



Basic System Features

Supports Two-way Loss
Supports Two-way Noise
C-Notched Noise
C-Message Noise
Peak-to-Average Ratio (P/AR)

3-Tone Gain/Slope
Provides Quiet Termination
Compensation For Access Line Loss
Supports Echo Canceller Testing
Originates Test Sequence Call
DTMF Compelled

Options

Two or Four-wire Termination
110 VAC Operation
48 VDC Operation*
Loop or Ground Start (2-wire)
E&M Type I or Type II (4-wire)
600 or 900 Ohm Termination (2-wire)

ERL Measurement (4-wire)*
CAROT Compatibility*
Emulates Test Lines From Other Manufacturers*
(Consult factory for details)

*Indicates cost option. Please consult factory for details.

Introduction

The Model T346 Universal Test Line/Responder combines the test and measurement capabilities required by most network testing systems in one unit. The programmed flexibility of the T346 allows one responder to provide the testing termination for the multiple applications existing on modern telecommunications networks. The fully configured unit provides the features of an analog test line/responder, a DTMF-compelled responder, a 105 Type test line, a 56A Responder (it is CAROT compatible), plus it provides a signal for P/AR measurement.

Description

The Model T346 may be located at any dialable 2-wire or 4-wire point in the network. For 2-wire installation, supervision may be either loop or ground start with connection made via a barrier terminal or RJ-11C jack. For 4-wire installation,

supervision is E&M type I or II with connections made via a barrier terminal strip or RJ-11C jacks.

During installation the send and receive functions may be calibrated to compensate for loss in the access lines associated with the switches between the testing unit and the responder. This allows any testing performed on inter-machine trunks to indicate only the loss associated with the trunk.

When the T346 is ordered the type of test line desired is pre-defined by the customer. The T346 will then operate as the pre-defined test line unless DTMF-compelled by the testing system to operate as another type of test.

The T346 also has the ability to receive a DTMF number sequence, disconnect, then originate a call from the remote location to the number which was received and perform the test sequence under control of the called test equipment, such as the WILCOM T328 Master Test Line and Controller.

The basic configuration is upgradable to provide the following enhanced testing capabilities:

CAROT Compatibility —

Type 105 Test Line and 56A Responder Functions, either 2-wire or 4-wire

Echo Testing —

The 4-wire version of the T346 can make Echo Return Loss, Singing Return Loss High and Singing Return Loss Low Tests.

The fully configured T346 may be DTMF-compelled to provide an extremely flexible Test

Line/Responder. Upon receiving specific DTMF digits, the T346 will exit the pre-defined test line mode and emulate many existing analog test lines plus provide access to over 40 individual testing functions. Specific DTMF digits also provide access to the CAROT compatible mode of operation. The T346 may also be used as a termination for Echo Canceller testing with provision for attenuation pads built into the unit.

Specifications

Measurements —

Detector type:	True RMS
Level Range:	0 dBm to -51 dBm, ± 0.1 dB
Frequency Response:	300 Hz to 3000 Hz
Noise Range:	10 dBmC to 55 dBmC, ± 1 dB CMSG
C Notch	50dB below 1004 tone

Output —

Frequency Range:	300 Hz to 3000 Hz, 1 Hz steps
Level Range:	0 dBm to -51.1 dBm, 0.1 dB steps
Level Accuracy:	± 0.03 dB at 1004 Hz, 0.1 dB over band
Harmonic Distortion:	at least 50 dB below fundamental

Input and Output Characteristics —

Line Impedance:	600 and 900 ohms, selectable
Electronic Hold:	23 mA minimum through 1700 ohms 46 mA maximum through 400 ohms
Ringer Equivalence:	0.6A
DTMF Signaling:	meets EIA Specification RS-464

Environmental —

Operational:

Temperature: 15 to 35 degrees C
Relative Humidity: 10-95% non-condensing

Non-Operational (storage):

Temperature: -40 to 75 degrees C
Relative Humidity: 10-95% non-condensing
Altitude: 40,000 feet (12000 meters)

Electrical —

115 Vac, 50/60 Hz or 48 Vdc

Physical —

Width:	17.1 in. (435 mm)
Height:	3.5 in. (89 mm)
Depth:	7.9 in. (201 mm)
Weight:	6.9 lb (3.13 kg)

Ordering Information —

T346 Universal Test Line/Responder

Specify:

Interface:
2-wire
Ground Start
Loop Start
4-wire
E&M Type I
E&M Type II

Power Source

115 VAC
48 VDC

Predefined Test Line Type

(Consult factory for available types)

Options:

—01—CAROT Compatibility
—02—Echo Testing

wilcom

MODEL T346
UNIVERSAL TEST LINE/RESPONDER

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1.0 GENERAL

1.1 Introduction

1.1.01 The Model T346 Universal Test Line/Responder combines the test and measurement capabilities required by most network testing systems in one unit. The programmed flexibility of the T346 allows one responder to provide the testing termination for the multiple applications existing on the modern telecommunications network. In a fully configured implementation, the unit provides the features of an analog test line/responder, a DTMF-compelled responder and a Type 105 Test Line and a 52A Responder plus a P/AR signal and call originating capability combined in a single unit. At the time of purchase the following must be specified:

Interface: 2 wire or 4-wire

Predefined Test Line Type: (consult factory for available types)

Power Source: 115 Vac or - 48 Vdc

Options:

01 - CAROT Compatibility

02 - Echo Testing

1.2 Description

1.2.01 The Model T346 may be located at any dialable 2-wire or 4-wire point in a network. For 2-wire installation, supervision may be either loop or ground start with circuit connection made via a barrier terminal strip or RJ-11C jack. For 4-wire installation, supervision is E&M type I or II with circuit connections made via a barrier terminal strip.

1.2.02 During installation the send and receive functions may be calibrated to compensate for the access line loss from the associated switch to the responder. This allows any testing performed on inter-machine trunks to accurately indicate the trunk circuit loss. At the same time, one of four predefined test line sequences is switch selected to establish the default responder characteristics. The specific operating instructions are a function of the type of sequence selected.

