

APC 1077B
MANUAL INTERROGATOR

INSTRUCTION MANUAL
May 1985

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TERMS AND ABBREVIATIONS COMMONLY USED IN THIS MANUAL

ANI

Automatic Number Identification

ASCII CODE

American Standard Code for Information Interchange, an 8 bit code.

BANANA PLUG TERMINAL

A single conductor plug having a banana-shaped spring metal tip.

DIAGNOSTIC DUMP

Transfer of diagnostic data contained in memory of an APC ROTL system to the printer.

DP

Dial Pulse

DTMF

Dual-tone multifrequency

EML

Expected Measured Loss

FAREND

Terminating office for the trunk under test (TUT).

FETL

Farend test line

FSK

Frequency shifted keying

KP

Multifrequency signal that indicates 'prepare for digits'.

MA

milliamps

MF

Multifrequency

MS

milliseconds

NEAREND

Office where a ROTL or nearend responder is located and from where testing takes place to a distant office.

OUTPULSING

To dial out.

RESPONDER

Equipment at the farend and/or nearend that responds to test requests from a controller or RTS (ROTL Test Set).

ROTL

Remote office test line. The unit that receives commands from a controller or RTS and seizes outgoing trunks to be tested. Contains a built-in responder and Code 105 test line.

TRS JACK

Tip/Ring/Sleeve jack.

SIMPLEX

Signaling path over a dry talk circuit which uses the two sides of the circuit in parallel. Derived by connecting the mid-points of repeating coils which are across the circuit.

ST

Final multifrequency signal that indicates end of pulsing.

TEST LINE

A test termination circuit capable of applying signaling and transmission tests and recognizing and replying to specific signals received.

TLP

Transmission level reference point.

TPT

Test progress tone (2225 Hz). Used as an identifying tone to indicate to the controller the time sequence and progress of the trunk being tested.

TUT

Trunk under test. The trunk between the nearend and farend which is selected and seized for testing.

APC 1077B
MANUAL INTERROGATOR

GENERAL DESCRIPTION

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Pouch contains power cord and manual.

1. Introduction

1.01 This section introduces the 1077B Manual Interrogator (herein referred to as 1077B), describes it, points out operating features, and explains capabilities. Refer to Fig. 1-1.

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed here.

1.03 Comments concerning the content or organization of this document, as well as suggestions for improvement are welcomed. Direct comments to:

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2. General Description and Capabilities

A. Physical Description

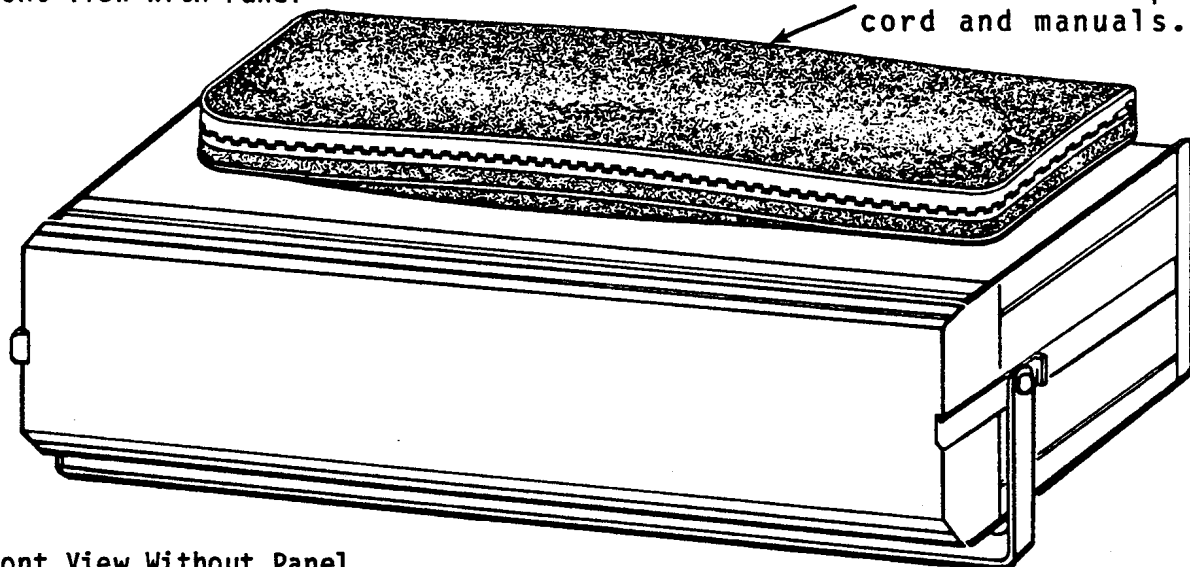
2.01 Physical dimensions of the unit are 15 X 18 X 8 inches. Weight is approximately 22 pounds. A pouch is supplied for cord storage and secured to the top panel of the unit with hook and loop fastener material.

2.02 The 1077B is AC powered. An IEC AC power supply connector and circuit breaker are located at the rear of the unit. The 1077B can be operated from an input of 100, 120, 220 or 240 VAC. The 1077B is normally shipped to operate with 120 VAC. Refer to Fig. 1-2.

2.03 The operating environment is 0 to 50° C (32 to 122° F) with 10 to 90% relative humidity (noncondensing).

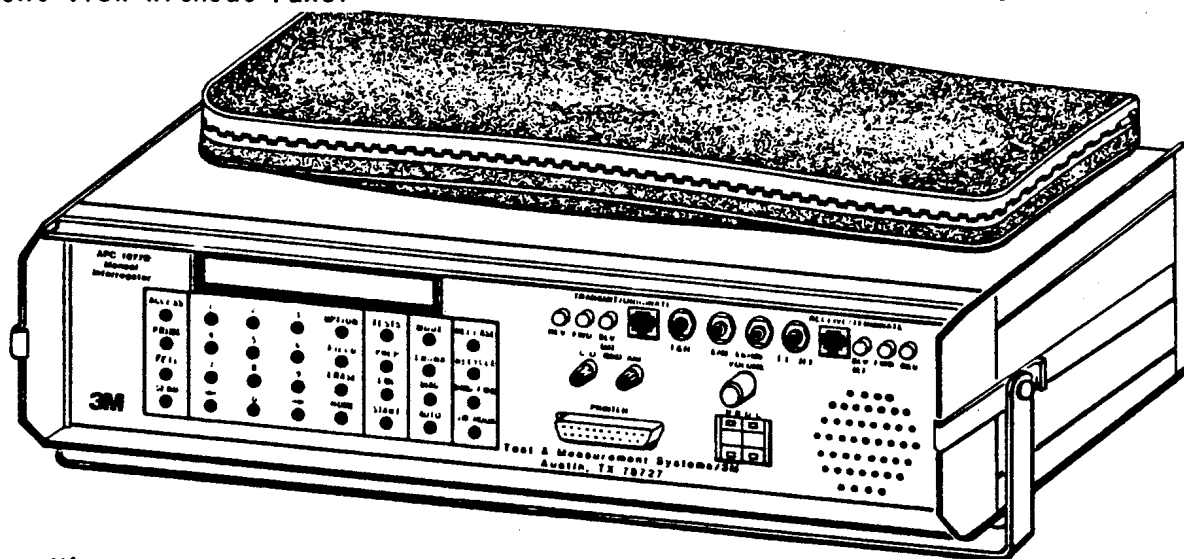
2.04 The 1077B is a portable instrument used in conjunction with a farend test line to perform one- and two-way transmission tests on trunks. A 56B-type responder is an integral portion of the 1077B. When testing into a farend 105 test line responder

Front View With Panel

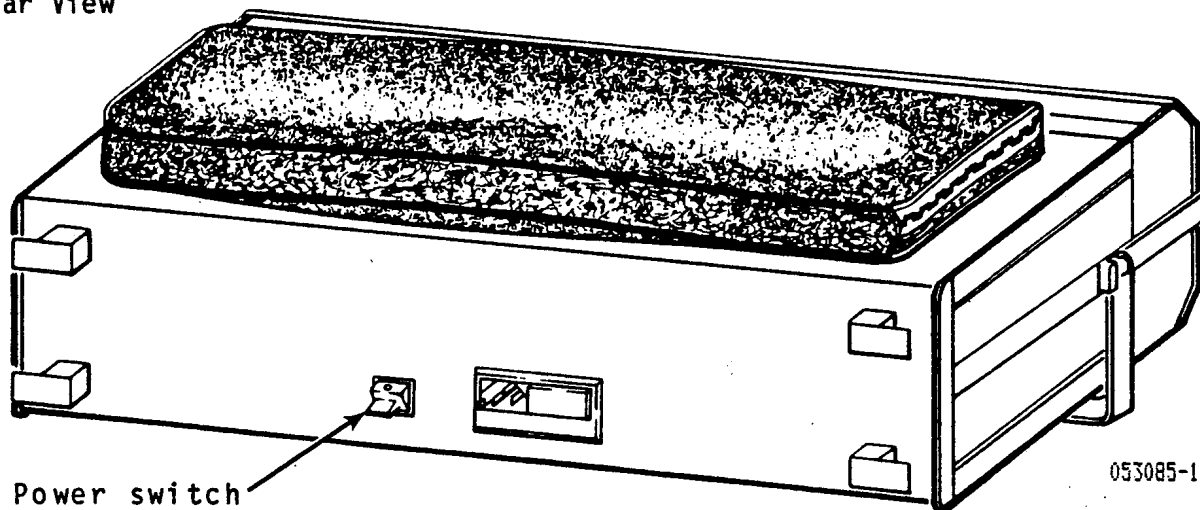


Pouch contains power cord and manuals.

Front View Without Panel



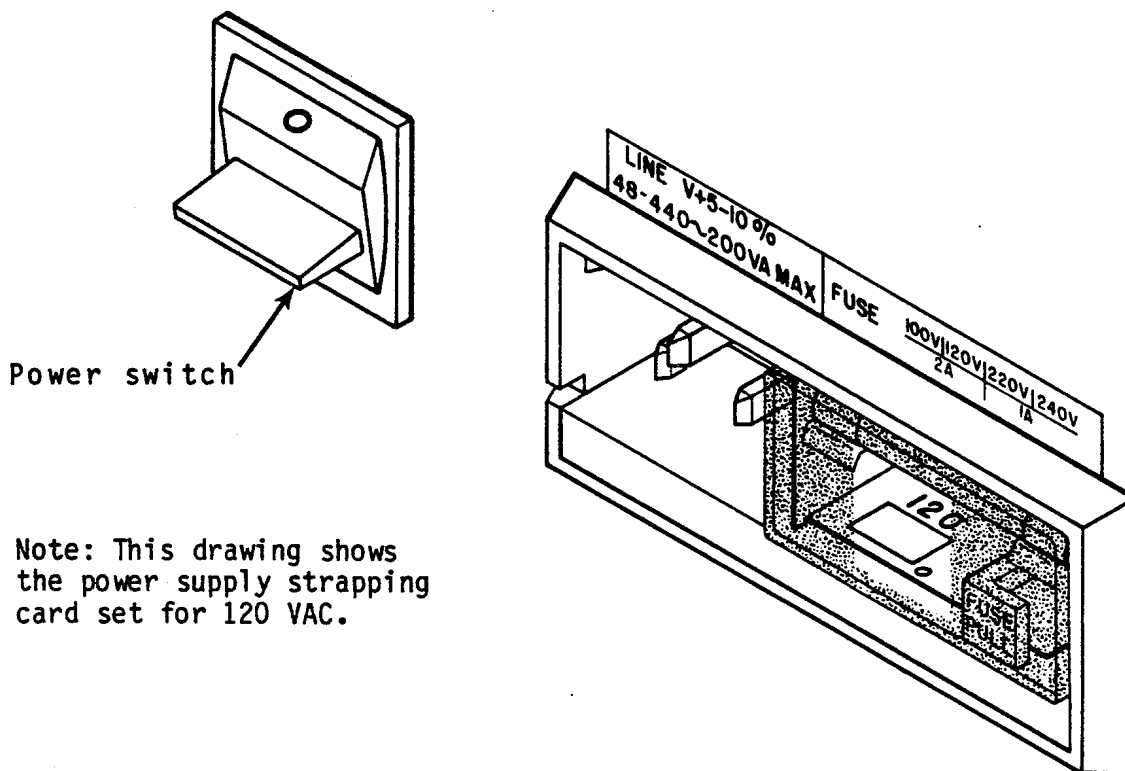
Rear View



Power switch

053085-149

Fig. 1-1 -- 1077B Manual Interrogator



Note: This drawing shows the power supply strapping card set for 120 VAC.

Fig. 1-2 -- Power Supply as Shipped

053085-150

that is properly equipped, the following tests may be performed:

Two-way loss
C-message noise
C-notch noise
Gain/slope (three frequencies)
ERL (echo return loss)

2.05 A farend with a New 100 test line allows one-way loss, noise, and ERL tests. A Code 102 test line (milliwatt) allows one-way loss tests.

2.06 As a nearend responder, the 1077B may interface to 2- or 4-wire trunks at either 900 or 600 ohms, using loop start, sleeve ground, or E&M signaling. Patch cord access is allowed using either 310-type jacks or the modular phone jacks on the front panel. Indicators on the front panel display the status of E&M leads as well as forward and reverse battery. Outpulsing types include DTMF, DP, MF, and SF.

2.07 The 1077B may also be used in the ROTL test set mode to control ROTLs to perform trunk tests from a remote location. In this mode, connection is to a subscriber line using loop supervision. Direct connection to a ROTL using a 310 plug (T, R, S) is also supported.

2.08 The built-in responder may also be used as a farend Code 105 test line responder. In the 2-wire mode, the responder may be ringing activated or sleeve ground activated. The 4-wire mode provides E&M signaling.

2.09 The 1077B provides 4-wire access to trunks for farend or nearend responder operation. This 4-wire circuit may be used for either originating or terminating calls. The 4-wire circuit may be split internally into two 2-wire circuits. When in the 2-wire modes, one circuit is used for originating and the other for terminating calls. In certain situations,

both of the 2-wire circuits may be used simultaneously allowing functioning modes to operate at the same time.

2.10 Operator controls and indicators on the 1077B front panel allow easy entry of required parameters, control of testing sequences, and display of results. The twenty character display shows the numbers entered, parameter setups; and display of test results. Pushbutton keys allow entry of setup parameters and control of testing.

2.11 Automatic operating features include detection of farend test line type by answer tone, and automatic sequencing of all test steps and control sequences. This feature is available in both the local and remote control modes.

B. External Connections

2.12 An RS-232-C type serial port (accessed by a 25-pin female D-subminiature connector) allows automatic logging of measurement results when attached to a printer. Two-way communications through this port allow remote automatic control of the 1077B features.

2.13 Four plugs that accept 310-type plugs and allow access to the T, R; T1, R1; E&M; Eb, and Mb leads.

2.14 Two jacks that accept modular phone plugs and allow access to the T, R; T1, and R1 leads.

3. Operating Features

3.01 The following are features of the 1077B. These features are shown in Fig. 1-3.

a) Twenty character display and an array of 32 pushbuttons for entry of parameters and display of results.

b) Up to three 30-digit fields for control of outpulsing and ROTL priming. Outpulsing types include DP, DTMF, MF, and SF.

c) Selection of up to nine tests to be run, including loss, C-message noise, C-notch noise, gain/slope (L04, L10, L28), and echo return loss (ERL, SRL, SRH).

d) Farend test line selection including 100, 102, and 105.

e) Trunk impedance selection including 600 or 900 ohm.

f) Test level point selection including 0 or -2 dB.

g) Entry of test limits for each test type allows automatic repeat of failed tests and logging of failed results.

h) Mode selection includes ROTL test set, farend responder (2- or 4-wire), and nearend responder (2- or 4-wire). Additionally, the farend 2-wire mode may be active when the ROTL test set mode is selected.

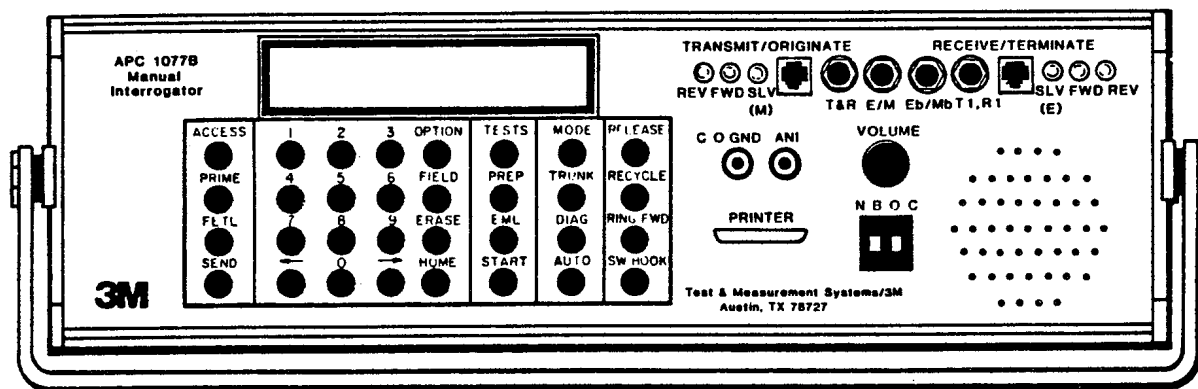
i) Built-in diagnostics allow extensive self-checking of the 1077B.

j) Automatic control initiation in the local operating mode. Automatic control is always active when operating remotely through RS-232-C interface.

k) Switch hook control for loop start, sleeve ground start, and E&M signaling.

l) Release, recycle, disconnect, and ring forward functions for ROTL control.

m) Status indicators for forward and reverse battery, and for E&M supervision status.



053085-151

Fig. 1-3 -- 1077B Front Panel

n) Automatic logging of test results and operating parameters on user provided printer (RS-232-C interface).

o) Built-in speaker and volume control for monitoring progress of testing.

4. Electrical Specifications

A. 1056B Responder Specifications

4.01 The following are the AC signal specifications for the 1056B responder contained within the 1077B. These items are presented for reference only and are superseded by the specifications for the 1056B found in its instruction manual.

Impedance: 600 or 900 ohms, echo return loss greater than 30 dB.

Test Level Point: 0 or -2 dB, $\pm .02$ dB.

Milliwatt: 1004 ± 2 Hz at 0 $\pm .02$ dBm. Total harmonic distortion is less than 50 dB.

Gain/slope: 404 ± 2 Hz, 1004 ± 2 Hz, and 2804 ± 2 Hz at -16 dBm $\pm .02$ dBm.

Return loss noise signals: -4 dBm in 4-wire mode, -10 dBm in 2-wire mode.

Loss measurement: -15.8 to +5 $\pm .1$ dBm.

Gain/slope measurement: -36.8 to -14 $\pm .1$ dBm

Noise measurement: 15 to 55 dBmC, + 1 dB from 300 to 3000 Hz, + 2 dB from 60 to 300 Hz and 3000 to 3300 Hz.

C-notch noise: 34 to 74 dBmC. 1004 Hz rejection greater than 50 dB.

Return loss: 0 to 40 ± 1 dB.

Network build-out capacitor (NBOC): 0 to 86 ± 1 nF.

B. 1077B AC Specifications

4.02 The following are the AC signal specifications for the 1077B. The 1077B specifications represent tones used for control and status and are not precise in nature.

MF tones: 700, 900, 1100, 1300, 1500, and 1700 Hz, + .5% at -7 ± 1 dBm per frequency. Duration 75 ± 5 ms, interdigit time 75 ± 5 ms.

