prior to affecting the condition of a trunk. The ROTL office can authorize up to eight remote locations the ability to condition trunks within the ROTL office. Prior to attempting to condition a trunk, the test center must request that the ROTL perform a security call back (SCB). The SCB is requested by the test request code followed by a single digit 0 through 7. This last digit identifies which test center is requesting to condition trunks in the ROTL (near-end) office.

3.05 The No. 2 ESS has a table of SCB directory numbers in program store (PS). The test center transmits the identity digit which is the digit that follows the test request code of the call back unlock request code (see Fig. 5). The ROTL program uses the identity digit to access the SCB table for the test center call back DN. Then, a call is originated by the ROTL to the test center. The DN called by the ROTL is to a location that can return the 1000-Hz unlock signal. When this call to the test center terminates, 1000 Hz is sent to the ROTL office. When the ROTL office detects this 1000 Hz tone, a bit is set in the ROTL memory. This allows the test center to condition trunks within the ROTL office. The SCB DN table is used to determine if the particular test center is authorized to exceed the automatic maintenance limit (AML). Only manual test centers are allowed to exceed the AML. The AML limits the total number of trunks from any trunk group which can be made busy at one time.

D. Trunk Status Requests

3.06 In addition to conditioning trunks, any test center can request the maintenance busy status of either a single trunk or a trunk group. A single trunk request is followed by the trunk identity (trunk group and member) 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 than the AML permits maintenance busy in the group.

Responses to Trunk Status Requests

TPT (2225 Hz)—(individual trunk)—Trunk is not MB.

—(trunk group)—No trunks in this group are MB.

Two-bursts TPT—(trunk group)—Some trunks (but fewer than AML limit) are MB.

60 IPM ***Low Tone***—(individual trunk)—Trunk is MB.

—(trunk group)—Number of MB trunks has reached or exceeded the AML.

120 IPM ***Low Tone***—Priming information error

4. TESTS PERFORMED BY ROTL

TRANSMISSION TESTS

A. 100-Type Test—Remote Office Responder Testing

4.01 The test center originates a call to the ROTL office via DDD network or direct connection. The call is processed with the central office switching equipment in the same manner as a regular call. When the ROTL has been seized it returns TPT (2225 Hz) to the test center. When the No. 2 ESS is prepared to receive test priming information (an MF receiver is connected) the TPT is turned off. This is an indication to the test center to transmit the trunk under test identity and the FETL number. The test center provides the ROTL with information about the type of test to be made.

4.02 This test is a one-way (far-to-near) loss or noise transmission test from a 100-type test line in the far-end office. The test center transmits MF test priming information to the No. 2 ESS which is interpreted by the ROTL program. The ROTL program decodes the priming information and connects the ROTL applique circuit to the trunk under test. The far-end test line number is outpulsed. The far-end office connects to a 100-type test line. Then, the far-end office transmits 1000 Hz at 0 dBm for five seconds to the ROTL office. This tone is followed by a quiet termination. If the 52A responder in the near-end office is requested by the test center to make a 1000-Hz loss measurement, the 52A responder (near-end) measures the received signal from the TUT. This signal received by the near-end office responder is converted to measurement data consisting of a guard band (1200 Hz) and a data band (2200 Hz) followed by a trailing guard band (1200 Hz). The duration of the data band is proportional to the amplitude of the received signal. The measurement data collected at the ROTL 52A responder is forwarded to the test center. Then, the ROTL office sends a 1000-Hz signal to the test center for as long as the 1000-Hz signal is present from the far-end office. The 52A responder (near-end) resets when the tone is turned off by the far-end office to await additional MF commands from the test center. The responder is then ready to make a noise measurement upon command from the test center.

B. 102-Type Test—Remote Office Responder Testing

4.03 The test center originates a call to the ROTL office via DDD network or direct connection. The call is processed with the central office switching equipment in the same manner as a regular call. When the ROTL has been seized it returns TPT (2225 Hz) to the test center. When the No. 2 ESS is prepared to receive test priming information (an MF Receiver is connected) the TPT is turned off. This is an indication to the test center to transmit the trunk under test identity and the FETL number. The test center provides the ROTL with information about the type of test to be made.

4.04 This test is a one-way loss test (far-to-near) from a 102-type test line in the far-end office. The test center transmits MF test priming information to the No. 2 ESS which is interpreted by the ROTL program as a request to connect to the TUT. The terminating 102-type test line DN is then outpulsed to the far-end office over the TUT. When the test line is seized at the far-end office, the 102-type test line transmits 1000 ±10 Hz at 0 dBm to the ROTL office. These types of test lines send the signal periodically; nine seconds on, are second off. The 52A responder in the ROTL office makes a loss measurement only when the tone is present so that the interruption in the 1000 Hz from the code 102-type test line does not cause any error in the measurement.