1.2.03 Once installed, the unit operates automatically as the predefined test line type. Specific DTMF codes, when received by the T346, will interrupt the fast cycling automatic mode for manual testing or for changing sequence characteristics for the duration of the individual test access.

1.2.04 In the basic configuration, either 2-wire or 4-wire, the T346 is a DTMF-compelled test line providing the following test capabilities:

1. Two-Way Loss
2. Two-Way Noise
3. C-Notched Noise
4. 3-Tone Gain/Slope
5. Quiet Termination
6. P/AR Signal
7. Loop Back
8. Signal-to-Noise Ratio
9. Echo Return Loss

1.2.05 The unit also has the ability to receive a DTMF number sequence, disconnect, originate a call from the remote location to the number which was received and perform the test sequence under control of the called test equipment, such as the Wilcom T328 Master Test Line and Controller.

1.2.06 The basic configuration is upgradable to provide the following enhanced testing capabilities:

CAROT Compatibility-

Type 105 Test Line and 52A Responder
functions, both 2-wire and 4-wire

Echo Path Testing-

On 4-wire versions the T346 can perform and report the results of Echo Return Loss, Singing Return Loss high and low

1.2.07 In the fully configured unit, the DTMF-compelled capabilities combine with MF capabilities to provide an extremely flexible responder. Upon receiving specific DTMF digits, the T346 will exit the predefined test line operation and emulate many existing analog test lines plus provide access to over 40 individual testing functions. The unit is then capable of performing the functions of a far end Type 105 Test Line and 52A Responder. Conversely, if the T346 is predefined as the Type 105/52A combination, a DTMF command will cause the unit to switch to emulation of specific analog test line/responders.

Ordering Information -

T346 Universal Test Line/Responder

Specify-

Interface: 2-wire or 4-wire

Predefined Test Line Type:

(consult factory for available types)

Power Source: 115 Vac or -48 Vdc (4-wire version)

115 Vac only (2-wire version)

Options:

01-CAROT Compatibility

02-Echo Testing

2.0 SPECIFICATIONS

2.1 Measurements

Detector type:	True RMS
Level Range:	0 dBm to -51 dBm, +/- 0.1 dB
Frequency Response:	300 Hz to 3000 Hz
Noise Range:	9 dBmC to 55 dBmC, +/- 1 dB
Noise Weighting:	C-Message/C-Notched
Return Loss:	0 - 40 dB +/- 1 dB

2.2 Output

Frequency Range:	300 Hz to 3000 Hz, 1 Hz steps
Level Range:	0 dBm to -51.1 dBm, 0.1 dB steps (-10 dBm for FCC registered)
Level Accuracy:	+/- 0.03 dB at 1004 Hz, 0.1 dB over band
Harmonic Distortion:	at least 50 dB below fundamental

2.3 Input and Output Characteristics

Line Impedance:	600 and 900 ohms, selectable
Electronic Hold:	23 mA minimum through 1700 ohms 46 mA maximum through 400 ohms
Ringer Equivalence:	0.6A
DTMF Signaling:	meets EIA Specification RS-464
DTMF or MF Receiver:	15 dB Signal to Noise Ratio

2.4 Environmental

Operational:

Temperature:	15 to 35 degrees C
Relative Humidity:	10-95% non-condensing

Non-Operational (storage):

Temperature:	-40 to 75 degrees C
Relative Humidity:	10-95% non-condensing
Altitude:	40,000 feet (12000 Meters)

2.5 Electrical

115 Vac, 50/60 Hz or 48 Vdc

2.6 Physical

Width:	17.1 in. (435 mm)
Height:	3.5 in. (89 mm)
Depth:	7.9 in. (201 mm)
Weight:	6.9 lb (3.13 kg)

3.0 CONTROLS AND CONNECTIONS

3.1 General

3.1.01 This section describes the controls and connectors that are necessary for system connection and operation.

3.2 Rear Panel

3.2.01 The barrier terminal strip provides the following connections:

- a. RCV-NET: Receive Network (Horizon Type)
- b. T,R: Tip, Ring (4-wire send pair or 2-wire interface)
- c. T₁, R₁: Tip₁, Ring₁ (4-wire receive pair).
- d. E, M: 4-wire Type I signalling
- e. S_B, S_G, E, M: 4-wire Type II Signalling
- f. G: Ground
- g. -48V: Office battery
- h. T₂, R₂: LINE 2

3.2.02 Modular Connectors

- a. L1_a: T-Green, R-Red, T₁-Yellow, R₁-Black (2-wire modular phone connection)
- b. L1_b: E-Green, M-Red, -48V-Yellow, G-Black
- c. L2: S_B-Green, S_G-Red, T₂-Black, R₂-Yellow

3.2.03 Fuse - A twist lock fuse holder for ac power protection accomodates a 0.5 ampere fuse.

3.2.04 ac Power Receptacle - This three prong plug supplies ac power to the unit through the line cord provided. It also serves as an on/off connection for the set.

4.0 INSTALLATION

4.1 General

4.1.01 The installer's responsibility to the telephone company as required by Part 68 of the FCC rules must be complied with before the T346 is connected into the telephone network.

4.1.02 There are various types of installation applications associated with the SMARTS System. The T346 is a basic unit. Additional items and options are necessary to implement full installation. Items such as a modular to modular telephone cords, modular to spaded telephone cords and wire for connecting to the stand-off insulators are needed. At the time of purchase it has to be specified whether the interface is to be 2-wire or 4-wire. Other options include predefined test line type, CAROT* compatability and echo testing.

4.2 Preparation for Use

This section contains the information required to prepare the T346 for use as either a 2-wire or 4-wire unit.