DTMF tones: 697, 770, 852, 941, 1209, 1336, 1477, 1633 Hz + .5% at -7 ± 1 dBm per frequency. Duration is 55 ± 5 ms, interdigit time is 55 ± 5 ms.

SF tone: 2600 Hz \pm .5% at -7 \pm 1 dBm. 10 PPS, 60% on-time. Interdigit time is 800 ms.

Dial pulse: 10 PPS, 60% make.

Control Tone: 1300 Hz \pm .5% at -7 \pm 1 dBm.

C. 1077B DC Specifications

4.03 The following paragraphs describe DC signaling specifications for the 1077B.

Supervision Leads

4.04 The E&M leads are used for multiple purposes. For 4-wire E&M trunks, these leads provide Type I or Type II signaling capabilities. The 1077B may appear as either a trunk circuit or a signaling circuit as described in Notes on the Network. The M lead is always the output from the 1077B and the E lead is always the input to the 1077B. Both the E and M leads are current limited through a 56 ohm resistor. Different configurations for E & M signaling are shown in Section 2, page 2-19.

4.05 For Type II signaling, the M lead provides a relay contact closure between the M and Mb leads. The E lead accepts a contact closure between the E and Eb leads. The potential provided on the Eb lead may be either 0 ohm central office ground or 1000 ohm -48V internal battery.

4.06 For Type I signaling, the M lead may provide either 0 ohm central office ground or 1000 ohm -48V internal battery. Signaling means include transfer from open to ground, transfer from open to battery, or transfer between battery and ground. The E lead will accept either 0 ohm central office ground or 1000 ohm battery. Signaling means include transfer to ground or transfer to battery.

4.07 In the 2-wire modes, the M lead is used as the sleeve lead for originating trunk seizure, and provides closure to ground to seize the trunk. The E lead is used as the sleeve lead for terminating trunk seizure and accepts closure to ground to seize the 1077B.

Ringin Detector

4.08 The ringin detector on the terminating line circuit accepts signals of at least 85V peak at 16-66 Hz.

Hold Coils

4.09 The 1077B provides two electronic hold coils for the originating and terminating line circuits. Each simulated coil resistance maintains 30 to 45 ma hold current from battery potentials of 42 to 56 volts in series with 400 ohms.

D. Power Specifications

4.10 The 1077B operates from input ranges of 100/120/220/240 VAC and 47-63 Hz. The power supply meets the EMI/RFI requirements specified in FCC Docket 20780 for Class A equipment and VDE 0871 for Class A equipment without additional noise filtering. Refer to Fig. 1-4 for setting the 1077B line operating voltage, if required.

E. RS-232 Specifications

4.11 The serial communications port is a subset of the RS-232-C specifications. Output signal levels are +12V for mark and -12V for space. Input circuits accept from +3V to +15V for mark and from -3V to -15V for space. Connector pin-outs and signal functions are shown in TABLE 1-1. Data rate is 300, 600, 1200 or 2400 baud with 1 start bit, 1 parity bit, 7 data bits, and 1 stop bit. Output parity bit is always a space. Parity is not checked on input.

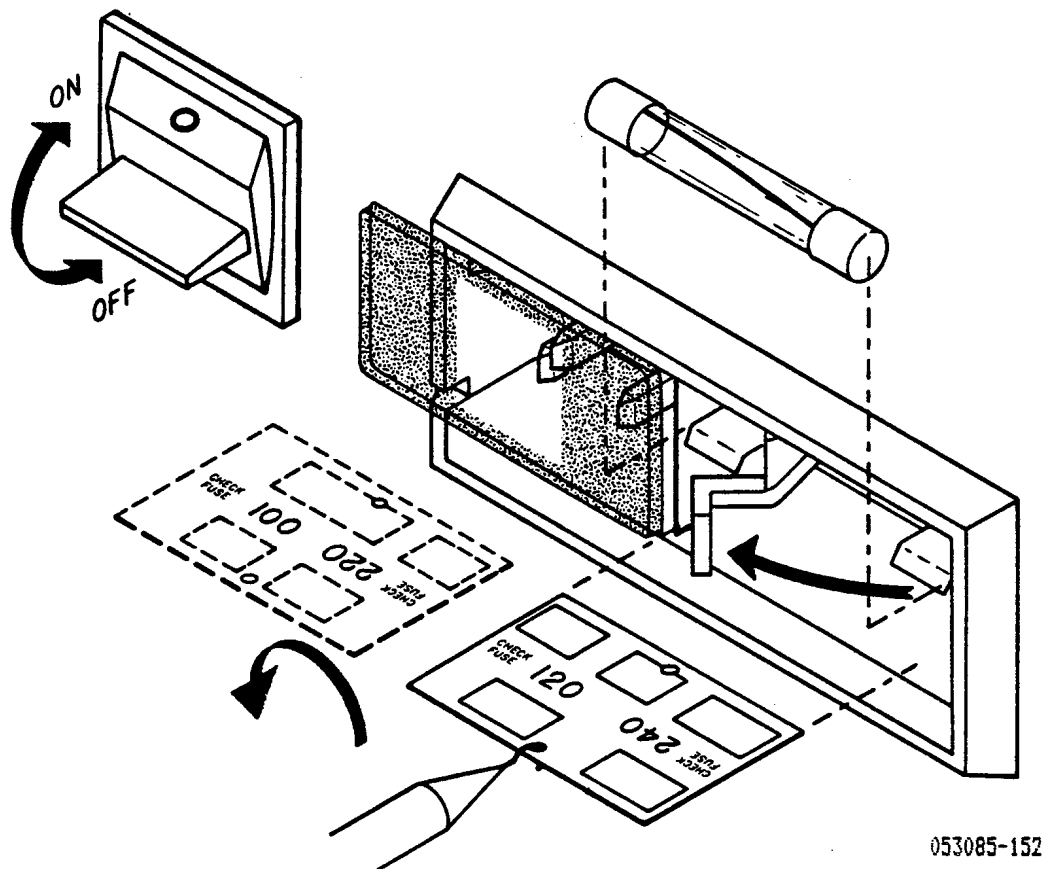


Fig. 1-4 -- Changing Input Voltage

053085-153

TABLE 1-1		
1077B EIA Pin #	FUNCTION	ROTL or MODEM EIA Pin #
1	Protective Ground	1
2	Transmit Data (TX DATA)	3
3	Receive Data (RX DATA)	2
4	Request to Send (RTS)	5
5	Clear to Send (CTS)	4
6	Data Set Ready (DSR)	6
7	Signal Ground	7
8	Data Carrier Detect (DCD)	20
20	Data Terminal Ready (DTR)	8

5. External Connections

A. Transmission Connections

5.01 External connections consist of four jacks that accept 310 plugs (T, R; T1, R1; E&M; Eb, Mb), two jacks that accept modular phone plugs (T, R; T1, R1), one 25-pin D-subminiature receptacle (RS-232), and the AC power connection.

5.02 Transmission connections consist of the T, R and T1, R1 pairs. The T, R pair is used for the transmit (referenced to the 1077B) pair of a 4-wire circuit or for the originating 2-wire circuit. The T, R pair appears as tip and ring of the 'T, R' 310 jack, and as the red and green pair of the 'T, R' modular phone jack. The sleeve lead of the 'T, R' 310 jack also contains the M lead and can be used for sleeve control for originating 2-wire trunks. The T1, R1 pair appears as tip and ring of the 'T1, R1' 310 jack, and as the red and green pair of the 'T1, R1' modular phone jack. The sleeve lead of the 'T1, R1' 310 jack also contains the E lead and can be used for sleeve activation for terminating 2-wire trunks.

B. Supervision Connections

5.03 The E&M jack provides access to the E&M signaling leads when used as a 4-wire trunk. The E lead appears as the tip of the 310 jack and is the input control lead to the 1077B. The M lead appears as the ring of the 310 jack and is the output control lead from the 1077B. The E lead also appears as the sleeve lead on the 'T1, R1' 310 jack, and the M lead also appears as the sleeve lead on the 'T, R' 310 jack. The Eb, Mb jack provides access to the return leads for E&M signaling when Type II signaling is used. The Eb lead appears as the tip of the 310 jack and is the return for the E lead. The Mb lead appears as the ring of the 310 jack and is the return for the M lead. The sleeve leads of both the E&M and the Eb, Mb 310 jacks have no connection.

5.04 A banana plug terminal is provided to reference to central office ground. Central office ground is isolated from AC safety ground.

C. RS-232 Connections

5.05 A 25-pin female D-subminiature connector is provided for connection to the RS-232 printer or remote control device. TABLE 1-1 shows signal definitions for this connector.

D. Power Connections

5.06 The AC power receptacle and ON/OFF switch are located on the rear panel of the 1077B. The power and neutral leads are connected to the input transformers of the power supplies, and the safety ground is connected to the case of the 1077B. There is no internal connection between safety ground and AC neutral, or between safety ground and central office ground.

6. General Operation

6.01 The 1077B has three primary operating modes: nearend responder, farend responder, and ROTL test set. The nearend and farend responder modes may operate on either 2- or 4-wire trunks or lines. The ROTL test set mode is always 2-wire and is connected to a line circuit. There is a secondary operating mode associated with each 2-wire primary mode. For ROTL test set and nearend responder primary modes, the secondary mode is the modem mode (where an external modem is used). For the farend responder primary mode, the secondary mode is the ROTL test set mode. When the primary mode is 2-wire, the secondary mode may be executed simultaneously. For example, the primary mode may be farend responder where incoming calls are accepted for 105 tests, and the secondary mode allows the user to place calls to ROTLs for control of testing. In this mode, it is possible to call a remotely located ROTL and direct it to

place a call to the responder in the 1077B. When the primary mode is either ROTL test set or nearend responder, a modem may be used for accepting remote control commands directing operation of the primary mode. The method of initiating and controlling various modes is described in more detail in the following sections.

A. Nearend Responder Mode

6.02 As a nearend responder, the 1077B is capable of seizing a trunk or a line circuit, outputting a farend test line number, detecting farend answer tone, and conducting one- and two-way transmission tests. The trunk may be 2-wire loop start, 2-wire sleeve ground start, 2-wire E&M, or 4-wire E&M. E&M signaling may be Type I or Type II. The line circuit may be 2-wire loop start or 4-wire E&M (some types of switches only). When operating in an automatic mode, outputting progresses after some type of start sending signal is received. On line circuits, the signal is usually dial tone. For trunks, the signal may be a wink start, battery reversal, or a simple time delay. Outputting types include dial pulse, DTMF, MF, or SF. The farend test line may be a 100 or 102 test line, 105 responder, or an APC 1020B Combination Test Line.

Mode Selection

6.03 Mode selection is used to specify nearend responder operation. Choices include 2- or 4-wire nearend. If 2-wire is selected, the secondary operating mode may be modem. There is no secondary operation possible in the 4-wire mode. A modem, if connected, is automatically active in the 2-wire nearend mode. The terminating circuit must be a line circuit and ringing detection is used to recognize an incoming call. The incoming sleeve is not used because it is required for the 2-wire E&M trunk supervision.

Trunk Selection

6.04 Trunk selection specifies which type of originating trunk and supervision are used in the nearend mode. If the 4-wire nearend mode is used, the trunk must be a 4-wire E&M trunk. Supervision may be specified for the trunk for detection of start dial sequence and may include wink start, dial tone detection, or timed delay. For the 2-wire nearend mode, the trunk may be a line circuit, a 2-wire loop start trunk, or a 2-wire E&M trunk. Supervision may be specified as wink start, dial tone detection, battery reversal, or a timed delay. The supervision requirements specified in this manual must be met before outputting can proceed during automatic operation. For E&M type signaling, additional selections are allowed to specify Type I or II supervision, and whether the 1077B appears as a trunk circuit or a signaling circuit. Type I or II selection controls whether the supervision leads are single ended or looped. Single ended leads supply battery and ground; looped leads provide simple contact closures. The trunk circuit or signaling circuit selection essentially specifies if battery or ground is to be provided on the M lead and sensed on the E lead.

Trunk Seizure

6.05 Trunk seizure is attempted when the switch hook button is depressed or when starting an automatic sequence. For a 2-wire loop trunk, the sleeve lead (M lead) is first examined for presence of ground. If present, the trunk is busy and seizure will not proceed. For all trunk types, the M lead is activated (battery, ground, or closure), and for loop start trunks the hold coil is closed. Next, the 1077B waits to detect start dial supervision. This may be a wink returned on the E lead, a battery reversal for loop trunks, dial tone on line circuits, or a fixed time delay.

Outpulsing

6.06 The farend test line number is entered into the ACCESS field. Up to 30 digits may be entered with pauses, signaling changes, and special digits. Outpulsing may be DP, DTMF, MF, SF, or a combination of these. Pauses may be time delays or detection of secondary supervision. The entire field will be outpulsed when the SEND key is depressed or after detection of start dial supervision in the automatic modes.

Farend Detection

6.07 The farend test line will answer with a tone signal, which may be the test tone for 100 or 102 test lines. The 105 responder answers with 2225 Hz (TPT). The 1077B will detect either tone, and when in automatic, will adjust test requirements to match the proper test line.

Prep Digit

6.08 The prep digit, in the nearend mode, governs the impedance, test level point, and farend test line type for the 1077B. Impedance may be 600 or 900 ohms, TLP may be 0 or -2 dB, and the test line may be 100, 102, or 105. The digit is not transmitted to the farend but is interpreted internally to govern test interface requirements. The test line type governs the farend answer tone expected and whether tests will be one- or two-way.

Test Selection

6.09 Test selection allows entry of any or all of the possible transmission tests allowed by the 1077B, and the selection of responder self-checks, actual measurements, or both. In the manual mode, tests are run one at a time each time the START TEST key is depressed. In automatic modes, all tests are run in succession.

Testing

6.10 When the farend test line is accessed, testing may be begun. When in manual mode, testing is initiated with the START TEST key. In automatic, testing begins as soon as farend answer tone supervision is satisfied. Test results for both directions are displayed.

Test Completion

6.11 When testing is complete, the RELEASE key may be used to send the MF release command to the farend 105 responder to initiate its hangup and reset. The SW HOOK (switch hook) key may be used to drop the trunk or line connection.

Automatic

6.12 The automatic mode is initiated by the AUTO key. This key causes all steps required for the nearend test sequence to be sequenced automatically. If an error is encountered during the sequence, the 1077B halts and the error code is displayed. In addition, when operating in the remote mode, automatic operation is always in effect.

Printer

6.13 If the user's printer is attached to the RS-232 port, all test results are logged 'on the fly' as tests are being performed. When remote control is in effect, results are sent to the RS-232 port or modem, depending on the source of the remote control device. Data formatting has various options depending on the type of controlling device receiving data.

B. Farend Responder Mode

6.14 As a farend responder, the 1077B is capable of receiving incoming calls on a trunk or line circuit and providing the full set of tests defined for a Code 105 test line

responder. The incoming circuit may be a 2-wire ringing activated line circuit, a 2-wire trunk with sleeve ground start, a 2-wire E&M trunk, or a 4-wire E&M trunk. When an incoming call is detected, the 1077B provides DC answer supervision, and after a timed delay, returns TPT to the caller. Answer supervision may include loop closure on 2-wire circuits, and activation of the M lead for all circuit types. Testing procedures are controlled by the remotely located nearend device. Test termination may occur after a timeout condition or upon receipt of a release MF command. When termination occurs, the 1077B is ready to receive another call.

Mode Selection

6.15 Mode selection specifies the farend responder operation. Choices include 2-wire and 4-wire farend. If 2-wire is selected, the secondary operating mode may be ROTL test set. There is no secondary operation possible in the 4-wire mode. The farend operating mode is automatic and the keyboard is used to control the ROTL test set secondary mode. If remote control is active through the local RS-232 port, it applies to the ROTL test set secondary mode. The originating circuit used for the ROTL test set must be a loop start line circuit. The E&M leads are reserved for the farend mode terminating circuits. Any incoming call will be answered automatically and connected to the 1056B responder for the farend mode.

Trunk Selection

6.16 Trunk selection specifies which type of terminating trunk and supervision are used in the farend mode. If 4-wire farend is used, the trunk must be 4-wire E&M. For the 2-wire farend mode, the trunk may be a line circuit, a 2-wire loop start trunk, or a 2-wire E&M trunk. Incoming calls are recognized by ringing across

tip and ring, or by activation on the E lead (either battery or ground). E&M may be Type I or II, and the 1077B may appear as a trunk circuit or a signaling circuit.

Manual Activation

6.17 The farend mode of the 1077B may be activated manually by depressing the SW HOOK key if the ROTL test set secondary mode is not enabled. When this occurs, the 1077B goes offhook as determined by the trunk type, sends TPT, and waits for an MF test command. This mode is terminated either by again depressing the SW HOOK key, by receipt of a release MF or by timeout.

Automatic

6.18 The 1077B farend mode defaults to automatic operation simply by selecting the farend mode. In automatic mode, the 1077B will accept an incoming call, connect the 1056B responder, perform tests, and reset. This mode will continue until overridden by a mode change, or by being pre-empted by a pushbutton or remote control command.

C. ROTL Test Set Mode

6.19 The ROTL test set mode allows the access and control of a ROTL to perform trunk testing. The ROTL may be remotely located and accessed by dialing over the network, or may be local to the 1077B with a patch cord connection. The ROTL test set mode always operates on a 2-wire basis. The testing sequence includes accessing the ROTL, sending priming to specify the test type, trunk address, and farend test line number, monitoring the progress of the call, and sending MF test commands and interpreting the resulting data. When the ROTL is remotely located, the 1077B will originate a call on a 2-wire line circuit with loop closure seizure. The access number for the ROTL will be

outputted in DP or DTMF. A 2225 Hz detector is used to detect the ROTL TPT answer tone. Priming is sent in MF digits. The FSK data returned is decoded and the results are formatted for display and printing. After each trunk is tested, the ROTL is recycled and the connection is maintained for the next test. After all testing through this ROTL is complete, the disconnect tone is sent to the ROTL and the connection is dropped.

Mode Selection

6.20 Mode selection is used to specify the ROTL test set mode. The secondary mode may be modem or farend. The originating circuit is a 2-wire loop start line circuit and the terminating circuit is a 2-wire ringing activated line circuit.

Trunk Selection

6.21 Trunk selection has no effect in the ROTL test set mode because both the originating and terminating circuits must be line circuits.

Call Origination

6.22 The SW HOOK button initiates seizure of the originating line circuit. The hold coil is closed across tip and ring and the 1077B listens for dial tone. Dial tone is detected by 1 second of constant energy greater than -30 dBm. When dial tone is detected, outputting may proceed.

Outputting

6.23 The ROTL access number is entered into the ACCESS field. Up to 30 digits may be entered including pauses, signaling changes, and special digits. Outputting may be DP or DTMF, or a combination of the two. Pauses may be time delays or detection of secondary dial tones. The entire field will be outputted when the SEND key is depressed or after the

detection of the first dial tone in the automatic mode.

ROTL Detection

6.24 TPT answer tone is used to detect when the ROTL answers the call and is ready to accept priming. In automatic operation, the 1077B will wait up to 1 minute for the call to complete.

Priming

6.25 The priming digits specify to the ROTL the type of test, trunk address, and the farend test line number and type, and are entered in the PRIME field. Up to 30 digits may be entered and outputting is always MF. Blanks may be inserted for readability and pauses may be inserted for single digit tone delays (i.e., #5 XBAR). KP and ST are automatically inserted at the beginning and end of the field. The entire field is outputted when the SEND key is depressed or as required in the automatic mode.