C. 105-Type Test—Responder to Responder Testing

4.05 This test is a 2-way transmission test for loss and noise measurements and a variety of other measurements for the trunk under test.

4.06 The test center controls the measurements of trunks between the near-end office and a far-end office containing the 105-type test line. The test center gains access to the ROTL via a regular dialed-up connection.

4.07 All measurement results on the trunk under test are sent back to the test center in the form of frequency-shift data signals.

4.08 The test center originates a call to the ROTL office via DDD network or direct connection. The call is processed with the central office switching equipment in the same manner as a regular call. When the ROTL has been seized it returns TPT (2225 Hz) to the test center. When the No. 2 ESS is prepared to receive test priming information (an MF receiver is connected) the TPT is turned off. This is an indication to the test center to transmit the trunk under test identity and the FETL number. The test center provides the ROTL with information about the type of test to be made. When the trunk under test has been seized, the DN of the far-end 105-type test line is outpulsed. After the connection has been established, the ROTL makes a bid for the near-end 52A responder. When the 52A responder is available, control is given to the test center. The test center controls the action of the 52A responder at the ROTL office and the 51B or 52A responder at the far-end. The test center controls the responders by means of two-out-of-six (2/6) MF command signals. The responder connection in the far-end office is made via the 105-type test line. Then, the responders make the required measurements. The results of the measurements are forwarded to the test center.

Loss Measurements

4.09 Loss measurements are initiated when the test center sends a 2/6 MF command signal to the ROTL 52A responder and to the (far-end) 51B or 52A responder which requests loss measurements.

4.10 The ROTL 52A responder sends guard tone (1200 Hz) to the test center. At about the same time, the far-end 51B or 52A responder sends a 1000 Hz (1 MW) test tone from its MW generator over the trunk under test. This tone level is to be measured by the ROTL 52A responder.

4.11 The ROTL 52A responder measures the 1-kHz signal received from the far-end 51B or 52A responder. It converts the measured loss to a data signal (2200 Hz). Then, the ROTL 52A responder transmits the data signal (2200 Hz) to the test center, immediately following the 1200-Hz guard tone. After the data tone of 2200 Hz is a second 1200-Hz guard tone; this second guard tone is a trailing guard tone. The 52A responder also transmits a 1000 Hz (1 MW) test tone to the far-end 51B or 52A far-end responder after the far-to-near transmission test has been made. The 1000-Hz test tone transmitted to the far-end from the ROTL 52A responder allows the near-to-far loss on the trunk under test to be measured.

4.12 The far-end 51B or 52A responder measures the level of the 1000 Hz signal from the ROTL 52A responder. The received signal is converted to a data signal (2200 Hz) which is transmitted back toward the test center along with guard tone on both sides of the data signal. The ROTL 52A responder contains a data tone detector that detects the guard tone (1200 Hz). When the guard tone is detected the trunk under test is bridged to the access connection. The access connection routes the data tone (2200 Hz) to the test center. After completing the loss measurements, the responders return to a signal-receive state awaiting further command signals from the test center.

Noise Measurements

4.13 Noise measurements are initiated when the test center sends the appropriate 2/6 MF command signals to the ROTL 52A responder and far-end 51B or 52A responder at time intervals that sequence the noise measurements.

4.14 The far-end 51B of 52A responder does not recognize the first 2/6 MF signal. Therefore, the far-end responder leaves the trunk under test terminated. The ROTL 52A responder measures the near-end noise, converts the measurement into a data signal (2200 Hz), and transmits this signal to the test center.

4.15 The test center then sends a second 2/6 MF signal to the responders. The far-end 51B or 52A responder recognizes the MF signal and measures the far-end noise. Also, the ROTL 52A responder provides a termination for the trunk under test. The far-end 51B or 52A responder transmits a guard tone (1200 Hz) followed by the data signal (2200 Hz) toward the test center. The ROTL 52A responder detects the guard tone (1200 Hz) and bridges (cuts through) the trunk under test to the access connection so that the data signal (2200 Hz) from the far-end responder can be sent to the test center. The responders then return to a signal-receive state awaiting further MF command signals from the center.

4.16 The test center causes self-checks to be made on both responders (near-end and

far-end) for loss, noise, and other tests that are requested when the far-end has a 52A responder (which allows more tests to be made). The results of the self-checks are transmitted back to the test center.

D. Terminal Balance

4.17 The terminal balance function of the ROTL involves connecting a 100-type test line to a selected outgoing trunk from the ROTL central office (see Fig. 7). Upon reception of the same information as a loss test, except for a different request code, a call is originated by the ROTL over the selected trunk. When the call terminates, a start test tone (1000 Hz) is expected by ROTL. After it occurs, a 100-type test line is attached to the trunk in the ROTL office. This test line provides five seconds of 1000-Hz MW tone followed by a 30-minute period of quiet balance termination. The test is terminated by receiving a disconnect on the trunk under test. After a 60-second time-out, the ROTL is no longer associated with this test and a recycle signal from test center will have no effect.