4.2.01 2-Wire Installation Procedure

Tools Required: 1 - Small flathead screwdriver
 1 - Small Phillips screwdriver

Parts List: 1 - Modular to Modular Telephone Cord

1. Remove top cover of unit by removing 2 Phillips screws on rear panel
2. Locate Switch S4 (Figure 4-1) on top P.C. board labeled 600 ohm / 900 ohm near the rear of the unit. Select one of the impedance options applicable to the 2 wire station that the unit will be connected to. If you are unsure as to the setting of this switch, consult your PBS/Switch vendor for this information. (Typically set for 600 ohm).
3. Locate Switch S2 on the center P>C> board near the rear of the unit (Fig. 4-1). This is an eight position switch in which each position will be either Open (Switch = Up) or Closed (Switch = Down). Refer to Fig. 4-2 for Switch setting descriptions and make the appropriate selections.
4. Locate Switch S3 (Fig. 4-1) on the same P.C. board next to Switch S2. Refer to Fig. 4-3 for switch setting descriptions and make the appropriate selections.
5. Plug one end of the power cord provided into the unit on the rear panel and the other end into an A.C. power outlet. Power is now applied to the unit.

6. If access Line Loss compensation is desired, complete this procedure next. Refer to section 5.0.
7. Perform the NULL adjustment. Refer to the T346 Manual for procedure.
8. Replace top cover and secure with Phillips screws removed in Step 1.
9. There are two methods of connecting the 2-wire circuit to the unit (Refer to Fig. 4-1).
 - A. Using a Modular to Modular telephone cord, plug one end into the modular plug labeled L1a on the rear panel of the T346 and the other into the modular jack of the line to test.
 - B. Using a Modular to Spaded telephone cord, plug the modular end into the modular jack of the line to test. Connect the spaded end to the terminal board located on the rear panel of the T346 as follows:
 - Green Wire to T
 - Red Wire to R
 - Yellow Wire to T1
 - Black Wire to R1