Trunk Seizure

6.26 After priming is sent, the ROTL attempts to seize the trunk. If successful, it returns TPT. If not, it sends busy or reorder. In automatic mode, the 1077B detects the disposition and proceeds accordingly.

Farend and Nearend Responders

6.27 If trunk seizure is successful, the ROTL sends TPT to Control and the farend test line number is outputted. When the farend answers, it sends a tone (2225 or 1004 Hz, depending on the type of farend) which is detected by and retransmitted to the controller by the ROTL. The ROTL will then attach its responder (nearend) and transmit a final TPT to Control. Testing may now proceed. The 1077B (controller) detects these TPTs (test progress tones) and proceeds

automatically in the automatic mode. The operator must control the START TEST function in the manual mode.

Prep Digit

6.28 The prep digit is sent to the ROTL before each test command to set the test line type, impedance, and test level point for the ROTL. Test lines may be 100, 102 or 105; impedance may be 600 or 900 ohms; and TLP may be 0 or -2 dB. The test line type governs whether the tests are one-way or two-way and which tests may be run.

Test Selections

6.29 Test selection allows the entry of any or all of the possible transmission tests allowed by the 1077B, and the selection of responder self-checks, actual measurements, or both. In the manual mode, tests are run one at a time each time the START key is depressed. In automatic modes, all tests are run in succession.

Testing

6.30 When both responders are connected to the trunk, testing may proceed. In manual mode, testing is initiated with the START key. In automatic, testing proceeds after the last TPT. Test results for both directions are displayed and sent to the RS-232 port.

Test Completion

6.31 Tests are completed with either the release or recycle command. Release is sent to both responders to cause them to drop the trunk and prepare for another call. Recycle causes the ROTL to drop the trunk and the nearend responder. In either case, the ROTL is prepared to receive new priming.

Note: Release should always be used prior to recycle in the manual mode.

Disconnect

6.32 When the SW HOOK key is depressed, the disconnect tone is sent to the ROTL and the access line is dropped.

Automatic

6.33 The automatic mode is initiated by the AUTO key. This causes all steps required for the ROTL test sequence to be performed automatically. If the 1077B encounters an error, it is displayed and the sequence is halted. The sequence also halts after test results are complete to allow entry of new priming. When under remote control, automatic operation is always in effect.

Printer

6.34 If the user's printer is attached to the RS-232 port, all test results are logged 'on the fly' as tests are performed. When remote control is in effect, results are sent to the RS-232 port or a modem, depending on the source of the remote control device. Data formatting has various options depending on the type of controlling device receiving the data.

7. Remote Control

7.01 Remote control may be used to control the nearend and ROTL test set modes. It allows entry of mode selections, trunk types, access numbers, priming, test selections, etc. It allows anything that can be entered from the key panel and some additional features. It also allows initiation and termination of test sequences. Testing always proceeds automatically, and test results and error codes are returned to the remote controller.

7.02 Remote control may be initiated through the local RS-232 port or through a modem. The local port always

has priority. Test results are sent to the local port and may also be sent to a modem. Test commands and results may

be buffered in internal RAM for later execution and printing.

APC 1077B
MANUAL INTERROGATOR

OPERATION

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1. General

1.01 This section contains detailed operating instructions for the 1077B Manual Interrogator. Operation of the control panel is explained, followed by step-by-step, typical operating sequences; several paragraphs on external connections; and priming format tables for switches supported.

1.02 Before reading this section on operation, it is recommended that the user refer to Part 3, Typical Operating Sequences, and with the 1077B, follow the steps as described. Performing a typical sequence first

will help in understanding the operating instructions.

1.03 Whenever this section is re-issued, the reason(s) for reissue will be listed here.

1.04 Comments concerning the content or organization of this document, as well as suggestions for improvement are welcomed. Direct comments to:

Test & Measurement Systems/3M
Lab - Technical Communications
P O Box 2963
Austin, TX 78769-2963
512/834 1800

1.05 The operator controls the 1077B with the keyboard and display panel (refer to Fig. 2-1).

1.06 The keyboard is divided into sections according to the type of key. There are four basic types of keys:

a) Edit keys: used to affect some change in the display.

b) Numeric keys: used to enter a string of numbers (0-9) into the display.

c) Display keys: used to display numeric fields and other parameters.

d) Function keys: used to cause action to occur.

1.07 The four basic types of keys create several categories and include all of the keys on the 1077B as shown in Fig. 2-2. A quick reference of the display and function keys are as follows:

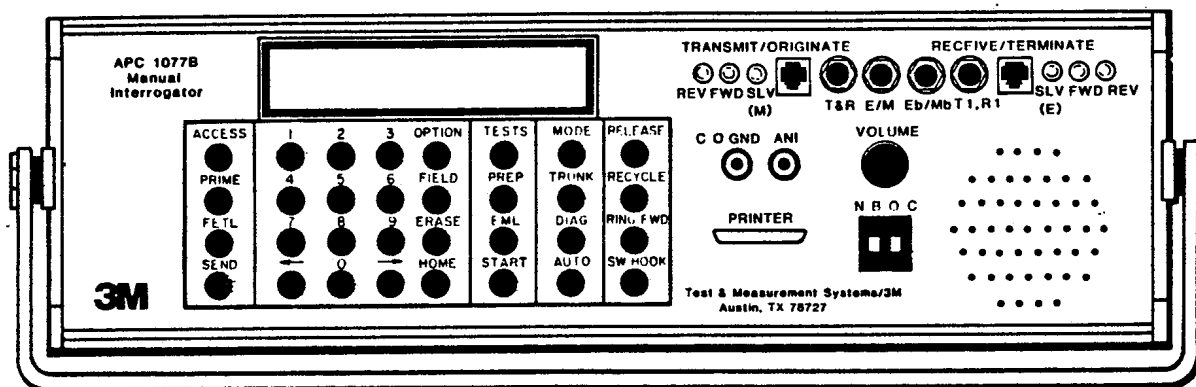
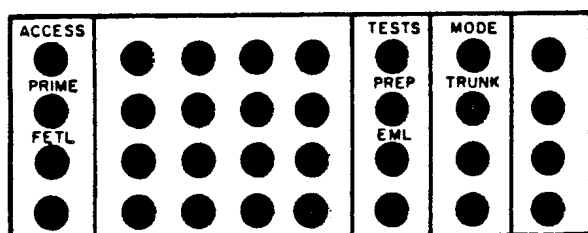


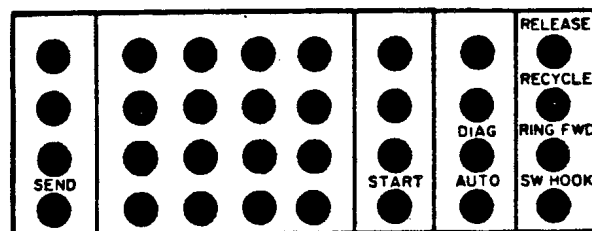
Fig 2-1 -- Operator Controls

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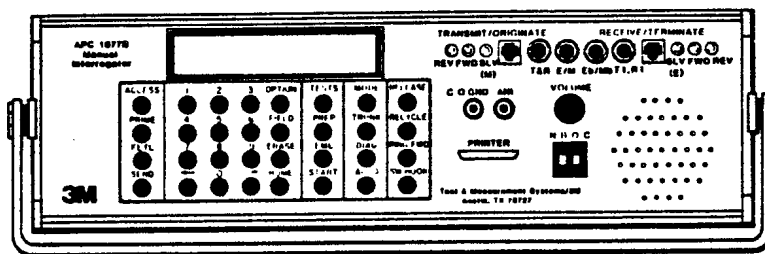
Display Keys			
ACCESS	Trunk address digits or ROTL access number	RELEASE	Causes responders to hang up
PRIME	ROTL priming digits	RECYCLE	Causes ROTL to abort current activity
FETL	Farend test line number	RING FWD	Sends 1300 Hz 0.1 second to ROTL
TESTS	Loss, noise, noise-with-tone, ERL, SRL, SRH. Self-checks are also included.	DIAG	Initiates 1077B self tests
PREP	600/900 termination, 0/-2 dB TLP and test line type	<p>1.08 The data shown in the display will correspond to the last function entered from the keyboard. Typical data includes the various operating mode selections, the access number and priming field numeric entries, general testing parameters and setups, and the results of the transmission test measurements. For each major keyboard function, the entire field will be displayed, but only one function will occupy the display at one time.</p>	
EML	Expected measured loss (measurement loss limits)		
MODE	Farend, nearend, and ROTL test set (2- and 4-wire)		
TRUNK	Supervision and signaling method for trunk under test		
Function Keys			
SEND	Initiates outpulsing of Access, Prime, and FETL	<p>1.09 All operating parameters and numeric entry fields are stored in the internal memory and may be recalled for use or display at any time.</p>	
START	Initiates transmission tests		
AUTO	Initiates automatic operation	<p>2. Detailed Operation</p>	
SW HOOK	Causes the unit to go on and off hook. Sends release or disconnect automatically depending on mode.	<p>2.01 This Part describes the detailed operation of the 1077B and is essentially a tour through the keyboard. TABLE 2-1 lists the keys in the various categories.</p>	



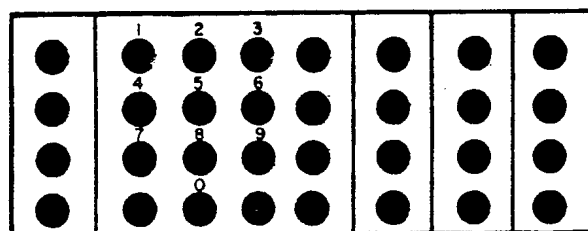
DISPLAY



FUNCTION



NUMBER



EDIT

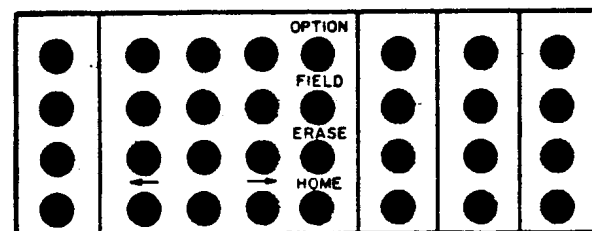


Fig. 2-2 -- Key Types

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TABLE 2-1 KEY TYPES			
DISPLAY	FUNCTION	NUMBER	EDIT
ACCESS	SEND	0	
PRIME	START	1	<-- (CURSOR LEFT)
FETL	AUTO	2	--> (CURSOR RIGHT)
TESTS	RELEASE	3	OPTION
PREP	RECYCLE	4	FIELD
EML	RING FWD	5	ERASE
MODE	SW HOOK	6	HOME
TRUNK	DIAG	7	
		8	
		9	

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A. Edit Keys

2.02 Edit keys are used to change items in the display. There are six edit keys. The ERASE, HOME, <--, and --> keys are used consistently among the various display selections. The OPTION and FIELD keys are for editing test parameters. They are associated with the display keys.

Left and Right Cursor (<--, -->)

2.03 The cursor keys are used to move the blinking cursor to the left or right within a display. They are used with all the display keys except the MODE key. The cursor may be a dot, period, or a sequence of dots which are blinking. Pressing the <-- or --> keys will move the cursor to the left or right by one position. In numeric displays, the cursor will blink the digit that may be changed or entered. On other displays, the cursor will blink the selection being modified. Within the numeric displays, a digit may be entered or changed at the cursor position and the cursor will move one position to the right. For long fields (mainly in ACCESS, PRIME, and FETL), the items in the display may also scroll to the left as additional items are added to the right. The cursor keys will repeat if held depressed.

Home

2.04 The HOME key moves the cursor to the left-most position of the display and moves the displayed field to its original position if it has been scrolled.

Erase

2.05 The ERASE key, in numeric fields, deletes all characters at and to the right of the cursor. For other fields, it restores the original default selection as if no change had been made to the field.

Field and Option Keys

2.06 The FIELD and OPTION keys are used to select various options from the menus displayed. Their operation depends on which menu occupies the display. Refer to TABLE 2-2 for a summary of the FIELD and OPTION keys.

B. Numeric Keys

2.07 The ACCESS, PRIME and FETL fields are used for the various outputting requirements of the 1077B, and each may contain up to 30 digits and special digits.

2.08 The number keys (0-9) are used for digit entry (ACCESS, PRIME, and FETL). The number entered will appear at the cursor position and the cursor will advance to the right. When the cursor reaches the right end of the display, the contents of the display will scroll to the left and entry may continue up to the maximum size of the field. Blanks may be inserted anywhere in the field by advancing the cursor (-->) past a position with no entry. Blanks are for readability and have no other effect.

C. Display Keys

Access

2.09 The access field contains either the trunk address and farend test line number when in the nearend mode, or the ROTL access number when in the ROTL test set mode. The entire field is stored internally and may be recalled at any time for editing or outputting. Only 16 digits are displayed at any given time and the remaining digits are displayed by scrolling the field to the left or right as required.

2.10 The right-most two characters of the display contain the initial signaling mode to be used when outputting begins. The signaling mode

TABLE 2-2
SUMMARY OF OPTION AND FIELD KEYS

OPTION key functions

a) Used to enter or change a special digit in:

- 1) ACCESS
- 2) PRIME
- 3) FETL

b) Used to select a menu. Each menu usually contains multiple items. When used with:

- 1) MODE - Eight modes of operation
- 2) TRUNK - Six trunk configurations and five signaling methods.

Note: Use <-- and --> to select trunk and signaling indicated by blinking dots (cursor).

- 3) TESTS Choice of nine tests for each position. Up to seven positions in the display. Use <-- and --> to advance to these positions.
- 4) PREP Three positions (<-- and --> to advance). First position is 600 or 900, second position is 0 or -2 dB, and third is 100, 102 or 105.
- 5) EML Used to change the + or - sign of the limits. Use <-- and --> to advance.

FIELD key functions

a) Used to select the outpulsing method in:

- 1) ACCESS (TT/SF/MF/DP)
- 2) FETL (TT/SF/MF/DP)

b) Used to select tests run when the TESTS key is depressed:

- 1) SELF-CHECK (S C)
- 2) MEASUREMENTS (MEAS)
- 3) BOTH

c) Used to select test limits in EML:

- 1) LOSS
- 2) NOISE
- 3) N/T
- 4) L04
- 5) L10
- 6) L28
- 7) ERL
- 8) SRL
- 9) SRH

Note: The FIELD key is not used for MODE, TRUNK, PREP and PRIME.

can be changed by depressing the FIELD key. The outpulsing mode may also be changed midstream by including the special digits embedded within the digits. Special digits are defined in TABLE 2-3.

2.11 The access number may contain digits, extended digits, supervision pauses, and signaling changes. Anything other than the digits 0-9 are referred to as special digits. Normal digits are entered directly with the number keys. Special digits are entered by the OPTION key.

2.12 ERASE, HOME, -->, and <-- operate as described in 2.03 through 2.05. The FIELD key is used to change the initial signaling mode.

2.13 The OPTION key is used, in conjunction with other keys, to enter special digits. If the cursor is presently positioned at a special digit, depressing this key changes the special digit to the next special digit in sequence. Successively depressing the OPTION key will cycle through all of the special digits. There are currently 17 special digits listed in TABLE 2-3 and they are listed in the order in which they occur.

TABLE 2-3
ACCESS SPECIAL DIGITS

DIGIT	MEANING
SUPERVISION PAUSES .	
.	wait for dial tone
,	pause 1 second
W	wait for wink
Q	wait for quiet
SIGNALING CHANGES	
/	change to dial pulse
+	change to DTMF
-	change to SF
K	change to MF and send KP
S	change to DTMF and send ST
F	insert FETL during outpulsing
EXTENDED DIGITS	
*	DTMF 941,1209
#	DTMF 941,1336
A	DTMF 697,1633
B	DTMF 770,1633
C	DTMF 852,1633
D	DTMF 941,1633
@	DTMF 941,1633 continuous duration
	space, no effect
Note: Digits are selected by depressing the OPTION key.	

2.14 The FIELD key is also used to change the initial dialing mode. If the cursor is not at a special digit, the FIELD key will cycle the dialing mode through TT, DP, MF, and SF.

Prime

2.15 The prime field contains the ROTL priming digits. Digits are entered with the number keys. KP and SP are inserted automatically upon outputting and are not entered by the operator. Outputting is always MF. The FIELD key has no effect in the prime field. The other edit keys work as normal.

FETL (Farend Test Line)

2.16 The FETL field may contain supplemental digits that can be inserted in the outputting of the access field, or any other digits that are to be outputted manually. When an 'F' is encountered in the access field, the FETL is outputted, and then the access outputting is resumed. The FETL field may be outputted by itself manually at any time by displaying the field and depressing the SEND key.

Tests

2.17 The test fields control transmission test and result interpretations. These fields include TEST, PREP, and EML.

2.18 The test key allows the entry of the tests to be run and the sequence in which they will be run. Up to nine separate test selections are allowed. The display only shows three tests at a time. The <-- and --> keys must be used to see the other six tests. This field also specifies whether measurements, self-checks, or both are to be run.

2.19 Test selections are listed in TABLE 2-4. A particular test is selected by the OPTION key or by a number. When the OPTION key is depressed, the displayed test is changed to the next one in the order listed in the table. The cursor does not advance after OPTION is depressed. If a number (1 through 9) is entered, the test corresponding to that number in the table is selected, and the cursor automatically advances to the next selection. The field will alternate the far right of the display among MEAS, S.C., and BOTH. The right and left cursor keys are used to move around among the nine test fields. The fields will scroll through the display because only three tests may be shown at any time. The HOME key moves to the first test selection, and the ERASE key resets the display to the initial value of LOSS, NOISE, and MEAS.

Prep

2.20 The prep field allows the selection of impedance (600 or 900 ohms), test level point (TLP 0 or -2 dB), and farend test line type (100, 102, or 105). The OPTION key is used to alternate among the selections at the cursor position. Alternatively, the number keys may be used to force a particular selection at the cursor position. When the number keys are used, the cursor advances automatically. The number keys correspond to the significant digit of the selection:

6 = 600 ohms
9 = 900 ohms

0 = 0 dB
2 = -2 dB

0 = 100 type test line
2 = 102 type test line
5 = 105 type test line

The cursor keys move among the display fields. HOME moves the cursor to the left position, and ERASE resets the

TABLE 2-4 TEST CODES		
TEST	CODE	DESCRIPTION
LOSS	1	loss at 1004 Hz, 0 dB
NOIS	2	C-message noise
N/T	3	C-notched noise
L04	4	gain slope at 404 Hz, -16dB
L10	5	gain slope at 1004 Hz, -16dB
L28	6	gain slope at 2804 Hz, -16dB
ERL	7	echo return loss mid band
SRL	8	singing return loss low band
SRH	9	singing return loss high band

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selection to the initial value of 900, 0, 105. Field has no effect.

2.21 If in ROTL test set mode, the prep digit is sent to the ROTL to set its circuits as specified. If in nearend mode, the prep field is interpreted internally. For 100 and 102-type test lines, the tests are one-way and only one result is displayed.

EML

2.22 The EML fields allow entry of optional limits to be applied to test results. When the limits are in effect, test results are compared to the limits for pass or fail. An audible feedback signal may be generated to indicate the limit status and the test may be repeated if limits are exceeded (paras. 2.47 and 2.48). The FIELD key is used to position the limit selection for each test. Tests are LOSS, NOIS, N/T, L04, L10, L28, ERL, SRL, and SRH. The OPTION key changes the sign of the selection (+ or -). The number keys allow entry of a specific value for each test. Test value units are as follows:

Loss-type tests (LOSS, L04, L10, and L28) are in units of .1 dB.