E. Tests Initiated From ROTL Office

4.18 The results of each test performed by the ROTL 52A responder are returned to the test center in an encoded form. This test center may be a CAROT or a common systems RCU. These systems are usually remote from the ROTL central office. To aid the craftsperson in confirming and correcting troubles, the MCI/RCU is used.

4.19 The MCI/RCU when used in conjunction with a ROTL, provides a stand-alone test function (see Fig. 7). The MCI/RCU allows manually requested, automatically performed transmission tests to be made on outgoing or 2-way trunks.

4.20 This arrangement allows the craftsperson to repeat tests made routinely by the test center using the same measurement equipment in order to confirm trouble reports. Only the answer decoding equipment is different, thus reducing the possibility of inconsistent measurements.

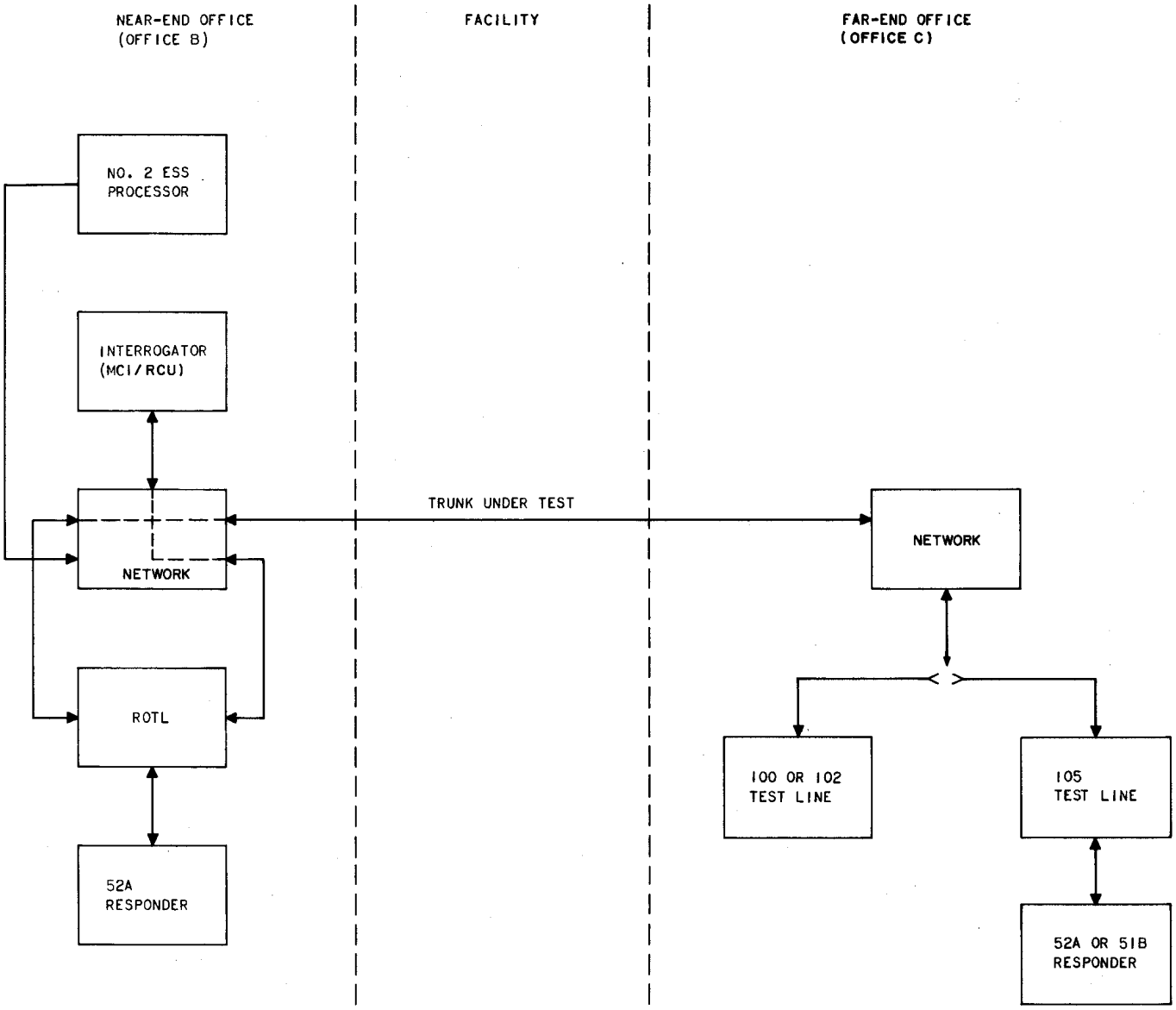

Fig. 7—Near End Mode Utilizing MCI/RCU