10. T346 UTL is now ready for full operation.

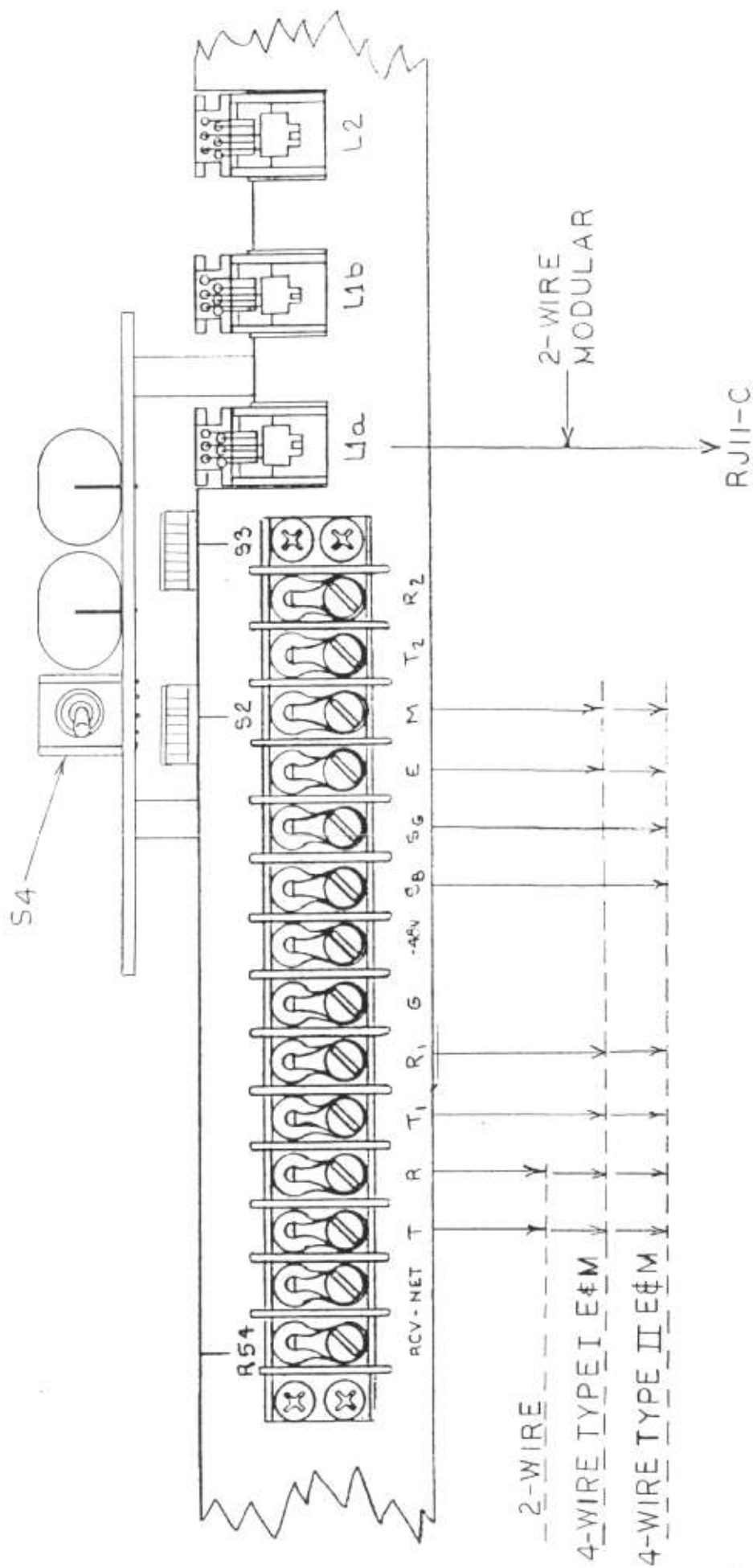


FIGURE 4-1

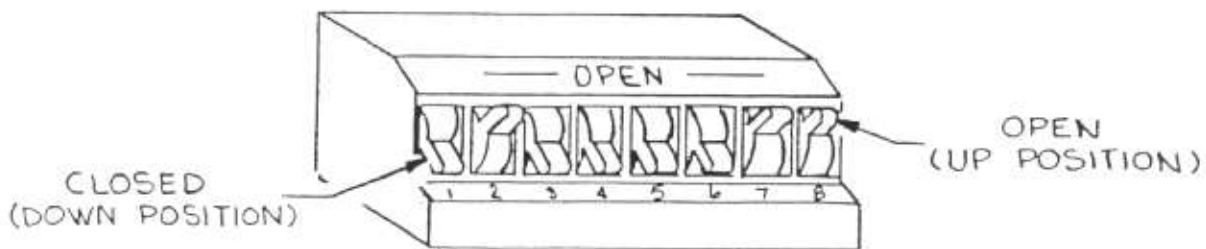


FIGURE 4-2A

Switch S2

- Description:
- 1, 2 & 3 = Test Progress Tone (TPT). A variable time that the TPT will remain on. This is used in special applications only. Nominally set for 500ms.
 - 4 & 5 = Send Level Selectable tone reference levels from -10 to -16 dBm (Applies to code 105 and UMR responders only)
 - 6 & 7 = Not Used.
 - 8 = MF/DTMF. Selectable Signaling Mode (MF = Multi - Frequency, DTMF = Dual tone Multi - Frequency or Touch Tone)

Settings

Time (ms)	<u>Switch</u>			Level dB	<u>Switch</u>	
	<u>1</u>	<u>2</u>	<u>3</u>		<u>4</u>	<u>5</u>
400	Closed	Closed	Closed	*-16	Closed	Closed
500	Open	Closed	Closed	-10	Open	Closed
600	Closed	Open	Closed	-15	Closed	Open
700	Open	Open	Closed	*-16	Open	Open
800	Closed	Closed	Open			
900	Open	Closed	Open			
1000	Closed	Open	Open			
1500	Open	Open	Open			

Switch

8

MF Open
DTMF Closed

FIGURE 4-2

*Take your choice



FIGURE 4-3A

Switch S3

Description: 1, 2, & 3 = Post Seizure Delay. A variable time between the detection of answer supervision and the start of Test progress tone (TPT). This is used in special applications only. Nominally set for 500ms.

4 = 2 wire / 4 wire. Selects the circuit interface connection.

5, 6, 7 & 8 = Device Emulated Selection. Selects the type of device that will be emulated.

<u>Time</u> <u>(ms)</u>	<u>Switch</u>			<u>Switch</u>	
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
200	Closed	Closed	Closed	2 wire	Closed
300	Open	Closed	Closed	4 wire	Open
400	Closed	Open	Closed		
500	Open	Open	Closed		
600	Closed	Closed	Open		
700	Open	Closed	Open		
800	Closed	Open	Open		

<u>Emulation type</u>	<u>Switch</u>			
	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
T346	C	C	O	C
UMR	C	C	C	O
UMR w/Opt. Format	O	C	C	O
CODE 105	C	C	C	C

C = CLOSED O = OPEN

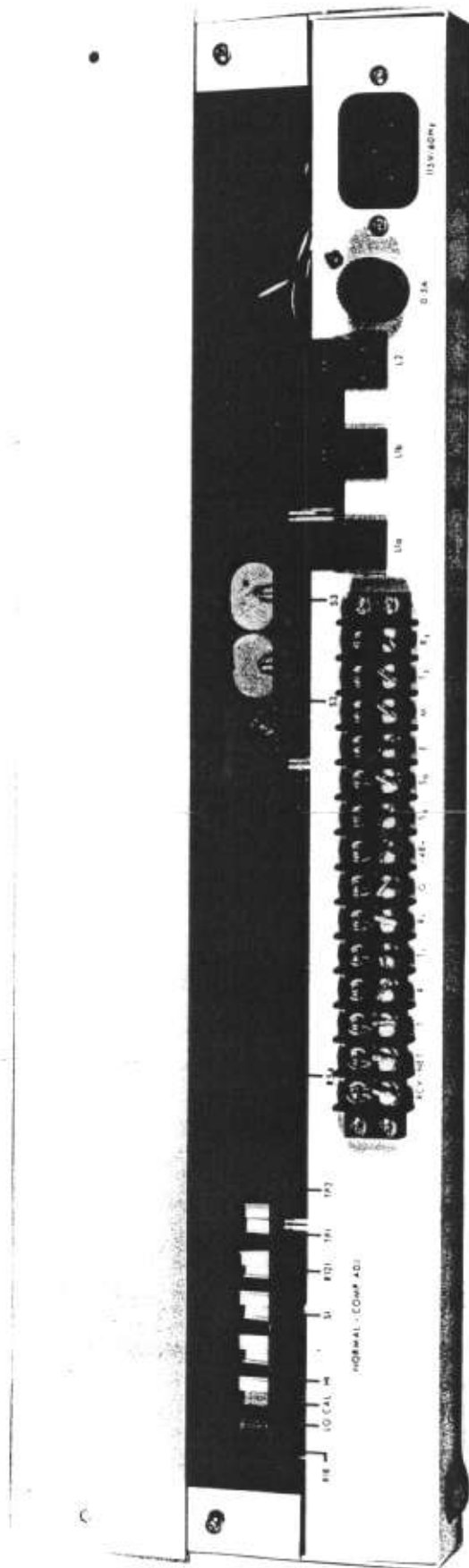
FIGURE 4-3

4.2.02 4-Wire Installation Procedure

Tools Required: 1 - Small flathead screwdriver
 1 - Small Phillips screwdriver

Parts List: 6 or 8 pieces of 22/24 AWG wire
 depending upon Type of E&M Signalling
 used.
 (Variable length dependent upon distance
 of T346 from the line interface).