Noise-type tests (NOIS, N/T, ERL, SRL, and SRH) are in units of 1 dB.

The right and left arrows move among the four sets of numbers for each test.

2.23 The first pair of numbers represent the low and high limits for the far-to-near measurement for the test. The second pair represents the near-to-far measurement. When the far-to-near limits are entered, they are copied to the near-to-far, so that the initial setting is such that the limits for both directions are the same. If a different set of limits is desired for near-to-far, the right arrow positions the cursor to the second pair of numbers and the limits can be entered. Each limit represents a lower and upper limit for the test result. If the result is greater than or equal to the first number and less than or equal to the second, the test passes. Otherwise, it fails.

Note: Loss-type tests are negative numbers (-5.0 equals 5 dB of loss), so that the test limits must be entered as negative numbers, with the greater loss entered first (since it is the most negative

number). For noise-type tests, 0 would be appropriate for the lower limit, as less noise is always desirable. For ERL-type tests, 99 would be appropriate for the upper limit because more return loss is always desirable. The default limits for each test are set to the range of valid results for that test, and the ERASE key will reset all limits to this value and disable the audio feedback tone.

Mode

2.24 The MODE key allows entry of the primary and secondary operating modes of the 1077B. The valid mode combinations are always displayed in pairs, and the available modes are listed in TABLE 2-5. The first entry of each pair is the primary mode and the second is the secondary mode. The OPTION key alternates among the paired selections. The number keys select the pairs as listed in TABLE 2-5. The FIELD and cursor keys are not used.

Trunk

2.25 The TRUNK key allows entry of the trunk type for the primary operating mode and specifies the supervision requirements for the trunk. The secondary mode, if active,

is always a 2-wire loop start line circuit. The first trunk selection allows LINE, LOOP, and four types of E&M. E&M may be Type I or Type II, and each of these may be referenced to as a trunk circuit (TK) or a signaling circuit (SG). The second trunk selection allows entry of the supervision requirements that must be met when the trunk is seized and before dialing may proceed. These selections include dial tone, wink start, timed delay, immediate dial, or quiet. The OPTION key alternates among the selections at the cursor position, and the cursor keys move the cursor left and right. Alternatively, a number key may be used to force a particular option as listed in TABLE 2-6 and the cursor will automatically advance when a number key is depressed. The FIELD key has no effect.

D. Function Keys

Send

2.26 The SEND key is used to manually initiate outpulsing. It will send the ACCESS, PRIME, or FETL field, whichever is in the display. Once outpulsing is initiated, it will continue until the field is complete or

TABLE 2-5
OPERATING MODES

PRIMARY	SECONDARY	CODE	DESCRIPTION
FAREND	ROTLTS	1	2 wire farend, secondary ROTL test set
FAREND	2W	2	2 wire farend, secondary none
FAREND	4W	3	4 wire farend, secondary none
NEARND	2W	4	2 wire nearend, secondary none
NEARND	4W	5	4 wire nearend, secondary none
NEARND	MODEM	6	2 wire nearend, secondary MODEM
ROTLTS	2W	7	2 wire ROTL test set, secondary none
ROTLTS	MODEM	8	2 wire ROTL test set, secondary MODEM
ROTLTS	FAREND	9	same as FAREND, ROTLTS

TABLE 2-6
TRUNK TYPE CODES

TRUNK TYPE CODE		DESCRIPTION
LINE	1	SUBSCRIBER LINE
LOOP	2	LOOP TRUNK
E&M I TK	3	E&M TYPE I TRUNK CIRCUIT
E&M I SG	4	E&M TYPE I SIGNALING CIRCUIT
E&M II TK	5	E&M TYPE II TRUNK CIRCUIT
E&M II SG	6	E&M TYPE II SIGNALING CIRCUIT

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until an error is encountered. Errors occur when a required supervision event is not satisfied. If this occurs, depressing the SEND key again will continue where the error was detected. To restart from the beginning, depress the DISPLAY key for the field before depressing SEND again. In the automatic modes, the SEND key is not used. However, outpulsing occurs exactly as described in the following paragraphs.

2.27 Outpulsing begins in the initial signaling mode specified in the right-hand end of the display. The initial supervision requirements for the trunk type specified are satisfied when the SW HOOK key is depressed (see para. 2.41). After outpulsing begins, signaling modes and supervision requirements are specified by the special digits in the number field being sent.

2.28 Signaling modes include DTMF, MF, SF, and DP.

- a) DTMF (touch tone) digits are sent 10 digits per second with 50 ms tone and 50 ms quiet.
- b) MF (2 of 6) is sent 6.7 digits per second with 75 ms tone and

75 ms quiet, except for KP, which is 110 ms long.

- c) SF (2600 Hz pulses) and DP (dial pulse) are sent at 10 pulses per second, 60 ms tone or make, 40 ms quiet or break, with 800 ms interdigit time.

2.29 In all modes, the quiet and interdigit times precede the digit being sent. When changing to a different mode, the quiet time is governed by the mode being changed to. The 'K' and 'S' special digits serve the dual function of changing signaling modes and sending the specified digit. All other change digits (/ , - , and +) simply change modes and perform an interdigit delay.

2.30 Two examples of where signaling changes would be used include a 'non-senderized' maintenance port on a tandem switch, and a dial pulse PABX accessing outside services. In the first case, DTMF signaling would be used to access a specific trunk and then MF or SF signaling would be required to outpulse on the trunk. In the second case, DP would be required to access an outside circuit and then DTMF would be used to complete the call.

2.31 Supervision changes are used to satisfy a secondary event before outpulsing continues. These include '.' (wait for dial tone), 'W' (wait for wink), 'Q' (wait for quiet) and ',' (pause for one second). A one second pause is unique in that no requirements for continuation are specified, and the circuit is not monitored for supervision or tone during the pause. This delay would typically be used to allow circuit cut-through during a multistage call. The other four require satisfaction before proceeding.

2.32 Wait for dial tone requires that a tone of at least -30m dB be present for one second without interruption. There are no frequency or amplitude characteristics required of the tone. The 1077B will wait up to 4 seconds for the dial tone before declaring error. During this time, the circuit is also monitored for busy, reorder, or voice announcement. Busy tone is at 60 IPM (interruptions per minute), reorder is 120 IPM, and voice is any four tone bursts longer than 150 ms occurring in 4 seconds or less. If any of these responses are detected, or a time-out occurs, an error is declared.

2.33 Wait for wink requires a supervision change on the E lead, or battery reversal. The change is from onhook to offhook and back to onhook. Onhook is idle on the E lead or forward battery. The wink must be minimum 200 ms and maximum 500 ms. The wink must occur in 4 seconds or an error is declared. The circuit is not monitored for tone while waiting for the wink.

2.34 Wait for quiet requires that the circuit be free of tone for 2 seconds. This is used only where abnormal responses are provided. Busy, reorder, and voice announcement are detected.

Start

2.35 The START key is used to initiate transmission tests. In manual operation, one test is performed each time the START key is depressed. In automatic, the START key would not normally be needed. If the testing sequence is reached in the automatic mode, depressing the AUTO key again will cause testing to repeat continuously.

2.36 Tests are run in the order entered with the test display. When the last test is run and the START key is depressed again, the test cycle is repeated. This also applies to continuous operation. The tests may represent responder self-checks, actual measurements, or both. If BOTH is specified under the tests display, the self-check immediately precedes its measurement.

Auto

2.37 The AUTO key initiates automatic operation. The 1077B will sequence all required actions to perform a complete transmission test. The sequence will stop after the tests are complete in the nearend mode or after a RELEASE or RECYCLE in the ROTL test set mode. If an error occurs, the sequence will stop and the cause displayed. Automatic operation may be initiated anywhere in the sequence and the 1077B will continue from the appropriate step. If transmission tests are being performed, depressing the AUTO key will cause the tests to run continuously until another key is depressed.

Release

2.38 The RELEASE key sends the release MF digit to the responders to cause them to hang-up, drop the trunk, and prepare for additional calls.

Recycle

2.39 RECYCLE sends 1 second of 1300 Hz to the ROTL to cause it to abort whatever is in progress, drop the trunk, and prepare for new priming.

Ring Forward

2.40 The RING FWD key sends 1300 Hz for 100 ms to the ROTL to control the 103 operational test line sequence. It is also used to initiate the EOTT (extended operational trunk test) feature of #5 XBAR switches. If a valid FSK signal is received after the ring forward is sent, it is decoded and its duration in ms is displayed. This number may be looked up in a table (customer supplied) to determine the EOTT results.

Switch Hook

2.41 The SW HOOK key controls the supervision of the 1077B. When idle, switch hook causes the 1077B to go offhook and seize a trunk. Otherwise, it goes onhook to drop the trunk. It automatically sends a release or disconnect tone when appropriate.

2.42 Trunk seizure depends on the trunk type specified and the supervision required before dialing. For a line circuit, the hold coil is closed across tip and ring and the 1077B checks for supervision. For a 2-wire loop trunk, the M lead, being used as the sleeve, is first checked for presence of ground. If so, the trunk is busy and processing halts. Otherwise the sleeve is grounded and the hold coil is closed across tip and ring, and supervision is checked. For E&M trunks, the M lead is transferred from idle to active as governed by the trunk type and supervision is checked. In all of the above cases, satisfying the supervision requirements will cause the offhook sequence to be complete so that automatic operation may proceed.

2.43 The supervision requirements in the trunk type govern what the 1077B looks for after going offhook. If dial tone is required, there must be a signal greater than -30 dBm on the line (or trunk) for a constant duration of one second. If wink start is required, there must be a supervision change on the E lead for E&M trunks, or on the EC lead a battery reversal for loop trunks. The wink is a transition to the offhook state for a minimum duration of 200 ms, followed by a transition back to onhook. The 1077B detects the transition to offhook and then waits 400 ms before proceeding. This allows a simple reverse battery supervision change to be interpreted as a wink also. If time delay is specified, the 1077B waits two seconds before proceeding. For immediate dial, a 400 ms delay is executed before proceeding. If quiet is required, there must not be any tone on the trunk for two seconds before proceeding. This allows for the case where an exception condition such as busy or reorder may be detected, but the absence of any exception means to proceed.

2.44 If the supervision requirement in the trunk is left blank, it defaults to any. This allows for the detection of either dial tone or a supervision reversal. This is the default selection and would be appropriate in most cases.

2.45 Going onhook causes all supervision to release, releasing the trunk or line circuit. A two second delay is initiated before any other function may occur in automatic operation. If a far-end responder was accessed, the release MF is sent before going onhook. If a ROTL was accessed, the two second 1300 Hz disconnect tone is sent before hanging up.

Diagnostics

2.46 The DIAG button initiates the internal self-testing feature of the 1077B. The set of automatic self

tests that are executed at power up is initiated. Then the keyboard may be used to run additional diagnostics or to repeat a particular test. There are 16 tests corresponding to the numeric keypad. Tests 0 through 9 are run automatically where the success of the test can be verified by the internal circuitry, and the remaining 6 tests corresponding to the edit keys must be manually initiated with results being determined by the operator. A summary of the tests run are in TABLE 2-7.

E. Audio Feedback Tones

2.47 During testing, two audio feedback tones are generated for each test to indicate whether measurements are within limits. The first tone indicates far-to-near results and the second is near-to-far. There are

four tones that represent measurement status:

- 1004 Hz - within limits
- 1500 Hz - above limits
- 666 Hz - below limits
- 'bonk' - limits were specified incorrectly

2.48 The EML fields specify pass/fail limits for tests. If limits are specified, each test result is compared with its limit and if it fails, the test is repeated once immediately before the results are sent to the RS-232 port. Also, if not under remote control, a tone is 'beeped' to indicate high, low, or acceptable. If the 1077B is placed in continuous testing, the tones could be used for audio feedback while adjusting the trunk circuit.

TABLE 2-7
DIAGNOSTICS

0 - RAM	8 - FUTURE
1 - ROM	9 - FUTURE
2 - TIMER	<-- - DISPLAY
3 - ENVELOPE DETECTOR	--> - KEYBOARD
4 - TONE DETECTOR	FIELD - FSK SET
5 - FSK DECODER	OPTION - FACTORY CALIBRATION
6 - RESPONDER SELF-CHECKS	ERASE - BAUD RATE
7 - FUTURE	HOME - FUTURE

Note: To exit keyboard test, enter -> twice ('bonk').

053085-161

3. Typical Operating Sequences

A. Nearend Responder 2-Wire Mode

3.01 The following information describes an example operating sequence of the 1077B when serving as a 2-wire nearend responder on a trunk or line circuit:

STEP	ACTION	VERIFICATION
Basic Set-up (steps 1 - 5)		
1	Set the 1077B on a convenient surface.	
2	Using the supplied power cord, connect the unit to a 115 VAC, 60 Hz outlet.	
3	Turn on the the power switch marked 1/0 located on the back panel. The 1077B will automatically begin its self-check sequence.	The display panel will indicate the test as it is being run and the results of the tests. Results will be routed to a printer, if attached.
4	The 1077B will complete its self-checks.	Display reads 1077B 4-WIRE REMOTE
5	The 1077B is ready for operation. Basic set-up is the same for any 1077B operation.	
6	Insert a 310 plug from a patch cord connected to a trunk test jack into the jack labeled T, R (transmit/originate) on the front panel.	
7	To get into the 2-wire nearend mode, depress the MODE and then the OPTION key until in the nearend 2W mode.	Display reads MODE NEARND 2 WIRE
Note: If the set-up parameters entered in steps 8 through 12 are entered via the remote option (using external terminal) and saved with the SAVE command, the unit will save and default to those values in future use.		
8	Select the trunk type by depressing the TRUNK key. The cursor will blink the left field. Select trunk type by depressing the OPTION key until the correct type of trunk is displayed.	Some displays are SUB LINE DIAL TONE SUB LINE IMMEDIATE LOOP TRNK WINK STRT LOOP TRNK TIME DELY

(Continued On Next Page)

Then depress the --> key to get to the right field. Depress OPTION key until the correct supervision is displayed.

9 Select the tests to be performed.

- a) Depress the TESTS key.

Display reads
LOSS BOTH

- b) To run additional tests depress the --> key to display another field.

Display reads
LOSS BOTH

- c) Depress the OPTION key until the desired test is displayed.

The second field will change test types. There are nine possible tests.

- d) Repeat steps b) and c) until all desired tests are entered.

After three fields are entered the display will scroll to the left.

- e) Select whether tests will be MEAS, S.C., or BOTH by depressing the TESTS key followed by the FIELD key.

Display will change right-most field from BOTH, to S.C., to MEAS, and back to BOTH.

10 For test preparation, depress PREP key. To change PREP, depress the --> key and then the OPTION key.

Display reads
PREP 900 ODB 105

11 Set-up for test limits.

- a) Depress the EML key. The first test entered in Step 9 will be displayed and the cursor will be blinking at the first field that can be changed.

Display reads (example)
LOSS F-N -15.0+05.0
 ↑ Lower Upper
 Far-to-Near

- b) The first field that can be changed is the plus (+) or minus (-) sign of the lower limit of the far-to-near measurement. The OPTION key will change signs.
- c) Enter the numeric digits for the lower limit of the far-to-near limit.
- d) Depress the --> key to get to the field containing the upper limit. Again the OPTION key will change the sign, if desired.
- e) Enter the upper limit of the far-to-near limit.

(Continued On Next Page)

f) Depress the --> key again to get to the near-to-far limits. Display reads (example)
LOSS N-F -15.8+05.0

g) Perform b) through e) for near-to-far limits if different from far-to-near.

h) To set limits for the next test, if selected in step 9, depress the FIELD key and repeat the process in steps b) through g). Depress FIELD key for each test selected. Display reads (example)
NOISE F-N +15.0+55.0

Note: HOME will go back to the first field. ERASE will erase all entries back to default.

12 To enter access number, depress the ACCESS key. Display reads (example)
.

a) Enter the access number. The display will scroll to the left as it is filled.

Note: To erase an entire field, depress HOME and then ERASE.

b) Enter the signaling mode by depressing the FIELD key until the desired signaling mode is displayed. The display will change the right-most field from TT to DP to MF to SF.

13 After steps 1 through 13 have been completed, the unit is now ready to test. There are two methods for performing tests: manual and automatic.

MANUAL METHOD

a) Depress the SW HOOK key. The unit should go offhook and dial tone should be heard.

b) Depress the ACCESS and then the SEND keys. The 1077B should display the access field and output the access digits.

c) The operator should then wait for TPT (test progress tone). TPT is heard on the speaker.

d) Perform tests by depressing the START key. The 1077B should run the first test specified, displaying results.

Note: If a printer is attached to the RS-232 port (PRINTER), test results will be printed out as they are performed.

e) Perform each successive test by depressing the START key.

(Continued On Next Page)

AUTOMATIC METHOD

a) Depress the AUTO key.

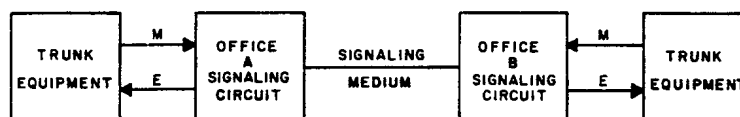
The unit will output the access number and then perform all tests entered in step 9. A RELEASE command will automatically be sent upon completion of tests.

b) After performing all tests entered, depressing the AUTO key a second time will run all tests continuously until the SW HOOK or RELEASE key is depressed. This must be done prior to RELEASE being automatically sent.

B. Nearend Responder 4-Wire Mode

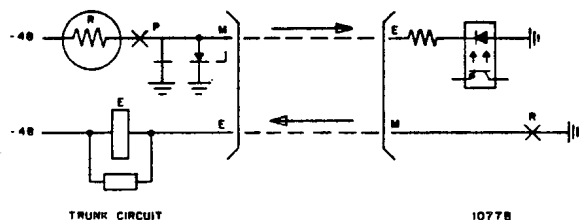
3.02 The following information describes the operating sequence for the 1077B when serving as a 4-wire nearend, on a 4-wire trunk or line circuit:

STEP	ACTION	VERIFICATION
1	Perform basic set-up steps (page 2-14). Get into the 1077B nearend 4-wire mode by depressing the MODE and OPTION keys.	Displays reads MODE NEARND 4 WIRE
2	Insert a 310 plug from a patch cord connected to T1, R1 (trunk or line circuit) to the T, R (receive/terminate) jack on the 1077B. Insert a 310 plug from a patch cord connected to T, R, (trunk or line circuit) to the T1, R1, jack on the 1077B (transmit/originate). Insert a 310 plug from a patch cord connected to E & M of the trunk or line circuit to the Eb/Mb jack of the 1077B. Insert the E/M jacks if required. Refer to the figures on Page 2-19 to determine E & M setups. Note: The following example shows displays for a nearend E & M 1077B configured as the signaling facility.	
3	Select trunk type by depressing the TRUNK and then the OPTION keys until the desired trunk type is displayed.	Display reads (example) E&M 1 SG
4	Select signaling supervision by depressing the --> and then the OPTION keys.	Display reads (example) E&M 1 SG IMMEDIATE
5	The remaining steps are the same as in the nearend 2-wire mode (pages 2-14 through 2-17).	