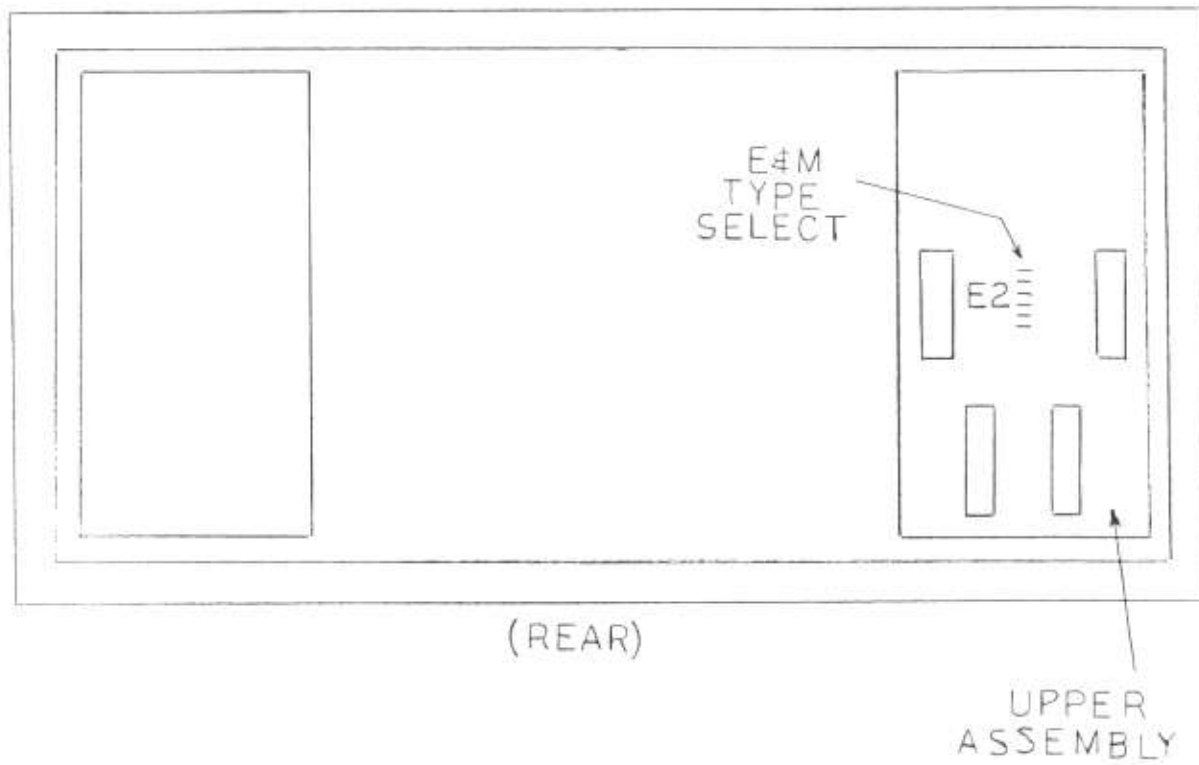
1. Remove top cover of unit by removing 2 Phillips screws on rear panel.
2. Locate E&M type selection jumpers on the right side upper mounted P.C. Board as you view the unit from the rear (refer to Fig. 4-5). Select the applicable jumper arrangement for either Type I or Type II E&M Signalling of the circuit interface.
3. Locate Switch S2 on the center P>C> Board near the rear of the unit (Fig. 4-1). This is an eight position switch in which each position will be either Open (Switch = Up) or Closed (Switch = Down). Refer to Fig. 4-2 for switch setting descriptions and make the appropriate selections.
5. Plug one end of the power cord provided into the unit on the rear panel and the other end into an A.C. power outlet. Power is now applied to the unit.
6. If Access Line Loss compensation is desired, complete this procedure at this time.
7. Replace the cover and secure with 2 Phillips screws removed in Step 1.
8. Using 22-24 AWG wire, make the appropriate cross-connections between the T346 terminal strip, located on the rear panel, and the line interface (Refer to Fig. 4-6).
 - A. For Type I E&M, cross-connect signals T, R, T1, R1, E and M.
 - B. For Type II E&M, cross-connect T, R, T1, R1, E, M, SB, and SG.
9. T346 UTL is now ready for full operation.
10. Plug the power cord into the male receptacle on the right side of the rear panel and the other end into a 110V ac power outlet. Power is now applied to the set.



REAR PANEL

FIGURE 4-4

T346 TOP VIEW



STRAPPING OPTIONS

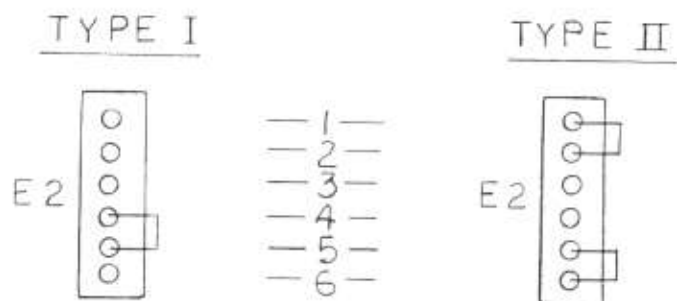


FIGURE 4-5

5.0 FIELD CALIBRATION

5.1 Access Line Loss Compensation Procedure

5.1.01 The T346 is factory-calibrated assuming negligible transmission loss in the line assigned to it. When it is desired to adjust the T346 to compensate for transmission losses in the access line, the following procedure is used:

1. Install T346 according to Installation Instructions (section 4.2.02).
2. Remove top cover by removing the two screws located on the rear of the unit.
3. Locate NORMAL/COMP ADJ. switch S1 by the label on the left side of the rear panel. Place the switch in the COMP ADJ position.
4. Dial the T346 from a local DTMF push button phone.
5. When the T346 goes off-hook, after ring, enter the exchange office milliwatt number into the T346 memory using the DTMF push-button phone.
6. Hang up. The T346 will call the milliwatt number.
7. Locate the three LED's next to S1, and wait until one turns on.
8. Adjust R54 until the CAL LED turns on. If the LO LED is on, turn R54 clockwise; if the HI LED is on, turn R54 counter clockwise.
9. Place S1 in the NORMAL position.
10. Dial the same exchange office milliwatt number using a telephone line different from the T346.
11. Use a level measuring set to measure the level received from the milliwatt on the second line.
12. Drop the line. Then, using the same (second) line, dial through to the T346.
- # 13. Once a reference tone of 1004 Hz is heard, send the T346 the DTMF numbers 77 and 33.