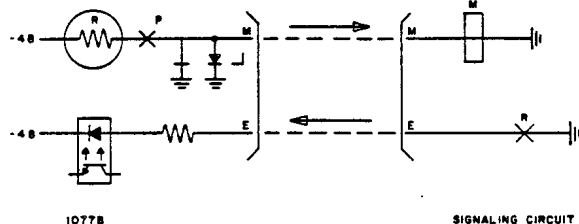


E & M LEAD CONTROL STATUS

E & M TYPE I INTERFACE

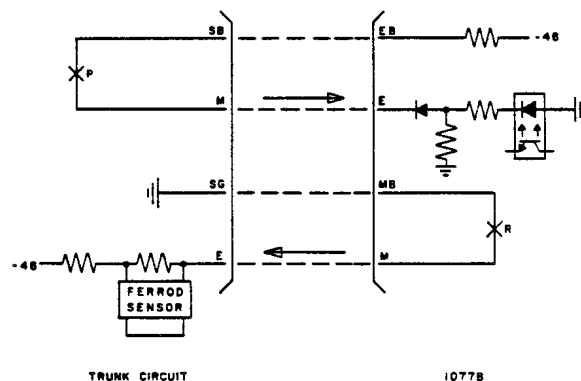


1077B as SIGNALING CKT

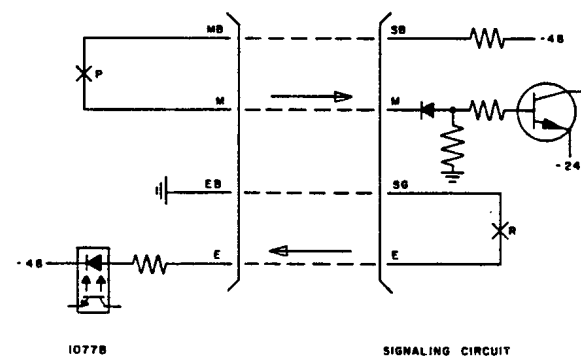


1077B as TRUNK CKT

E & M TYPE II INTERFACE



1077B as SIGNALING CKT



1077B as TRUNK CKT

C. Farend Responder 2-Wire Mode

3.03 The following information describes an example operating sequence for the 1077B in the farend 2-wire mode:

STEP	ACTION	VERIFICATION
1	To get the 1077B into the farend mode, depress the MODE key, then depress the OPTION key until the desired mode appears in the display.	Display reads MODE 2 WIRE FAREND
2	Insert a 310 plug from a patch cord into the T1,R1 jack of the 1077B.	
3	Select TRUNK type.	
4	Select PREP.	
5	Depress the AUTO key.	The display will remain the same.
6	The 1077B is now ready to accept an incoming call as a farend 105 test line/responder.	

D. Farend Responder 4-Wire Mode

3.04 The following information describes an example operating sequence for the 1077B in the farend 4-wire mode:

STEP	ACTION	VERIFICATION
1	To get the 1077B into the farend mode, depress the MODE key, then depress the OPTION key until the desired mode appears in the display.	Display reads MODE 4 WIRE FAREND
	Note: In this example, the 1077B is configured as trunk.	
2	Insert a 310 plug from a patch cord connected to T1, R1 (signaling facility) to the T, R (receive/terminate) jack on the 1077B. Insert a 310 plug from a patch cord connected to T, R, (trunk or line circuit) to the T1, R1,	Display reads E&M II TK

(Continued On Next Page)

jack on the 1077B (transmit/originate). Insert a 310 plug from a patch cord connected to E & M of the trunk or line circuit to the Eb/Mb jack of the 1077B. Insert the E/M jacks if required. Refer to the figures in the chart following para. 3.02 for E & M setups.

- 3 The remaining steps are the same as for the 2-wire operating sequence.

E. ROTL Test Set Mode

- 3.05 The following describes an example operating sequence of the 1077B in the ROTL test set mode.

STEP	ACTION	VERIFICATION
1	To get the 1077B into the ROTL test set mode, depress the MODE key, then depress the OPTION key until the desired mode appears in the display.	Display reads MODE ROTLTS 2 WIRE
2	Depress the ACCESS display key and input the appropriate ROTL system access number using the numeric keys. Then depress the FIELD key to select the type of signaling required.	Access number will appear in the display (e.g 1 512 555 1212) followed by the type of signaling (DP, MF, SF, or TT).
3	Depress the PRIME key and numerically enter the priming digits (priming is in MF).	Priming digits will appear in the display.
Note: To obtain a workable set of priming digits for your system, the Priming formats in Part 5 (this section), should be consulted. Remember, KP and ST are included automatically and cannot be entered.		
4	Depress the PREP key.	Display reads PREP 900 ODB 105
5	If displayed prep is not desired, change by alternating depressions of the PREP key followed by the OPTION key. Use the cursor key to change fields.	
6	Depress the TEST key.	Display reads LOSS BOTH
7	By depressing the FIELD and OPTION keys alternately, the test mode can be changed.	Display indicates test or tests selected.

(Continued On Next Page)

- | | |
|--|--|
| 8 Depress the SW HOOK key. | Dial tone is heard. |
| 9 Depress the ACCESS key followed by the SEND key. | Outpulsing is heard, followed by TPT when the ROTL answers. |
| 10 Depress the PRIME key followed by the SEND key after TPT stops. | TPT is heard when:
(a) TUT is seized.
(b) Farend responder is answered.
(c) Nearend responder is attached. |
| 11 Depress the START key for each test desired. | For each test run, the outgoing MF commands and returned FSK data is heard. The test results are displayed and printed if a printer is attached to the EIA port. |
| 13 Following the last test, depress the RELEASE key. | The responders are released and TPT is heard. The ROTL remains ready for additional priming and testing. |
| 14 When all desired testing is completed, depress the SW HOOK key. | Two-second disconnect tone is heard followed by hang-up. |

4. External Connections

A. General

4.01 External signal connections consist of the following:

- a) 2 modular phone jacks
- b) 1 T,R 310-type jack
- c) 1 T1, R1 310-type jack
- d) 1 E&M 310-type jack
- e) 1 Eb, Mb 310-type jack
- f) 1 banana plug terminal for Central Office ground
- g) 1 banana plug terminal for ANI
- h) 1 25-pin D-subminiature RS-232 connector for a printer

B. Modular Phone Jacks

4.02 The two modular phone jacks are standard RJ-11-C line cord-compatible 6-position jack with only 4 wire positions terminated.

4.03 T and R are connected to the red and green leads of the modular T,R jack. T1 and R1 are connected to the red and green leads of the modular T1,R1 jack.

4.04 The offhook function connects tip and ring through the hold coil.

C. 310-Type Jacks

4.05 The four 310-type jacks are defined as follows:

a) T,R - Transmit referenced to the 1077B of a 4- or 2-wire originating circuit. The sleeve lead of this jack also contains the M lead and can be used for sleeve control.

b) E/M - Provides access to the E&M signaling leads when used as a 4-wire trunk.

1) The E lead appears as the tip of the E/M jack and is the control lead to the 1077B. It also appears as the sleeve lead on the T1,R1 jack.

2) The M lead appears as the ring of the E/M jack and is the output control lead from the 1077B. It also appears as the sleeve lead on the T,R jack.

c) Eb/Mb - Provides access to the return leads for E&M signaling when Type II signaling is used.

1) The Eb lead appears as the tip of the jack and is the return for the E lead.

2) The Mb lead appears as the ring of the jack and is the return for the M lead.

d) T1,R1 (Receive/Terminate) - Receive (referenced to the 1077B).

D. CO GND Banana Jack

4.05 The CO GND plug terminal is provided to reference to central office ground. Central office ground is isolated from AC safety ground. The CO GND is used as signal return reference for E & M leads or other types of DC supervision.

E. RS-232 Connector (PRINTER)

4.06 The RS-232 connection is an electronics industry standard 25-pin female subminiature D connector. Electrical connections are compatible with the EIA RS-232-C standard interface.

4.07 With the EIA connector, the 1077B acts as a mini-controller and can be remotely controlled. The connector can be plugged directly to a terminal; however, cross-wiring is required to connect the modem (null modem cabling). Wiring for this configuration is shown in the right-hand column of TABLE 1A, Section 1.

5. Priming Formats

5.01 The TABLES listed in Fig. 2-3 contain the priming digit formats for the switching systems indicated.

TABLE	TYPE OFFICE	PRIMING DIGITS FORMAT
A	Step-by-Step	Mini-ROTL (APC)
B	Step-by-Step	Mini-ROTL (WECO)
C	Step-by-Step	Expanded ROTL (APC)
D	Step-by-Step	Expanded ROTL (WECO)
E	#1 X-BAR & X-BAR Tandem Offices	Expanded ROTL (WECO)
F	#5 X-BAR	Expanded ROTL (WECO)
G	#1 EAX	Expanded ROTL (APC)
H	#2 EAX	Expanded ROTL (APC)
I	#3 EAX	Expanded ROTL (APC)
J	#1 ESS	Expanded ROTL (WECO)
K	#1 ESS	Mini-ROTL (APC)
L	#2 ESS	Expanded ROTL (WECO)
M	#4 ESS	Expanded ROTL (WECO)
N	NX-1	Expanded ROTL (APC)
O	DCO & DSS-1210	Expanded ROTL (APC)
P	DMS 100/200	Expanded ROTL (APC)
Q	All Offices	Small ROTL (WECO)
R	SP-1 4-Wire	Mini-ROTL (APC)
S	SP-1 2-Wire	Mini-ROTL (APC)
T	DMS-10	Mini-ROTL (APC)
U	GTD-5	Expanded ROTL (APC)
V	SL-1	Mini-ROTL (APC)
W	PBX Switches	Mini-ROTL (APC)
X	ITS 4/5 TRW/VIDAR	Mini-ROTL (APC)

Note: WECO stands for Western Electric Company

Fig. 2-3 -- TYPE OFFICE AND PRIMING DIGITS FORMAT

TABLE A APC 1062 SxS MINI-ROTL PRIMING																					
TYPE TEST	TEST LINE	DIGITS																			
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ST
TRANSMISSION TESTS	100	KP	0	0					T											ST	
	102	KP	0	2					R											ST	
	105	KP	0	5					K											ST	
OPERATIONAL TESTS	NON-SYNC	KP	2	0	TRUNK					FAREND TEST LINE										ST	
	SYNC	KP	2	1	ADDRESS				C	NUMBER										ST	
	103	KP	2	3					L											ST	
TERMINAL BALANCE TEST		KP	4	0					S											ST	
CONNECTION APPRAISAL TESTS	100	KP	6	0																	ST
	102	KP	6	2	FAREND TEST LINE NUMBER																ST
	105	KP	6	5																	ST

TABLE B SxS MINI-ROTL PRIMING (WECO)																																					
TYPE TEST	TEST LINE	DIGITS																																			
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ST																
TRANSMISSION TESTS	100	KP	0	0	A				N													ST															
	102	KP	0	2	L																															ST	
	105	KP	0	5	W																				O												ST
OPERATIONAL TESTS	NON-SYNC	KP	2	0	A	TRUNK			T													ST															
	SYNC	KP	2	1	Y	IDENTITY			E																							ST					
	103	KP	2	3	S				1																								ST				
TERMINAL BALANCE TEST	WITH TUT	KP	4	0																		ST															
	SUPERV.																																				
	NO TUT	KP	4	2																																	
	SUPERV. *																																				
CONNECTION APPRAISAL TESTS	100	KP	6	0	FAREND TEST LINE NUMBER															ST																	
	102	KP	6	2	FAREND TEST LINE NUMBER															ST																	
	105	KP	6	5	FAREND TEST LINE NUMBER															ST																	
HOME OFFICE TEST LINES (Restricted to ROTL 3 105 inputs)	105	KP	7	5	0	TEST LINE	N																														
					IDENTITY	I																															
						E																															
							2																														

*Provides access to MCI/RCU or RCP to allow for pulsing tests of outgoing trunks.

Note 1: Signal class digits are as follows:

DIGITS	TRUNK CLASS TYPE
0	Dial Pulse Loop Supervision
1	Dial Pulse Loop Supervision Stop Dial
2	Dial Pulse Simplex Supervision
3	Dial Pulse Simplex with Stop Dial
4	MF Signaling - Loop Supervision
5	MF Signaling - Simplex Supervision

Note 2: Class 0, 2, or 5 only.

TABLE C APC 1053 SxS ROTL PRIMING																										
TYPE TEST	TEST LINE	DIGITS																								
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	ST
TRANSMISSION TESTS	100	KP	0	0	TRUNK ADDRESS					T	FUTURE					FAREND TEST LINE NUMBER										ST
	102	KP	0	2						R																ST
	105	KP	0	5						K																ST
OPERATIONAL TESTS	NON-SYNC	KP	2	0	TRUNK ADDRESS					C L	FUTURE					FAREND TEST LINE NUMBER										ST
	SYNC	KP	2	1																						ST
	103	KP	2	3																						ST
TERMINAL BALANCE TEST		KP	4	0	TRUNK ADDRESS					C L	FUTURE					FAREND TEST LINE NUMBER										ST
CONNECTION APPRAISAL TEST	100	KP	6	0												FAREND TEST LINE NUMBER										ST
	102	KP	6	2																						ST
	105	KP	6	5																						ST

TABLE D SxS EXPANDED ROTL PRIMING (WECO)																						
TYPE TEST	TEST LINE	DIGITS																				
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ST	
TRANSMISSION TESTS	100	KP	0	0	TRUNK IDENTITY				N O T E	FAREND TEST LINE NUMBER										ST		
	102	KP	0	2																ST		
	105	KP	0	5																ST		
	100	KP	1	0																ST		
	102	KP	1	2																ST		
	105	KP	1	5																ST		
OPERATIONAL TESTS	NON-SYNC	KP	2	0	TRUNK IDENTITY				1	FAREND TEST LINE NUMBER										ST		
	SYNC	KP	2	1																ST		
	103	KP	2	3																ST		
	NON-SYNC	KP	3	0																ST		
	SYNC	KP	3	1																ST		
	103	KP	3	3																ST		
TERMINAL BALANCE TEST		KP	4	0	TRUNK IDENTITY				1	FAREND TEST LINE NUMBER										ST		
OVERVERRIDE OOS		KP	4	1																ST		
MAKE BUSY REMOTELY		KP	5	0																ST		
RESTORE IDLE REMOTELY		KP	5	1																ST		
INDIVIDUAL TRK STATUS		KP	5	2																ST		
TRK GRP STATUS BY TRK		KP	5	3																ST		
CALL BACK REQUEST		KP	5	5	ID	ST																
CONNECTION	100	KP	6	0	FAREND TEST LINE NUMBER															ST		
APPRAISAL	102	KP	6	2																ST		
TESTS	105	KP	6	5																ST		
HOME OFFICE TEST LINES	100	KP	7	0	TEST LINE IDENTITY				N O T E													
	SYNC	KP	7	1																		
	102	KP	7	2																		
	103	KP	7	3																		
	NON-SYNC	KP	7	4																		
	105	KP	7	5		2	ST															

Note 1: Signal class digits are as follows:

DIGITS	TRUNK CLASS TYPE
0	Dial Pulse Loop Supervision
1	Dial Pulse Loop Supervision Stop Dial
2	Dial Pulse with Simplex Supervision
3	Dial Pulse Simplex with Stop Dial
4	MF Signaling - Loop Supervision
5	MF Signaling - Simplex Supervision
6	Home office test of test lines on selector banks
9	SAMA Trunks

Note 2: Class 0, 2, or 6 only.

TABLE E #1 X-BAR & TANDEM ROTL PRIMING (WECO)																													
TYPE TEST	TEST LINE	DIGITS																											
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	ST										
TRANSMISSION TESTS	100	KP	0	0	TRUNK IDENTITY 5 DIGITS						SEE NOTE 1						FAREND TEST LINE NUMBER 3, 4, 5 OR 7 DIGITS			ST									
	102	KP	0	2																ST									
	105	KP	0	5																ST									
	100	KP	1	0																ST									
	102	KP	1	2																ST									
	105	KP	1	5																ST									
OPERATIONAL TESTS	NON-SYNC	KP	2	0	TRUNK IDENTITY 5 DIGITS						SEE NOTE 1						FAREND TEST LINE NUMBER 3, 4, 5 OR 7 DIGITS			ST									
	SYNC	KP	2	1																ST									
	103	KP	2	3																ST									
	NON-SYNC	KP	3	0																ST									
	SYNC	KP	3	1																ST									
	103	KP	3	3																ST									
TERMINAL BALANCE TEST		KP	4	0	TRUNK IDENTITY 5 DIGITS						SEE NOTE 1						FAREND TEST LINE NUMBER 3, 4, 5 OR 7 DIGITS			ST									
OVERRIDE OOS		KP	4	1																ST									
INDIVIDUAL TRK STATUS		KP	5	2																ST									
CONNECTION	100	KP	6	0																FAREND TEST LINE NUMBER (NOTE 2)									ST
APPRAISAL	102	KP	6	2																									ST
TESTS	105	KP	6	5																									ST

Note 1: Type of pulsing (two digits) as follows:

DIGITS	TYPE OF PULSING	
	PULSING	SUPERVISION
00	MF	Wink Start
01		Stop-60 Outpulsing
02		Delay Dial
03		Delay Dial (2W)
10	DP Loop A	Wink Start
11		Stop-60 Outpulsing
12		Delay Dial
19		Delay Dial (2W)
13	DP Loop B	Wink Start
14		Stop-60 Outpulsing
15		Delay Dial
16	DP Bat. & Grnd.	Wink Start
17		Stop-60 Outpulsing
18		Delay Dial
20	RP	Panel (24V)
21		X-bar (48V Panel, ESS, X-bar)
22		Panel, Loop Comp. Res. -200
23		X-bar, Loop Comp. Res. -300
24	RP	Panel, Loop Comp. Res. -600
25		X-bar, loop Comp. Res. -600
26		Panel, Loop Comp. Res. -900
27		Panel, Loop Comp. Res. -900
30	PCI	PCI, Loop Comp. Res. -000
31		PCI, Loop Comp. Res. -300
32		PCI, Loop Comp. Res. -600
33		PCI, Loop Comp. Res. -900
40	RP	2nd X-bar in same office Res. -000
41		2nd X-bar in same office Res. -300
42		2nd X-bar in same office Res. -600
43		2nd X-bar in same office Res. -900