#Refer to Section 6.0 for an explanation of 77 and 33.

14. Adjust R18 so that the level received at the measuring set is 10 dB lower than the received milliwatt level for the units having a -10 dB Reference Level. (15 dB lower for a -15 dB Reference level and 16 dB lower for a -16 dB Reference Level.)
15. Hang up the telephone.

5.1.02 This procedure must be repeated whenever the T346 is relocated, assigned to a different line or is the existing line loss has changed.

6.0 OPERATIONAL FUNCTIONS AND CODES

6.1 General

6.1.01 This section describes the various codes and their functions all of which are used in support of remote testing with the T346 Universal Test/Responder.

6.1.02 Installation procedures of Section 4.0 should be followed and one of four modes of operation switch-selected as per figure 4-3, switch S3. The possible selections are:

1. T346
2. UMR Non Optional Format
3. UMR Optional Format
4. CODE 105

NOTE: Each of the above selections is available with or without Return Loss Measurements when purchased.

6.2 T346 Automatic Operation

6.2.01 The T346 is one of four responses when switch S3 is selected to be in the T346 mode. (Refer to Figure 4-3.)

6.2.02 When the T346 number is dialed from, for example, a DTMF push button telephone the reply by the T346 will be automatic. If a T328 makes the call, it will have been told beforehand it is calling a T346. Again, the T346 will reply automatically as switch selected (paragraph 6.1.02).

6.2.03 The codes for the T346, of which the Hekimian Model 125 is a subset, are determined by setting switch S3 to the position in Figure 4-3 labeled EMULATION TYPE, "T346".

6.2.04 With switch S3 in the T346 position, the T346 Test Line will answer its assigned DTMF call numbers. After 2.7 seconds it will send a 1004 Hz tone at the switch S2 level setting (Figure 4-2) for 30 seconds. During the 30 seconds of operation the set will be waiting for the first command. If after 30 seconds no command is received, the T346 will go on hook. If during the 30-second wait the T346 receives the DTMF tones for 24, it will go into the automatic test sequence listed in 6.2.05.

6.2.05 Automatic Test Sequence (T346)
TABLE 1

<u>Measurement Direction</u>	<u>Responder</u>	<u>Test Equipment</u>
F to N *	(1) Transmit 1004 Hz	Measure Level
	(2) Transmit 1004 Hz	Measure C-Notch Noise
	(3) Go Quiet	Measure C-Message Noise
	(4) Transmit 404 Hz	Measure Level
	(5) Transmit 2804 Hz	Measure Level
N to F *	(6) Set 1004 Hz Level Indication	Transmit 1004 Hz
	(7) Set C-Notch Noise Indication	Transmit 1004 Hz
	(8) Set C-Message Indication	Go Quiet
	(9) Set 404 Hz Level Indication	Transmit 404 Hz
	(10) Set 2804 Hz Level Indication	Transmit 2804 Hz
F to N	(11) Transmit 404 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 404 Hz
	(12) Transmit 1004 Hz Registered Level	Measure Level at 1004 Hz
	(13) Transmit 2804 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 2804 Hz
	(14) Transmit C-Notch Noise Registered Level (+30 dB of the C-Notch Noise)	(Add +60 dB Algebraically to convert to dBrnC)
	(15) Transmit C-Message Noise Registered Level (+30 dB of the C-Message Noise)	(Add +60 dB Algebraically to convert to dBrnC)
N to F	(16) Go Quiet	Transmit White Noise and Measure EPL

Go "On-Hook"

*Far to Near, Near to Far

6.3 COMMANDS THAT HAVE BEEN PROGRAMMED INTO THE T346 UNIVERSAL TEST LINE RESPONDER

6.3.01 The codes (DTMF commands) that have been programmed into the T346 are listed in this section. The codes with an asterisk (*) are unique to the T346. Those that are not preceded by an asterisk are shared with the Hekimian 125 (H125) and the H115 Responder.

6.3.02 MANUAL OPERATION - To initiate the test and measurement sequence apply a "ringing voltage" (DTMF call numbers) to the T346. After 2.7 seconds it will send a 1004 Hz tone at the switch S2 level setting (Figure 4-2) for 30 seconds. From hereon, a code must be sent before the 30-second period ends (times out). If a longer time out is required, refer to code 72, 73, 74, 76 or 77. If a valid DTMF command is not received before the time out period ends, the T346 will go ON-HOOK.

6.3.03 DTMF CODE NUMBERS and DESCRIPTIONS

<u>DTMF</u> <u>CODE</u>	<u>DESCRIPTION</u>
*00	Send a 1004 Hz at the level preset by the level switches for 5.5 seconds. Then followed by quiet termination for the duration of time out.
*45	Broadband Noise band limited to 500 to 2000 Hz (ERL) transmitted at the level preset by level switches for a duration of 3 seconds.
*15	Switch to type 105 routine.
*16	Send a P/AR signal at the level preset by the level switches for a duration of 3 seconds.
*17	ERL - Per PUB 41009, apply to 4-wire units only.
*18	SRL High - Per PUB 41009, apply to 4-wire units only.
*19	SRL Low - Per PUB 41009, apply to 4-wire units only.