TABLE F #5 X-BAR ROTL PRIMING (WECO)													
ROTL TEST SET MF DIGITS SWITCH	MF DIGIT FUNCTIONS	ROTL REGISTER ACTIONS											SEE NOTE
			0	1	2	3	4	5	6	7	8	9	
1 (1TC-)	Test Class	Register Relays Operated by type XMSH OP Seizure	XMSH Test	XMSH No Test	OP Test	OP No Test	Bal	MB UL ULP	CA	Home Office Tst Ln			
2 (2TC-)	Test Class	Type of XMSH or CA Test Line	100		102			105					4
		Type of Op Test Line	Non Sync	Sync		103	Non Sync						
		Type of Balance Seizure	Test	No Test									
		Type of MB Call	Make Busy	Re- lease	Inter- rogate Trunk	Inter- rogate Trunk		OPR,UL ULA (Callback Verfi.)					
3 (TYP-)	Type of Call	Type of Orig Test Line	Local Orig (LOTL)	Toll Orig (TOTL)	Term to PBX (LLP TRM)		Term to Home Testline			CCSA (TOTL)	Tanden (TOTL)	CCSA (LOTL)	
	Orig office ID		0	1	2	3	4	5	6	7	8	9	
4 (TR-)	Type of Translator	Marker Leads Grounded LOTL	LT	LT1	LT2	LT3	2DT	XII				FVD	9
		TOTL/TRM	LT						OA	OB	TT	FVD	9
5 (MG-)	Marker Group	Marker Group	00	100	200		00	100	200	00	100	200	
		2W 4W Marker	2W	2W	2W		2W	2W	2W	4W	4W	4W	
		Coin/Non-coin	Non Coin	Non Coin	Non Coin		Coin	Coin	Coin	Non Coin	Non Coin	Non Coin	
6 (CTA-)	Class Of Service Tens/Tanden Screening	Marker Leads Grounded LOTL TOTL, TRM	CTA4,7 TAN	CTA0,1 TAN1	CTA0,2 TAN2	CTA1,2 TAN3	CTA0,4 TAN4	CTA1,4 TOL	CTA2,4 INC	CTA0,7 PCR	CTA1,7 PCD	CTA2,7 PCD1	
7 (CU-)	Class of Service Units	Marker Leads Grounded LOTL	CU4,7	CU0,1	CU0,2	CU1,2	CU0,4	CU1,4	CU2,4	CU0,7	CU1,7	CU2,7	1,3
8 (CRU-)	Rate Treatment Units	Marker Leads Grounded LOTL	Note 6 CRU4,7	CRU0,1	CRU0,2	CRU1,2	CRU0,4	CRU1,4	CRU2,4	CRU0,7	CRU1,7	CRU2,7	1,3
9 (CG-)	Rate Treatment Tens/Trunk Class Group	Marker Leads Grounded LOTL TOTL			Note 7 CBA,OR	CGB OR	CBA FAC	Note 8 CGB,FAC					
10 (RA-)	Route Advance and Group Allotter	LOTL or TOTL # of Route Advances Allotter Group	0	1	2	3		0	1	2	3		1,5
			GPA	GPA	GPA	GPA		GPA	GPA	GPA	GPA		1,5
11 (TI-)	Trunk Selection Tens Info/Hold Magnet # of LLP Trk On line Switch of Line Link Frame	Marker Leads Grounded LOTL/TOTL Tens Trk Tens	F60 0	F61 0	F62 0	F60 1	F61 1	F62 1					2,5
		Term	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	2,5
12 (TF-)	Trunk Link Frame Units/ Hundreds Block # Assoc with LLP Trunk In # Group	Marker Leads Grounded LOTL/TOTL: TLF Units TRM	TF4,7 TBT0	TF0,1 TBT1	TF0,2 TBT2	TF1,2 TBT3	TF0,4 TBT4	TF1,4 TBT5	TF2,4 TBT6	TF0,7 TBT7	TF1,7 TBT8	TF2,7 TBT9	2,5
13 (TT-)	Trunk # Units Tens Block # Assoc with LLP Trunk In No. Group	LOTL/TOTL TRM	TT0 TBU0	TT1 TBU1	TT2 TBU2	TT3 TBU3	TT4 TBU4	TT5 TBU5	TT6 TBU6	TT7 TBU7	TT8 TBU8	TT9 TBU9	2,5
14-23 (A-K 2/5)	Farend Testline #	Marker Leads Grounded	(A-K) 4,7	(A-K) 0,1	(A-K) 0,2	(A-K) 1,2	(A-K) 0,4	(A-K) 1,4	(A-K) 2,4	(A-K) 0,7	(A-K) 1,7	(A-K) 2,7	

Notes:

1. Not required on TRM calls.
2. Not required on TRM class calls to home office test lines.
3. Not required on TOL and TAN class calls.
4. Digit 0 - non-synch when digit 2 or 3 is req. as 1TC digit.
Digit 4 - non-synch when digit 7 is req. as 1TC digit.
5. Not required on CA (connection appraisal) calls.
6. When marker group is not arranged for rate treatment, ROTL must be primed with digit 0.
7. When marker group is not arranged for either rate treatment or 60 classes of service and a numbering plan area code is not used as part of the called number (address), ROTL must be primed with digit 2.
8. When marker group is not arranged for either rate treatment or 60 classes of service and a numbering plan area code is used as a part of the called number (address), ROTL must be primed with digit 4.
9. Terminating calls to home office testlines may utilize a 4 digit terminating number with either an OA or OB indication, or a 5 digit terminating number with a FVD indication, or a 7 digit terminating number with a LT indication.

TABLE G APC 1071 #1 EAX PRIMING																							
TYPE TEST	TEST LINE	DIGITS																					
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	ST
TRANSMISSION TESTS	100	KP	0	0	M																		ST
	102	KP	0	2	0																		ST
	105	KP	0	5	D																		ST
	100	KP	1	0	I																		ST
	102	KP	1	2	F																		ST
	105	KP	1	5	I																		ST
OPERATIONAL TESTS	NON-SYNC	KP	2	0	E	TRUNK			TRUNK														ST
	SYNC	KP	2	1	R	GROUP			GROUP														ST
	103	KP	2	3		NUMBER			MEMBER														ST
	NON-SYNC	KP	3	0	D																		ST
	SYNC	KP	3	1	I																		ST
	103	KP	3	3	6																		ST
TERMINAL BALANCE TEST		KP	4	0	I																		ST
OVERRIDE OOS		KP	4	1	T																		ST

Note: 4th digit is a modifier digit:

- a) 0 = talk tandem offhook state without a transformer in the talking path
 b) 1 = talk tandem offhook state with a transformer in the talking path.

TABLE H APC 1058 #2 EAX ROTL PRIMING																													
TYPE	TEST	DIGITS																											
TEST	LINE	KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	ST					
TRANSMISSION TESTS	100	KP	0	0	M											FAREND TEST LINE NUMBER (LESS THAN 11 DIGITS)											ST		
	102	KP	0	2	D																						ST		
	105	KP	0	5	D																						ST		
	100	KP	1	0	I																						ST		
	102	KP	1	2	F																						ST		
OVERRIDE OOS	105	KP	1	5	I																						ST		
TERMINAL BALANCE TEST		KP	4	0	E	TRUNK					TRUNK																ST		
OVERRIDE OOS		KP	4	1	R	GROUP					GROUP																ST		
MAKE BSY (OOS) REMOTELY		KP	5	0	D	NUMBER					MEMBER					ST													
RESTORE IDLE REMOTELY		KP	5	1	I						NUMBER					ST													
INDIVIDUAL TRK STATUS		KP	5	2	G											ST													
TRK GRP STATUS BY TRK		KP	5	3	I											ST													
TRK GRP STATUS BY GRP		KP	5	4	T						ST																		
CALLBACK REQUEST		KP	5	5	D	ST																							
CONNECTION	100	KP	6	0						FAREND TEST LINE										ST									
APPRAISAL	102	KP	6	2						NUMBER (LESS THAN 12 DIGITS)										ST									
TEST	105	KP	6	5																ST									
HOME OFFICE TEST LINES	100	KP	7	0	N											ST													
	102	KP	7	2	O	TRUNK					NUMBER					ST													
	103	KP	7	3	T	AND					MEMBER					ST													
	NON-SYNC	KP	7	4	E											ST													
	105	KP	7	5											ST														

Note: 4th digit is a modifier digit.

- a) 0 = Talk tandem offhook state without a transformer in the talking path.
 b) 1 = Talk tandem offhook state with a transformer in the talking path.

TABLE I APC 1057 #3 EAX ROTL PRIMING																																																
TYPE TEST	TEST LINE	DIGITS																																														
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	ST																								
TRANSMISSION TESTS	100	KP	0	0	TRUNK GROUP NUMBER					TRUNK GROUP MEMBER NUMBER					REMOTE TEST LINE NUMBER (LESS THAN 12 DIGITS)												ST																					
	102	KP	0	2																							ST																					
	105	KP	0	5																							ST																					
	100	KP	1	0																							ST																					
	102	KP	1	2																							ST																					
OPERATIONAL TESTS	105	KP	1	5																							ST																					
	NON-SYNC	KP	2	0																							ST																					
	SYNC	KP	2	1																							ST																					
	103	KP	2	3																							ST																					
	NON-SYNC	KP	3	0																							ST																					
OVERRIDE ODS	SYNC	KP	3	1																							ST																					
	103	KP	3	3																							ST																					
MAKE BUSY REMOTELY		KP	5	0																												ST																
RESTORE IDLE REMOTELY		KP	5	1																												ST																
INDIVIDUAL TRK STATUS		KP	5	2																												ST																
TRK GRP STATUS BY TRK		KP	5	3																												ST																
TRK GRP STATUS BY GRP		KP	5	4																												ST																
CALL BACK REQUEST		KP	5	5	ID	ST																																										
HOME OFFICE TEST LINES	100	KP	7	0	TRUNK GROUP AND MEMBER NUMBER					ST																																						
	102	KP	7	2											ST																																	
	103	KP	7	3											ST																																	
	105	KP	7	5											ST																																	

TABLE J #1 ESS ROTL PRIMING (WECO)																								
TYPE TEST	TEST LINE	DIGITS																						
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	ST	
TRANSMISSION TESTS	100	KP	0	0	N	TRUNK NETWORK NUMBER						FAREND TEST LINE NUMBER (LESS THAN 11 DIGITS)										ST		
	102	KP	0	2	0																	ST		
	105	KP	0	5	D																	ST		
	100	KP	1	0	I																	ST		
	102	KP	1	2	F																	ST		
OVERRIDE OOS	105	KP	1	5	I																	ST		
	TERMINAL BALANCE TEST	OVERRIDE OOS	KP	4	0																	E	ST	
KP			4	1	R																	ST		
MK BSY (OOS) REMOTELY RESTORE IDLE REMOTELY INDIVIDUAL TRK STATUS TRK GRP STATUS BY GRP CALL BACK REQUEST		KP	5	0																		ST		
		KP	5	1																		ST		
		KP	5	2																		ST		
		KP	5	4																		ST		
		KP	5	5	ID	ST																		
CONNECTION APPRAISAL TEST	100	KP	6	0	FAREND TESTLINE NUMBER (LESS THAN 12 DIGITS)						ST													
	102	KP	6	2							ST													
	105	KP	6	5							ST													
HOME OFFICE TEST LINES	100	KP	7	0	N	TESTLINE DIRECTORY NUMBER						ST												
	103	KP	7	2	D							ST												
	105	KP	7	5	T							ST												
					E																			

Note: 4th digit is a modifier digit.

- a) 0 = Local originating call.
- b) 1 = Tandem 1 (2-wire tandem configuration with transformers.
- c) 2 = Tandem 2 (4-wire to 2-wire tandem configuration without transformer.

TABLE K APC 1074 #1 ESS ROTL PRIMING																											
TYPE TEST	TEST LINE	DIGITS																									
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	ST				
TRANSMISSION TESTS	100	KP	0	0	3	0	TRUNK NETWORK NUMBER								FAREND TEST LINE NUMBER (UP TO 11 DIGITS)											ST	
	102	KP	0	2	3	0																				ST	
	105	KP	0	5	3	0																				ST	
MAINTENANCE* BUSY OVERRIDE	100	KP	1	0	3	0	TRUNK NETWORK NUMBER								FAREND TEST LINE NUMBER (UP TO 11 DIGITS)											ST	
	102	KP	1	2	3	0																				ST	
	105	KP	1	5	3	0																				ST	

*Does not have the capability to override maintenance busy.

It will accept this priming for CAROT compatibility.

TABLE L #2 ESS ROTL PRIMING (WECO)																							
TYPE TEST	TEST LINE	DIGITS																					
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	ST
TRANSMISSION TESTS	100	KP	0	0	M																		ST
	102	KP	0	2	0																		ST
	105	KP	0	5	D																		ST
	100	KP	1	0	I	TRUNK			TRUNK														ST
	102	KP	1	2	F	GROUP			GROUP														ST
	105	KP	1	5	I	NUMBER			MEMBER														ST
TERMINAL BALANCE TEST		KP	4	0	E																		ST
TEST	100	KP	4	1	R																		ST
MK BSY (QOS) REMOTELY		KP	5	0								ST											
RESTORE IDLE REMOTELY		KP	5	1								ST											
INDIVIDUAL TRK STATUS		KP	5	2								ST											
TRK GRP STATUS BY TRK		KP	5	3								ST											
TRK GRP STATUS BY GRP		KP	5	4							ST												
CALL BACK REQUEST		KP	5	5	ID	ST																	
CONNECTION	100	KP	6	0																			ST
APPRAISAL	102	KP	6	2																			ST
TEST	105	KP	6	5																			ST
HOME OFFICE TEST LINES	100	KP	7	0								ST											
	103	KP	7	2								ST											
	105	KP	7	5								ST											

Note: 4th digit is a modifier digit.

- a) 0 = Talk tandem offhook state without a transformer in the talking path.
- b) 1 = Talk tandem offhook state with a transformer in the talking path.
- c) On callback request, ID is a test center identifier (0-7).

TABLE M #4 ESS ROTL PRIMING (WECO)																			
TYPE TEST	TEST LINE	DIGITS																	
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	ST
TRANSMISSION TESTS	100	KP	0	0	TRUNK IDENTITY FOR TRUNK APPEARANCE NUMBER								FAREND TESTLINE NUMBER LESS THAN 7 DIGITS						ST
	102	KP	0	2															ST
	105	KP	0	5															ST
	100	KP	1	0															ST
	102	KP	1	2															ST
	105	KP	1	5															ST
MK BSY (OOS) REMOTELY		KP	5	0									ST						
RESTORE IDLE REMOTELY		KP	5	1									ST						
INDIVIDUAL TRK STATUS		KP	5	2									ST						
TRK GRP STATUS BY TRK		KP	5	3									ST						
TRK GRP STATUS BY GRP		KP	5	4	NOTE 1						ST								
CALL BACK REQUEST		KP	5	5	NOTE 2				ST										
HOME OFFICE TEST LINES	100	KP	7	0	ST														
	102	KP	7	2	ST														
	105	KP	7	5	NOTE 3								ST						

Notes:

1. Trunk subgroup number (4 octal digits).
2. Control or caller identification (only values 0 - 7 are valid).
3. Seven digit decimal trunk appearance number (for 105 testline responsibility).

TABLE N APC 1059 NX-1 (TYPE N)																																																	
TYPE TEST	TEST LINE	DIGITS																																															
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ST																						
TRANSMISSION TEST	100	KP	0	0	0	TRUNK ADDRESS						INLET		0	FAREND TEST LINE NUMBER (< 11 DIGITS)														ST																				
	102	KP	0	2	0									INLET															0	ST																			
	105	KP	0	5	0																								INLET		0	ST																	
OPERATIONAL TESTS	NON-SYNC	KP	2	0	0	TRUNK ADDRESS						INLET		0	FAREND TEST LINE NUMBER (< 11 DIGITS)																ST																		
	SYNC	KP	2	1	0									INLET															0	ST																			
	103	KP	2	3	0																								INLET		0	ST																	
TERMINAL BALANCE TEST		KP	4	0	0	TRUNK ADDRESS						INLET		0	FAREND TEST LINE NUMBER (< 11 DIGITS)																ST																		
CONNECTION	100	KP	6	0	FAREND TEST LINE NUMBER																								ST																				
APPRAISAL	102	KP	6	2																									ST																				
TEST	105	KP	6	5																							ST																						

TABLE 0 APC 1067/1069 DCO/DSS-1210 ROTL PRIMING																												
TYPE TEST	TEST LINE	DIGITS																										
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	ST					
TRANSMISSION TESTS	100	KP	0	0	M																					ST		
	102	KP	0	2	0																					ST		
	105	KP	0	5	D																					ST		
	100	KP	1	0	I																					ST		
	102	KP	1	2	F																					ST		
VERRIDE	105	KP	1	5	I	TRUNK	TRUNK																			ST		
OPERATIONAL TESTS	NON-SYNC	KP	2	0	E	GROUP NUMBER																				ST		
	SYNC	KP	2	1	R																					GROUP MEMBER	FAREND TEST LINE NUMBER	ST
	103	KP	2	3																						NUMBER	LESS THAN 11 DIGITS	ST
	NON-SYNC	KP	3	0	D																					ST		
	SYNC	KP	3	1	I																					ST		
VERRIDE	103	KP	3	3	G																				ST			
TERMINAL BALANCE TEST		KP	4	0	I																				ST			
VERRIDE		KP	4	1	T																				ST			
MAKE BUSY REMOTELY		KP	5	0																					ST			
RESTORE IDLE REMOTELY		KP	5	1																					ST			
INDIVIDUAL TRK STATUS		KP	5	2																					ST			
TRK GRP STATUS BY TRK		KP	5	3																					ST			
TRK GRP STATUS BY GRP		KP	5	4																					ST			
CALL BACK REQUEST		KP	5	5	ID	ST																						
CONNECTION	100	KP	6	0																					ST			
APPRAISAL	102	KP	6	2																					ST			
TESTS	105	KP	6	5																					ST			
HOME OFFICE TEST LINES	100	KP	7	0	N																				ST			
	102	KP	7	2	0																				TRUNK GROUP	ST		
	103	KP	7	3	T																				AND MEMBER	ST		
	NON-SYNC	KP	7	4	E																				ST			
	105	KP	7	5																				ST				

Note: 4th digit is a modifier digit.

- a) 0 = Talk tandem offhook state without a transformer in the talking path.
- b) 1 = Talk tandem offhook state with a transformer in the talking path.

TABLE P APC 1066 DMS 100/200 ROTL PRIMING																								
TYPE TEST	TEST LINE	DIGITS																						
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	ST
TRANSMISSION TESTS	100	KP	0	0																				ST
	102	KP	0	2																				ST
	105	KP	0	5																				ST
	100	KP	1	0																				ST
	102	KP	1	2																				ST
OPERATIONAL TESTS	105	KP	1	5																				ST
	NON-SYNC	KP	2	0																				ST
	SYNC	KP	2	1																				ST
	103	KP	2	3																				ST
	NON-SYNC	KP	3	0																				ST
TERMINAL BALANCE TEST	100	KP	3	1																				ST
	102	KP	3	3																				ST
	105	KP	4	0																				ST
	100	KP	4	1																				ST
	102	KP	5	0																				ST
MAKE BUSY REMOTELY RESTORE IDLE REMOTELY INDIVIDUAL TRK STATUS TRK GRP STATUS BY TRK TRK GRP STATUS BY GRP CALL BACK REQUEST	105	KP	5	1																				ST
	100	KP	5	2																				ST
	102	KP	5	3																				ST
	105	KP	5	4																				ST
	100	KP	5	5																				ST
CONNECTION APPRAISAL TESTS	100	KP	6	0																				ST
	102	KP	6	2																				ST
	105	KP	6	5																				ST
	100	KP	7	0																				ST
	102	KP	7	2																				ST
HOME OFFICE TEST LINES	103	KP	7	3																				ST
	NON-SYNC	KP	7	4																				ST
	105	KP	7	5																				ST
	100	KP	7	6																				ST
	102	KP	7	7																				ST

TABLE Q ALL OFFICES SMALL ROTL PRIMING (WECO)							
TYPE TEST		PRELIM DIGIT	DIGITS				
			A	B*	C*	D*	E*
TRANSMISSION TESTS (ATMS Responder at ROTL Office)	SERVICE SEIZURE		1				
	TEST	4	1	N	N	N	N
	SEIZURE			O	O	O	O
OPERATIONAL TESTS	SERVICE SEIZURE		2	T	T	T	T
	TEST	4	2	E	E	E	E
	SEIZURE			1	2	2	3
TRANSMISSION TESTS (ATMS Responder at ROTL Office)	SERVICE SEIZURE		3				
	TEST	4	3				
	SEIZURE						
TERMINAL BALANCE TEST	SERVICE SEIZURE		5				
	TEST	4	5				
	SEIZURE						
SPARE			6				
SPARE			7				
1004 Hz , 1mW to be trans- mitted to control office			8				
TRUNK RESTORE TO SERVICE			9	N	N	N	N
INTERROGATE BSY STATUS OF TRUNK GROUP		4	9	O	O	O	O
TRUNK MAKE BUSY			0	T	T	T	T
INTERROGATE BUSY STATUS OF A TRUNK		4	0	E	E	E	E
				1	2	2	3

Notes: Apply to Step-by-step offices.