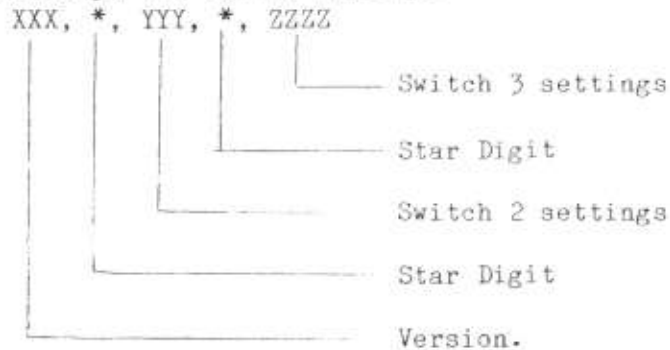
All signal sources for the ERL, SRL High and SRL Low will be sent at -10 dBm. The T346 will make the measurement from -10 to -50 dBm in the Receive Path. This will maintain a range of 0 to 40 dB of Return Loss. The measurement accuracy should be +/- 1 dB. The time of the signal should be only as long as necessary for the T346 to measure the return signal. The returned measurement should be at 1004 Hz and be the same level as received, that is between -10 and -50 dBm. Before the 1004 Hz is sent, there should be a break of at least 1 second from the sent echo signal so the receiving instrument can distinguish between the echo signal and the returned signal for the result of measurement.

4 When in the Code 105 UMR Mode this will place it in the T346 Operation Function. This is a special code and should be sent as a single digit.

<u>DTMF CODE</u>	<u>DESCRIPTION</u>
24	Start automatic sequence as describe by H125 Operation.
32	Transmit 404 Hz.
33	Transmit 1004 Hz.
34	Transmit 2804 Hz.
	NOTE: These frequencies are transmitted at the setting of the level switches. The timing is determined by the operation of the H125.
42	Measure 404 Hz Level.
43	Measure 1004 Hz Level.
44	Measure 2804 Hz Level.
	NOTE: These operations are defined in the operation of H125.
46	Transmit indicated 404 Hz level at 1004 Hz.
47	Transmit indicated 1004 Hz level at 1004 Hz.
48	Transmit indicated 2804 Hz level at 1004 Hz.
	NOTE: This operation is defined by the operation of H125. The analog response is limited to a level of -10 dBm. The DTMF response can go to 0 dBm.
62	Measure C-Notch Noise
63	Measure C-MSG Noise
64	Transmit indicated C-Notch level at 1004 Hz +30 dB
66	Transmit indicated C-MSG level at 1004 Hz +30 dB
	NOTE: The above 4 codes are response as defined by H125 operation. Output level for returned signal is limited to -10 dBm and DTMF response will return the actual value measured range up to 55 dBm.
72	Set time out default to 2 minutes.
73	Set time out default to 5 minutes.
74	Set time out default to 10 minutes.

76	Set time out default to 15 minutes.
77	Set time out default to 17 minutes.
DTMF CODE	DESCRIPTION
82	Quiet Termination
83	On hook; release the circuit and terminate the operation.
*10	This code is sent to the T346 prior to any requests for measurement. When received, the T346 will send responses back as coded DTMF digits. All measurements of loss are less than 0 dBm so the minus sign is assumed. All measurements of Return Loss are assumed to be returned as positive numbers in the range of 0-40. All response formats are 3 digits each. In the case of loss measurement the resolution is tenths of a dB. In the case of Noise and Return Loss the first digit is always zero and resolution is to a dB.
*20	This command is the callback feature of the T346 and has to be the last command to be executed. The T346 accepts digits sent to it as a callback number and is a first in, first dialed sequence. Digits have to be received at a rate faster than 1 digit per second. After a second has elapsed without a digit being received, the T346 will hang-up and dial the received number. The T346 then waits 25 seconds for a DTMF "#" signal. If a "#" is sensed it sends back a DTMF "#" and is ready for T346 commands. When the 25 seconds have elapsed without a "#" signal, the T346 will hang up. The digit "B" is used for a 3 second wait in the dialing sequence. The digits A, C, and D are reserved for future use.
*79	This will place the T346 in an infinite time-out.
*50	Loop back with 0 dB attenuation, 4-wire only.
*51	Loop back with -8 dB attenuation, 4-wire only.
*52	Loop back with -18 dB attenuation, 4-wire only.
*90	This command will return the program version installed in the T346 and also the switch settings. The format is: Version Number, *, S2 settings, *, S3 settings. Version Number will be a 3 digit code the same as Version Number; for example: 203 is version 2.03. The settings of S2 will be a 3 digit octal code in this format: First digit is Position 1,2, and 3. The second digit is position 4 & 5 and the third digit is Position 6,7 and 8. The closed

position is a zero, the open is a one. For S3 the groupings are: First digit is Position 1, 2 and 3. Second is Position 4. Third is Positions 5,6 and 7. Last Position 8. To recap, the format will be:



This concludes all the code functions of the T346. These codes are all that will be supported on the Model T346.

6.4 SWITCH SELECTION FOR VARIOUS OPTIONS

6.4.01 The switch selection of various options will be described in the following list.

6.4.02 First is S2, Figure 4-2, an eight position switch. For positions 1,2, and 3 the test progress tone can be varied between 400 and 1500 milliseconds. Positions 4 and 5 will define levels for output reference of -10, -15 and -16 dBm. Switch eight will define the MF or DTMF function. Positions 6 and 7 are reserved for future expansion. Switch Position 3, Figure 4-3, is also an 8 position switch that is used for more selections of variables and options. Positions 1,2 and 3 are used to select post seizure delay. The selections are from 200 to 800 milliseconds in 100 milliseconds increments. Position 4 is for selection of 2-wire or 4-wire operation. Positions 5,6,7 and 8 will define the various types of default test lines that the T346 can evaluate.

6.4.03 In all cases of measurements where there is a loopback on 4-wire circuits the measurement signal needs to be preceded by a echo canceller disable tone of 2125 Hz at (-10 dBm Switch Setting) for a period of at least 300 msec. The signal will have to follow this disable tone within 200 msec or the canceller will enable. This applies in the case of ERL, SRH, SRL.

6.4.04 In the case where a command is not received properly the T346 will not respond. For example: if an undefined command is received, the T346 will not give any error response; it will only wait for the next command.

6.4.05 Interfaces: The T346 has both 2-wire and 4-wire interfaces. These are specified at time of ordering. The 2-wire interface is capable of ground start or loop start. The 4-wire interface is strappable for E&M Type I or Type II.

- 6.4.06 Power: The unit has to be powered by either 115V ac or 48V dc. This power option is specified at ordering time. (A 2-wire H8 Vdc unit is not available).