1. Digit for one of ten test selectors
2. Digits to step test selector to outgoing trunk to be tested.
3. Digit to designate type of pulsing.
 - a) 1= MF outpulsing
 - b) 2 through 0 = dial pulsing

* Except for the 1000 Hz tone test. in #5 crossbar offices. these four digits are used to identify the location of the outgoing trunk to be tested and the directory number of the far end testline.

TABLE R																
APC 1068 SP-1 4-WIRE ROTL PRIMING																
TYPE TEST	TEST LINE	DIGITS														
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TRANSMISSION TESTS	100	KP	0	0	0	A	0	X	X	X	X	n	n	n	n	ST
	102	KP	0	2	0	A	0	X	X	X	X	n	n	n	n	ST
	105	KP	0	5	0	A	0	X	X	X	X	n	n	n	n	ST
MAINTENANCE+ BUSY OVERRIDE	100	KP	1	0	0	A	0	X	X	X	X	n	n	n	n	ST
	102	KP	1	2	0	A	0	X	X	X	X	n	n	n	n	ST
	105	KP	1	5	0	A	0	X	X	X	X	n	n	n	n	ST
CONNECTION APPRAISAL	100	KP	6	0	FAREND TESTLINE NUMBER											ST
	103	KP	6	2	UP TO 11 DIGITS											ST
	105	KP	6	5												ST

*Does not have the ability to override maintenance busy.
Will accept this priming for CAROT priming compatibility.

A = Receive Pad Loss:

0 = No Pad	5 = 5
1 = 1 dB Pad	6 = 6 dB Pad
2 = 2 dB Pad	7 = 0
3 = 3 dB Pad	8 = 0
4 = 4	9 = 0

XXXX = Trunk Number

nnnn = Farend Testline Number (4 digits)

TABLE S APC 1068 SP-1 2-WIRE ROTL PRIMING																			
TYPE TEST	TEST LINE	DIGITS																	
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
TRANSMISSION TESTS	100	KP	0	0	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
	102	KP	0	2	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
	105	KP	0	5	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
MAINTENANCE* BUSY OVERRIDE	100	KP	1	0	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
	102	KP	1	2	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
	105	KP	1	5	0	A	0	X	X	X	X	n	n	n	n	n	n	n	ST
CONNECTION** APPRAISAL	100	KP	6	0	FAREND TESTLINE NUMBER												ST		
	103	KP	6	2	UP TO 11 DIGITS												ST		
	105	KP	6	5													ST		

*Does not have the ability to override maintenance busy.
Will accept this priming for CAROT priming compatibility.
**Requires a separate subscriber line for connection appraisal.

A = Receive Pad Loss:

0 = No Pad	5 = 5 dB Pad
1 = 1 dB Pad	6 = 6 dB Pad
2 = 2 dB pad	7 = 0
3 = 3 dB Pad	8 = 0
4 = 4 dB Pad	9 = 0

XXXX = Trunk Number (OTT System Number)

nnnn = Farend Testline Number (7 digits)

TABLE T APC 1072 DMS-10 ROTL PRIMING																							
TYPE TEST	TEST LINE	DIGITS																					
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
TRANSMISSION TESTS	100	KP	0	0	B	B	S	P	P	U	U	FAREND TEST LINE NUMBER UP TO 11 DIGITS										ST	
	102	KP	0	2	B	B	S	P	P	U	U											ST	
	105	KP	0	5	B	B	S	P	P	U	U											ST	
	MAINTENANCE	100	KP	1	0	B	B	S	P	P	U											U	ST
	BUSY OVERRIDE	102	KP	1	2	B	B	S	P	P	U											U	ST
	105	KP	1	5	B	B	S	P	P	U	U	ST											
CONNECTION APPRAISAL	100	KP	6	0	FAREND TESTLINE NUMBER										ST								
	103	KP	6	2	UP TO 11 DIGITS										ST								
	105	KP	6	5											ST								

WHERE BB = BAY, WITH RANGE 01-16
 S = SHELF, WITH RANGE 1-6
 PP = PACK, WITH RANGE 01-16
 UU = UNIT, WITH RANGE 01-24 MEANING
 1-24 DIAL PULSE
 51-74 MEANING
 1-24 MF PULSE

TABLE U APC 1065 GTD-5 ROTL PRIMING																											
TYPE TEST	TEST LINE	DIGITS																									
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	ST			
TRANSMISSION TESTS	100	KP	0	0													FAREND TEST LINE NUMBER LESS THAN 11 DIGITS						ST				
	102	KP	0	2																			ST				
	105	KP	0	5																			ST				
	100	KP	1	0																			ST				
	OVERRIDE	102	KP	1	2	ST																					
OOS	105	KP	1	5	TRUNK GROUP NUMBER						TRUNK GROUP MEMBER NUMBER												ST				
OPERATIONAL TESTS	NON-SYNC	KP	2	0																			ST				
	SYNC	KP	2	1																			ST				
	103	KP	2	3																			ST				
	NON-SYNC	KP	3	0																			ST				
	OVERRIDE	SYNC	KP	3	1	ST																					
OOS	103	KP	3	3	ST																						
TERMINAL BALANCE		KP	4	0																			ST				
TEST	OVERRIDE OOS	KP	4	1																			ST				
MAKE BUSY REMOTELY		KP	5	0																			ST				
RESTORE IDLE REMOTELY		KP	5	1																			ST				
INDIVIDUAL TRK STATUS		KP	5	2	ST																						
TRK GRP STATUS BY TRK		KP	5	3	ST																						
TRK GRP STATUS BY GRP		KP	5	4	ST																						
CALL BACK REQUEST		KP	5	5	ID	ET																					
CONNECTION	100	KP	6	0	FAREND TEST LINE NUMBER																ST						
APPRAISAL	102	KP	6	2	(LESS THAN 12 DIGITS)																ST						
TESTS	105	KP	6	5																	ST						
HOME OFFICE TEST LINES	100	KP	7	0	N												ST										
	102	KP	7	2	O						TRUNK GROUP						ST										
	103	KP	7	3	T						AND MEMBER						ST										
	NON-SYNC	KP	7	4	E						NUMBER						ST										
	105	KP	7	5													ST										

TABLE V APC 1096 SL-1 ROTL PRIMING																								
TYPE TEST	TEST LINE	DIGITS																						
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	ST
TRANSMISSION TESTS MAINTENANCE* BUSY OVERRIDE	100	KP	0	0																				ST
	102	KP	0	2																				ST
	105	KP	0	5																				ST
	100	KP	1	0																				ST
	102	KP	1	2																				ST
	105	KP	1	5																				ST
CONNECTION APPRAISAL	100	KP	6	0																				ST
	103	KP	6	2																				ST
	105	KP	6	5																				ST

*ROTL will accept Maintenance Busy Override priming but does not support this function

TABLE W APC 1095 PBX ROTL PRIMING																										
TYPE TEST	TEST LINE	DIGITS																								
		KP	1	2	3	4	5	6	7	8	9	10	11	-- -- -- -- THROUGH -- -- -- --							21	ST				
TRANSMISSION TESTS	100	KP	0	0	T																				ST	
	102	KP	0	2	R																				ST	
	105	KP	0	5	K		TRK																			ST
MAINTENANCE* BUSY OVERRIDE					T		GRP																			ST
	100	KP	1	0	Y		#																			ST
	102	KP	1	2	P																					ST
	105	KP	1	5	E		(TRUNK ID NUMBER)																			ST
		FAREND TEST LINE NUMBER (11 DIGITS)																								

*The 1095 does not have the capability to override maintenance busy.
It will accept this priming for capability on demand tests for CAROT.

TABLE X APC 1073 ITS 4/5 ROTL PRIMING																										
TYPE TEST	TEST LINE	DIGITS																								
		KP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21			
TRANSMISSION TESTS <div>MAINTENANCE* BUSY OVERRIDE</div>	100	KP	0	0	A	B	X	Y	Y	Z	Z	FAREND TEST LINE NUMBER UP TO 11 DIGITS										ST				
	102	KP	0	2	A	B	X	Y	Y	Z	Z											ST				
	105	KP	0	5	A	B	X	Y	Y	Z	Z											ST				
	100	KP	1	0	A	B	X	Y	Y	Z	Z											ST				
	102	KP	1	2	A	B	X	Y	Y	Z	Z											ST				
	105	KP	1	5	A	B	X	Y	Y	Z	Z											ST				
CONNECTION** APPRAISAL	100	KP	6	0	FAREND TESTLINE NUMBER										ST											
	103	KP	6	2	UP TO 11 DIGITS										ST											
	105	KP	6	5											ST											

*Does not have the ability to override maintenance busy.
Will accept this priming for CAROT priming compatibility.
**Requires separate subscriber line for operation.

A = Signaling:

0 = MF, Wink, No ANI
1 = DP, Immediate Dial, No ANI
2 = MF, Wink, ANI
3 = DP, Immediate Dial, ANI
4 = MF, Wink, ANI, STP
5 = DP, Immediate Dial, ANI, STP
6 = MF, Wink, ANI, STP2
7 = DP, Immediate Dial, ANI, STP2
8 = MF, Wink, ANI, STP3
9 = DP, Immediate Dial, ANI, STP3
0 = MF, Wink, No ANI

B = Receive Pad Loss:

0 = No Pad
1 = 1 dB Pad
2 = 3 dB Pad
3 = 3 dB Pad
4 = 4 dB Pad
5 = 5 dB Pad
6 = 6 dB Pad
7 = 0
8 = 0
9 = 0

X = Group, range 0-3

YY = Port, range 00-15
ZZ = Link, range 01-24

APC 1077B
MANUAL INTERROGATOR

REMOTE OPERATION

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General

1.01 This section describes remote operation with the 1077B. Remote operation allows full unattended operation of the 1077B with either a terminal device or a computer. The remote control applies to a direct connection or an external modem connection to the RS-232-C (printer) port. The main features provided include remote access to a 1077B, and use of the 1077B as a trunk testing port by the APC START™ software. For information on using the 1077B with the APC START software package, refer to the 1078 START™ Instruction Manual (P/N 1000-0698-801)

1.02 Whenever this section is re-issued, the reason(s) for reissue will be listed here.

1.03 Comments concerning the content or organization of this document, as well as suggestions for improvement are welcomed. Direct comments to:

Test & Measurement Systems/3M
Lab - Technical Communications
P O Box 2963
Austin, TX 78769-2963
512/834 1800

2. Communications

2.01 Communications are through an RS-232-C compatible serial asynchronous link using 8-bit ASCII data with no parity, one start and one stop bit. A simple protocol with two variations are used. The two variations differ by the particular control characters used and information echoed to the communications port. The local RS-232 connector may be used to connect to a terminal or computer directly, or to a modem if cross-wired. Although this port supports 300, 600, 1200, and 2400 baud rates, the customer will normally use only the 300 and 1200 baud rate capabilities. External modems used should be compatible with Bell 103 or 212 auto answer modems.

Control Characters

2.02 There are two sets of control characters used by the remote control feature. The sets are used for the two protocols, called human interface and computer interface. In the human interface mode, all characters received are echoed to the communications port along with various information during testing. The assumption is that a person with a terminal device is operating the 1077B and the information is required by the person to interpret the testing sequence. The computer interface has no character-by-character echo, and the only information sent to the communications port is the transmission test results. The assumption here is that a computer is controlling the 1077B and only the minimum required information is desired.

2.03 There are four control characters used by the remote control feature: initiate remote control, terminate remote control, start of line, and end of line. The start of line character is sent from the 1077B to the communications port. The other three control characters are sent to the 1077B. The initiate control character must be received before any remote commands will be accepted. Any activity on the communications port before this character is received will be ignored. The terminate remote control character returns the 1077B to the local mode and any further

activity on the port will be ignored. The start of line character is sent from the 1077B to the remote controller to indicate readiness for the next command. Command entry is not allowed until this character is sent. The end of line character, received from the remote controller, indicates the end of a command line input so that the 1077B can begin processing the command. Before receipt of this character, the input line may be edited with the backspace character and the cancel character. TABLE 3-1 shows the characters used for the two protocols.

TABLE 3-1 CONTROL CHARACTERS		
FUNCTION	INTERFACE TYPE	
	COMPUTER	HUMAN
INITIATE REMOTE	SOH (Hex 01)	> (Hex 3E)
TERMINATE REMOTE	SOH (Hex 04)	EOT (Hex 04)
START OF LINE	DC1 (Hex 11)	> (Hex 3E)
END OF LINE*	DC3 (Hex 13)	CR (Hex 0D)
CHARACTER DELETE	BS (Hex 08)	BS (Hex 08)
LINE DELETE	CAN (Hex 18)	CAN (Hex 18)
*CR is also accepted for end of line for computer interface.		

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Remote Initiation

2.04 Remote control is initiated by receipt of the initiate remote character (>). Any activity on the communications port is ignored until this character is received. When the initiate remote character is received, any current activity in either the ROTL test set mode or the nearend mode is aborted in preparation for remote control. If a connection to a ROTL or responder is active, the disconnect signal will be sent and the access line to that device will go onhook.

Command Receipt

2.05 Commands are accepted after the 1077B sends the start of line character. This character may also be interpreted as a prompt. The command line is terminated upon receipt of the end of line character. The end of line character will be echoed to the remote controller. When this character is received, the command line is parsed and executed. Any characters received between the end of line and the next start of line are ignored. The command line may be up to 80 characters and

must contain exactly one valid command.

2.06 If the remote control device is a playback memory device, such as a paper tape reader, cassette tape reader, or a bubble memory terminal, the start of line and end of line characters for the computer interface will properly control the playback on and playback off features of that device. This allows the storage of a command program in that device and automatic execution of it by the 1077B. The DC3 character is always echoed for the computer interface regardless of whether the received character was DC3 or CR.

2.07 All commands except the GO command are used for setup only and return no results. The GO command will cause the current test requirements to be executed and the results returned to the remote controller. The setup commands need only be entered when their values change. Test results are formatted according to the type of interface in effect and sent to the communications port after the GO command is executed and before the next command line is accepted.

Remote Termination

2.08 Remote control is terminated when the terminate remote control character is received. Also, remote control will be aborted when any key on the front panel is pressed. If a front panel key is pressed, there will be no indication to the remote controller that processing has been aborted.

Output of Results

2.09 After a GO command is received, the 1077B will execute a transmission test sequence. The GO command will be terminated by the end of line character and that character will be echoed to the remote controller. After the test is completed, results will be

sent to the communications port, formatted appropriately. When all test results have been sent, the start of line character (prompt) will be sent. This character may be interpreted both as the end of results and the start of the next command. A computer controller need only scan for this single character to detect the end of the results.

3. Remote Commands

3.01 This part describes the command format recognized by the 1077B during remote operation. Unless otherwise specified, the following general guidelines apply to this description:

- a) Capitalized words representing commands and key words must be entered exactly as shown and in the order specified.
- b) Blanks are used to separate command words from parameters, and are otherwise ignored except that no blank may precede the command word.
- c) A parenthesized list means that one option must be selected from the items in the list. The parentheses are not to be entered.
- d) Each command must end with the appropriate end command character (DC3 or CR) and only one command may be entered on a line.

ACCESS 9.15122581651 DP

3.02 The ACCESS command allows entry of the access number for the ROTL access in the RTS mode or trunk access in the nearend mode. The number may be up to 30 characters long. Each character may be a digit, a special digit, a supervision or signaling digit, or a blank. Available characters are listed in TABLE 3-2. The signaling mode, if specified, must be preceded by a space (as in the heading to this paragraph). If not specified, the unit will default to TT.

TABLE 3-2
SPECIAL DIGITS for REMOTE CONTROL

DIGITS used with ACCESS**	MEANING
SUPERVISION PAUSES .	wait for dial tone pause 1 second
SIGNALING CHANGES / - K S	change to dial pulse change to SF send KP send ST
EXTENDED DIGITS * #	DTMF 941,1209 DTMF 941,1336
DIGITS used in with PRIME* and FETL**	MEANING
SUPERVISION PAUSES .	wait for dial tone
SIGNALING CHANGES K S	send KP send ST
* Outpulsing is always MF ** Outpulsing can be TT or DP	

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PRIME K652581651S

3.03 The PRIME command allows entry of the priming field for the RTS mode. Up to 30 digits may appear between the K and S. The K and S are optional. If the S is not entered, any remaining digits in the existing priming string are not changed. This allows the trunk address field of the priming string to be changed without having to re-enter the FETL number when testing several trunks in a group.

FETL 9591051

3.04 The FETL command allows the entry for the farend test line number. Available digits are the same as the PRIME number.

TEST (LOSS NOISE NTONE L04 L10 L28 ERL SRL SRH) (MEAS S.C. BOTH)

3.05 The TEST command specifies the transmission tests to be run. Up to 9 test selections may be entered from the first list above. The tests

will be run in the order specified. The second list allows the options for measurements, self-checks, or both; both is the default. If both is specified, the self-checks immediately precede their respective measurements.

PREP (600 900) (0 2) (100 102 105)

3.06 The PREP command sets the impedance, TLP and test line type for the transmission tests. Selections may appear in any order and it is not necessary to enter all selections.

For example, the following display would indicate that the termination is 900 ohms, 0 test level point, using a code 105 test line:

PREP 900 0 105

MODE (NEARND ROTLTS FAREND)
(2WIRE 4WIRE MODEM FAREND)

3.07 The MODE command sets the primary and secondary operating modes for the 1077B. One selection from each list must be entered in the order shown. Only valid combinations as listed in TABLE 2-5, Section 2 are allowed.

TRUNK (LINE LOOP E&M1TK E&M1SG E&M2TK
E&M2SG) (DIAL WINK TIME QUIET IMMEDIATE
ANY)

3.08 The TRUNK command specifies the type of trunk for the primary operating mode and the supervision requirements that must be met before outpulsing may proceed. Trunk types include, in order, subscriber line, loop trunk, E&M Type I trunk circuit, E&M Type I signaling circuit, E&M Type II trunk circuit, and E&M Type II signaling circuit. Supervision requirements include dial tone, wink start, timed delay, quiet, immediate dial, and any.

LIMITS test type
-06.1:-05.5/-04.2:-01.2

3.09 The LIMITS command sets the test limits range for each test to compare the results for success or failure. The command must be entered for each test that requires limits. The test type listed in the command is the same as the test selection in the TEST command.

3.10 Each pair of numbers separated by colons (:) represents the lower and upper bounds for the test results. Each number must be prefixed by a plus (+) or minus (-) sign. The numbers must be in the format shown with no blanks, and leading zeroes are required. The second pair of numbers after the slash (/) is the limits for for the near-to-far direction and is entered only when different from the far-to-near limits.

FIELD 9 (SXS3 SXS5)

3.11 The FIELD command specifies a digit position to be incremented sequentially when a group of tests are to be run. In the nearend mode, the field applies to the access number. In the ROTL test set mode the field applies to the priming. The field may be either a number or the SXS3 or SXS5 keywords. The SXS (3 or 5 wire) applies only to the ROTL test set mode and specifies the generation algorithm for the APC brand step-by-step ROTLs. For an APC step-by-step mini-ROTL, the priming must contain a blank between the 05 and the trunk address (priming digits 2 and 3) for the algorithm to work properly.

For example:

Maxi SXS - 0501001- - - -
Mini SXS - 05 1001- - - -

If a number is specified, it indicates the digit position to be incremented for a common control application. When the digit incremented overflows, the next digit to the left is also incremented. Digit positions begin at 1 (left most) and all characters

including digits, special characters, and blanks are counted. In the priming field, the initial KP is not counted.

GROUP 23

3.12 The GROUP command specifies how many sets of tests are to be run using the current setup. Used in conjunction with the field command, the priming or access numbers are updated after each test and the tests repeated the number of times specified by the group count. If the field is not specified, the same priming or access is used and the tests are repeated as already setup. At the end of the tests, a summary line of results is printed. The count may be from 1 to 99. This command is useful in the nearend mode to run connection appraisal tests.

TIME MM/DD/YY,HH:MM:SS

3.13 This command allows entry of the current time of day to initialize the internal clock for a scheduled start. The format above must be followed exactly with no blanks, and leading zeroes are required.

START MM/DD/YY,HH:MM:SS

3.14 The START command specifies the time to begin testing. When the GO command is entered, the 1077B waits until the start time passes to begin testing. The format for the time is the same as the TIME command.

RETRY 1

3.15 The RETRY command specifies how many times the particular test is to be retried before reporting an error. Any failure before completing the tests will cause a retry from the point of failure. The total number of tries is equal to retry plus one. The count may be from 0 to 9. Note that access to a ROTL is always tried 3 times, and transmission tests failing limits are always tried twice. Any other retry count is set by this command.

ECHO

3.16 The ECHO command sets the command echo mode typically used for a playback terminal. In this mode, changes in the setup will be highlighted on the printout as they go into effect and intermixed with the test results to assist in interpreting the results identifying circuit addresses. Refer to Fig. 3-1.

```
^a
ECHO
MODE ROTLTS 2WIRE
ACCESS 9.19166333436
TEST LOSS NOISE NTONE L04 L10 L28 MEAS
LIMITS LOSS -04.0:-03.0/-03.0:-02.0
LIMITS NOISE 15:18
LIMITS NTONE 34:35
LIMITS L04 -21.0:-18.0/-20.0:-17.0
LIMITS L10 -20.0:-19.0/-19.0:-18.0
LIMITS L28 -21.0:-18.0/-20.0:-17.0
PRIME 05 151109591051
FIELD SXS3
GROUP 10
TIME 02/28/85,08:29:00
START 03/01/85,01:00:00
GO
HANGUP
^d
```


COMMANDS

```

MODE      ROTLTS      2 WIRE
TEST      LOSS NOIS CNOT L04 L10 L28
LIMITS    LOSS F-N -04.0:-03.0 N-F -03.0:-02.0
LIMITS    NOISE F-N +15.0:+18.0 N-F +15.0:+18.0
LIMITS    NTONE F-N +34.0:+35.0 N-F +34.0:+35.0
LIMITS    L04 F-N -21.0:-18.0 N-F -20.0:-17.0
LIMITS    L10 F-N -20.0:-19.0 N-F -19.0:-18.0
LIMITS    L28 F-N -21.0:-18.0 N-F -20.0:-17.0
ACCESS    9.19166333436 TT
PRIME     05 151109591051 MF
PRIMING   FAILED          TIMEOUT

NOISE     MAX ERR
PRIME     05 171109591051 MF

L10       -18.9-18.6
PRIME     05 191109591051 MF

PRIMING   FAILED          BUSY
PRIME     05 101309591051 MF

TRIES 10 0-0-L 02 OPBAD 02 GOOD 06

```

RESULTS

Fig. 3-1 -- PLAYBACK MEMORY TERMINAL

HANGUP

3.17 The HANGUP command causes a disconnect signal to be sent to the ROTL (in the ROTL test set mode) and the phone line hung up in preparation for a new ROTL access number. This command is not required in the nearend mode.

GO

3.18 The GO command causes the current test setup to be executed. In the nearend mode, the responder will be dialed, the measurements specified will be made, the release command will be sent and the circuit hung up. In the ROTL test set

mode, if the ROTL is not accessed it will be dialed up first. Then priming will be sent and the transmission tests will be run. At the end of the test sequence the release responder MF command will be sent. The ROTL will be maintained on line until a HANGUP command is received or a new access number is entered. The GO command has no effect on the farend mode. The 1077B will accept new commands at the end of the GO test sequence.

CHECK

3.19 This command runs the 1077B internal self-check. Results returned consist of the single word: 'PASS' or 'FAIL'.

SETUPS

3.20 The SETUPS command is used to output the entire list of current parameters that have been entered by previous commands. This command will also show default parameters for items that have not been changed.

BUFFER command;command;

3.21 The BUFFER command allows the entry of additional commands to be executed after the current GO command is complete. The BUFFER must be entered before the GO. When the current GO has completed, the 1077B reads commands from the internal buffer rather than issuing the prompt for more input. After the buffer is exhausted, the prompt is issued and more input is accepted. The buffer

would normally contain GO commands after each setup change is made.

3.22 The internal buffer is 512 bytes (characters) long. As many command strings as will fit in the buffer may be entered with the BUFFER commands. On the BUFFER command line, commands are entered exactly as they would be if entered normally. Commands must be separated by semicolons (;), including the last entry of each line. Every character after the word BUFFER is entered into the internal buffer and the semicolons act as end of line indicators when commands are subsequently read from the buffer. Multiple BUFFER commands may be entered to stack commands until the buffer is full. Note that each individual BUFFER command is limited to 80 characters (1 line). Fig. 3-2 shows an example of the BUFFER command.

```
>MODE NEARND 2WIRE
>TRUNK LINE
>TEST LOSS NOISE MEAS
>PREP 900 0 105
>ACCESS 9.3456710
>GROUP 3
>BUFFER MODE ROTLTS 2WIRE;ACCESS 9.4748807;PRIME 050120341105;GO
>BUFFER PRIME 050122133;GO;PRIME 050121432;GO;PRIME 050117231;GO
>BUFFER PRIME 050118921;GO;PRIME 051213145;GO;HANGUP;
>GO
```

MODE	NEARND	2 WIRE			
TRUNK	LINE				
TEST	LOSS NOIS MEAS				
PREP	900 0dB 105				
ACCESS	9.3456710				
LOSS	-6.7 -5.1	NOISE	TT	15	15
LOSS	-6.0 -5.9	NOISE		16	15
LOSS	-7.5 -6.7	NOISE		22	19
MODE	ROTLTS	2 WIRE			
ACCESS	9.4748807		TT		
PRIME	050120341105		MF		
LOSS	-3.0 -3.1	NOISE		15	15
PRIME	050122133105		MF		
LOSS	-3.1 -2.9	NOISE		15	15

PRIME	050121432105		MF	
LOSS	-3.3 -3.1	NOISE	16	15
PRIME	050117231105		MF	
LOSS	-3.2 -3.4	NOISE	17	15
PRIME	050118921105		MF	
LOSS	-3.6 -3.1	NOISE	15	16
PRIME	051213145105		MF	
LOSS	-3.0 -3.1	NOISE	15	15

Fig. 3-2 --BUFFERED COMMANDS

SAVE

3.23 The SAVE command is used to store the current setup into the internal EEPROM. Everything that can be entered remotely is saved. This current setup may be retrieved by the LOAD command.

LOAD

3.24 The LOAD command retrieves the SAVED setup from the EEPROM. The saved setup is automatically retrieved on power up and becomes the default state for all command setups.

EPCLR

3.25 This command is used for troubleshooting the EEPROM and is rarely used by the customer. EPCLR will initialize all bytes of the internal EEPROM to zero.

PWRUP

3.25 The PWRUP command executes a power up reset exactly the same as if the power had been turned off and back on. If the 1077B is being accessed remotely, unpredictable events may occur.

4. Output Format

4.01 Test results are output in one of two formats depending on whether the remote control was ini-

tiated in human or computer interface modes. The ECHO command may be entered in the computer mode and will cause the setup changes to be printed also. The echo mode is automatically in effect with the human interface. This gives a total of three combinations of the output formats. The differences involve how the test results are formatted and whether setup changes are printed as they go into effect.

Computer Output

4.02 In the computer interface mode, test results are returned as a single line of numbers with no annotation. Refer to Fig. 3-3. Each test result occupies 5 characters for each direction of transmission. The numbers are right justified in the 5 character field and leading zeroes are suppressed (converted to blanks).

Human Output

4.03 The human interface output format provides the test results labeled with the test name and two sets of test results appear on each output line. Each test result occupies 5 characters with spaces between for easier readability. An example is shown in Fig. 3-4.

Echo Mode

4.04 When the ECHO command is entered, setup changes are printed as they go into effect. Examples are included in Figs. 3-3 and 3-4.

Group Summary

4.05 When the GROUP command is used to specify multiple test accesses for one GO command, a summary line is printed after the group is complete. This is shown in Figs. 3-3 and 3-4.

Limits

4.06 When limits are specified for tests in the human interface mode, only tests failing limits are

printed. This is shown in Fig. 3-4. The test results are always sent to the communications port in the computer interface mode.

5. Errors

5.01 Errors are detected by the 1077B and reported to the communications port as they occur. The action taken and information reported are listed in TABLE 3-3.

```
MODE NEARND 4WIRE
TRUNK E&MITK WINK
PREP 600 0 105
TEST LOSS NOISE ERL
LIMITS LOSS -07.0:-05.0
LIMITS NOISE +00.0:+23.0
LIMITS ERL +22.0:+99.9
ACCESS 2031312*.8369894
GO
ACCESS 2034117*.8369894
GO
ACCESS 2030923*.8369894
GO
ACCESS 2032226*.8369894
GO
ACCESS 2034610*.8369894
GO
```

COMMANDS

```
-5.7 -6.1 15 16 32 29
-6.3 -6.0 21 15 25 30
ACCESS PAUSE FAILED BUSY
-7.1 -7.3 15 15 34 32
-5.9 -6.1 17 16 28 31
```

RESULTS

Fig. 3-3 -- COMPUTER INTERFACE

```

>MODE ROTLTS 2WIRE
>ACCESS 9.19155293906
>TEST LOSS NOISE MEAS
>PREP 600 0 105
>PRIME K05015110111119591051S
>FIELD SXS5
>GROUP 10
>TIME 02/27/85,16:20:44
>START 02/27/85,22:00:00
>GO

```

MODE	ROTLTS	2 WIRE			
PREP	600	0dB	105		
TEST	LOSS	NOIS		MEAS	
ACCESS	9.19155293906			TT	
PRIME	05015110111119591051			MF	
PRIMING	FAILED		BUSY		
PRIME	05016100111119591051			MF	
LOSS	-3.7 -2.2	NOISE		15	15
PRIME	05016110111119591051			MF	
LOSS	-3.7 -2.2	NOISE		15	15
PRIME	05017100111119591051			MF	
LOSS	-3.7 -2.1	NOISE		15	15
PRIME	05017110111119591051			MF	
LOSS	-3.7 -2.1	NOISE		15	15
PRIME	05018100111119591051			MF	
LOSS	-3.7 -2.1	NOISE		15	15
PRIME	05018110111119591051			MF	
LOSS	-3.8 -2.2	NOISE		15	15
PRIME	05019100111119591051			MF	
LOSS	-3.8 -2.1	NOISE		15	15
PRIME	05019110111119591051			MF	
LOSS	-3.0 -2.5	NOISE		18	15
PRIME	05010130111119591051			MF	
PRIMING	FAILED		BUSY		
TRIES	10	0-0-L	00	OPBAD	02
				GOOD	08
>HANGUP					
>					

Fig. 3-4 -- HUMAN INTERFACE

TABLE 3-3
ERROR MESSAGES
(AUTOMATIC MODE ONLY)

All error codes consist of two parts: the step in which the error occurred (ERROR STEP) and the cause of the error (ERROR CAUSE). This table contains detailed descriptions of ERROR STEP, ERROR CAUSE, and conditions under which the various combinations will occur.

ERROR STEP

ACCESS FAILED	This step occurs when first trying to dial an access number or after a complete number is dialed. Does not include pauses for dial tone or supervision.
ACCESS PAUSE FAILED	This step occurs during other than above. Indicates error during pause for dial tone.
PRIMING FAILED	This step occurs after priming is sent to ROTL and awaiting response for trunk seizure.
CUT THRU FAILED	This step occurs after trunk is seized and awaiting answer from far end test line.
RECYCLE FAILURE	This step occurs when recycle is sent to ROTL and awaiting response.

ERROR CAUSE

PARKED	Constant TPT received for one minute or more. Indicates equipment busy with other calls.
TIMEOUT	No tone bursts received or any such bursts of short duration or long spacing. Indicates circuit high and dry or equipment failure.
NO DIAL TONE	No dial tone detected during dialing sequences. Indicates no circuit attached or sequence error when secondary dial tone is required.
REORDER	120 IPM low tone detected. Indicates equipment blockage or ROTL priming error.
BUSY	60 IPM detected. Indicates circuit busy.
NO ANSWER	Ringback tone detected. Indicates equipment failure or incorrect number dialed.
UNCLASSIFIED	At least four tone bursts of irregular period detected and not classified as busy, reorder, or no answer. A catch all category for unknown responses.

(Continued On Next Page)

TABLE 3-3 con't.

ERROR STEP AND CAUSE COMBINATIONS MOST PROBABLE CAUSE

ROTL Test Set or Nearend Mode

Note: Failures in the ROTL test set mode are failures to access a ROTL. Failures in the Nearend mode are failures to seize the trunk under test.

INVALID COMMAND

Command ignored. Occurs in remote operation only. Check format.

ACCESS FAILED followed by

PARKED

Constant TPT for 1 minute, recycle, constant TPT for 1 minute, waits for external command to hang up (computer or manual entry).

Causes: ROTL or farend busy, ROTL hardware failure, no wink from switch (ESS), or long term tests on other port.

TIMEOUT

Nothing received 60 seconds after priming digits sent.

Cause: Access circuit high and dry, check dialing format.

NO DIAL TONE

No dial tone received 20 seconds after going offhook.

Cause: Access Line not connected. Improper connection or 1077 hardware failure.

REORDER

120 IPM received after dialing.

Causes: Heavy traffic (all circuits busy), improper number dialed into ESS.

BUSY

60 IPM received after dialing.

Causes: ROTL access or called-party disconnect ROTL has not timed out (5-minutes).

NO ANSWER

ROTL access dialed and detected but not tripped.

Causes: Wrong number, ROTL turned off, or ROTL hardware failure.

(Continued On Next Page)

TABLE 3-3 con't.

UNCLASSIFIED

Number dialed, ringing tripped, something other than TPT detected.

Causes: Voice announcement (recording), warble tone, or voice (wrong number).

ACCESS PAUSE FAILED followed by

Note: ACCESS PAUSE FAILED errors occur with the Access Special Digits in TABLE 2-3.

DIAL TONE

No second dial tone detected.

REORDER

Requested circuit non-existent in nearend mode.

BUSY

Requested circuit busy in nearend mode.

PRIMING FAILED followed by

Note: PRIMING FAILED errors occur in the ROTLTS mode only and will not occur in the Nearend mode.

TIMEOUT

ROTL equipment error.

REORDER

Invalid priming.

BUSY

Trunk busy.

UNCLASSIFIED

ROTL equipment error.

CUT THRU FAILED followed by

PARKED

Farend busy.

TIMEOUT

Trunk High and Dry.

REORDER

Invalid farend number or all circuits busy.

BUSY

Farend busy.

NO ANSWER

Farend equipment failure.

UNCLASSIFIED

Voice announcement or excessively noisy trunk.

RECYCLE FAILED TIMEOUT

ROTL equipment failure or access line dropped.

SERVICE, REPAIR AND WARRANTY POLICIES

1. Introduction

1.01 This section describes the Test & Measurement Systems/3M (hereinafter may also be referred to as the Seller) service, repair, and warranty policies. It is intended for use as a procedural reference in the event the need for service or repair should arise, and also outlines limited warranty specifics.

2. Returns

2.01 All items returned to Test & Measurement Systems/3M must be accompanied by a Material Return Authorization (MRA) number, which may be obtained by contacting the Test & Measurement Systems/3M Repair Department, as specified below, that services your particular product. After receiving an MRA number, the equipment should be shipped prepaid to:

All APC and Dynatel Products:

Test & Measurement Systems/3M
ATTN: Repair Department
11705 Research Blvd.
Austin, Texas 78759
512/258 1651 or 800/531 5308
TWX 910 874 2020

All Dynatel and APC
Facilities Products:

Test & Measurement Systems/3M
ATTN: Repair Department
Bankers Industrial Drive
Atlanta, Georgia 30360
404/447 7145

Note: Both shipping carton and packing list must reference the MRA number.

2.02 Enclosed with the equipment should be a statement giving the reasons for return as well as the name, address and telephone number of the person to whom the unit is to be returned and billed.

3. Repairs

3.01 WARRANTY ON REPAIRED EQUIPMENT:

All repair of Test & Measurement Systems/3M instruments, except the APC Models 1301 and 1303, are warranted to be free from defects in material and workmanship for a period of ninety (90) days, commencing on the date of shipment to the buyer. APC Models 1301 and 1303 and all other Test & Measurement Systems/3M product repairs are warranted for thirty (30) days. Test & Measurement Systems/3M sole and exclusive liabilities under these warranties are and shall be limited to issuance of credit for or repair or replacement of goods or parts which are proved to be other than warranted; and Test & Measurement Systems/3M shall have sole discretion as to which of these remedies it shall provide. Test & Measurement Systems/3M shall not reimburse or make any allowance to buyer for any labor or freight charges incurred.

3.02 ON-SITE REPAIR: On-site repair service is available for the APC 1301 only. Contact Test & Measurement Systems/3M in Austin, Texas for specific charges.

4. New Product Limited Warranty

4.01 SELLER warrants its products to be free from defects in material and workmanship, subject to the following terms and provisions:

a) All test and measurement instruments, except the APC 1301 and 1303, are warranted for twelve (12) months after date of shipment from SELLER to the original purchaser. APC Models 1301 and 1303 are warranted for ninety (90) days on labor and twelve (12) months on parts after date of shipment from SELLER to the original purchaser.

b) SELLER's obligations under this warranty are limited to repairing, replacing or adjusting at SELLER's option any of SELLER's products which after normal and proper useage, proves to be defective on SELLER's inspection, provided that the purchaser shall have reasonably inspected products when received and notified SELLER of any apparent defects within fifteen (15) days of receipt of shipment. SELLER shall not be liable for any injury or for any manufacturing costs of the buyer, or any other special consequential damages incurred by the buyer by reason of the use of any defective SELLER's equipment.

c) Equipment delivered by SELLER shall not be considered defective if it satisfactorily fulfills the order or complies with published specifications on standard catalog items. This warranty does not extend to any SELLER' products which have been subjected to misuse, neglect, accident or improper applications, nor shall it extend to units which have been repaired or substantially altered outside of the SELLER's

factory, nor to any associated instruments, equipment or apparatus.

d) Products requiring repair may be returned to SELLER only after obtaining an MRA number. To obtain an MRA number, contact the SELLER's Repair Department as referenced in paragraph 2.01. After receipt of the MRA number, equipment requiring repair or replacement should be shipped prepaid to the factory accompanied by a written statement setting forth the MRA number and the defects observed. The MRA number should be clearly marked on the shipping carton and on the packing list.

5. Important Purchaser Notice

5.01 All statements, technical information and recommendations related to SELLER's products are based on information believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before utilizing the equipment, the user should determine the suitability of the product for his intended use, and assumes all risks and liability whatsoever in connection with that use.

5.02 All statements or recommendations not contained in SELLER's standard publications shall have no force or agreement unless in an agreement signed by officers of SELLER, and the above is made in lieu of all warranties, expressed or implied.