6.5 T346 OPTIONS

- 6.5.01 There will be two software versions available; one will include return loss routines; the other will not.

6.6 Code 105 Test Line/Responder and Universal Mini Responder (UMR)

- 6.6.01 The "MF" commands or codes that have been programmed into the T346 are described in this section.

- 6.6.02 When switch S3 (Figure 4-3) is placed in either the Code 105 or one of the two UMR positions, the unit will answer the call with a DTMF "#" signal. This is followed by a post seizure delay and test progress tone. The delay time and the time the tone remains on are set by switches S2 and S3 as described in figures 4-2 and 4-3.

*Universal Mini Responder

6.6.03 The routines performed by these emulated responders are compelled by 2/6 MF tones. Table 6-1 lists the digits and letters that correspond to the paired tones.

TABLE 6-1
MF FREQUENCY TABLE

DIGIT	LOW FREQUENCY	HIGH FREQUENCY
0	1300	1500
1	700	900
2	700	1100
3	900	1100
4	700	1300
5	900	1300
6	1100	1300
7	700	1500
8	900	1500
9	1100	1500
A	1100	1700
B	1500	1700
C	700	1700
D	900	1700
E	1300	1700

6.6.04 Tables 6-2 through 6-4 show how the digits and letters (abbreviations) are interpreted. After each measurement routine the unit goes through the following sequence: 430 ms of guard tone, data tone and 50 ms of guard tone. The data tone timing conforms to the Data Formulas shown in Table 6-5 entitled RESPONDER DATA FORMATS.

COMMAND TABLE 6-2
CODE 105

DIGIT	TEST	
0	RN	Near-End Noise Test
1	LSC	Loss (0 dBm, 1004 Hz) Self-Check
2	L	Loss (0 dBm, 1004 Hz) Test
3	N	Far-End Noise Test
4	NSC	Far-End Noise Self-Check
5	RL	Release
6	L4	Loss (-16 dBm, 404 Hz) Test
7	NEFT	Not Equipped For Test (preceded by quiet period)
8	SRL	Singing Return Loss Low
9	RNSC	Near-End Noise Self-Check
A	LAYER	Always precedes another digit to get layer 3 tests
B	NT	Noise with Tone test
C	ERL	Echo Return Loss
D	L10	Loss (-16 dBm, 1004 Hz) Test
E	L28	Loss (-16 dBm, 2804 Hz) Test
A0	NEFT	Not Equipped for Test (preceded by quiet period)
A1	SHISC	Singing Return Loss
A2	SRLHI	Singing Return Loss, High
A3	NEFT	Not Equipped For Test (preceded by quiet period)
A4	RN	Near-End Noise Test
A5	RL	Release
A6	L4SC	Loss (-16 dBm, 404 Hz)
A7	NEFT	Not Equipped For Test (preceded by quiet period)
A8	SLRSC	Singing Return Loss Self-Check
A9	NEFT	Not Equipped For Test (preceded by quiet period)
AA	NEFT	Not Equipped For Test (preceded by quiet period)
AB	NTSC	Noise With Tone Self-check
AC	ERLSC	Echo Return Loss Self-Check
AD	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
AE	L28SC	Loss (-16 dBm, 2804 Hz) Self-check

COMMAND TABLE 6-3
UMR NON OPTIONAL FORMAT

DIGIT	TEST	
0	RN	Near-End Noise Test
1	LSC	Loss (0 dBm, 1004 Hz) Self-Check
2	L	Loss (0 dBm, 1004 Hz) Test
3	N	Far-End Noise Test
4	NSC	Far-End Noise Self-Check
5	RL	Release
6	L4	Loss (-16 dBm, 404 Hz) Test
7	LL10	Transmit Tone (-16 dBm, 1004 Hz)
8	SRLM	Singing Return Loss Modified
9	RNSC	Near-End Noise Self-Check
A	LAYER	Always precedes another digit to get layer 3 tests
B	NT	Noise with Tone Test
C	ERLM	Echo Return Loss Modified
D	L10	Loss (-16 dBm, 1004 Hz) Test
E	L28	Loss (-16 dBm, 2804 Hz) Test
A0	LB18	18 dB Loopback
A1	SHISCM	Singing Return Loss High Self-Check Modified
A2	SRLHIM	Singing Return Loss, High Modified
A3	LB8	8 dB Loopback
A4	RN	Near-End Noise Check
A5	RL	Release
A6	L4SC	Loss (-16 dBm, 404 Hz)
A7	LBO	0 dB Loopback
A8	SLRSCM	Singing Return Loss Self-Check Modified
A9	LC10	Loss (-16 dBm, 1004 Hz) Test Through C-Message Filter
AA	NEFT	Not Equipped For Test (preceded by quiet period)
AB	NTSC	Noise with Tone Self-Check
AC	ERLSCM	Echo Return Loss Self-Check Modified
AD	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
AE	L28SC	Loss (-16 dBm, 2804 Hz) Self-Check

COMMAND TABLE 6-4
UMR OPTIONAL FORMAT

DIGIT	TEST	
0	RN	Near-End Noise Test
1	LSC	Loss (0 dBm, 1004 Hz) Self-Check
2	L	Loss (0 dBm, 1004 Hz) Test
3	N	Far-End Noise Test
4	NSC	Far-End Noise Self-Check
5	RL	Release
6	L4	Loss (-16 dBm, 404 Hz) Test
7	LL10	Transmit Tone (-16 dBm, 1004 Hz)
8	SRL	Singing Return Loss
9	RNSC	Near-End Noise Self-Check
A	LAYER	Always precedes another digit to get layer 3 tests
B	NT	Noise with Tone Test
C	ERL	Echo Return Loss
D	L10	Loss (-16 dBm, 1004 Hz) Test
E	L28	Loss (-16 dBm, 2804 Hz) Test
A0	LB18	18 dB Loopback
A1	SHISC	Singing Return Loss
A2	SRLH1	Singing Return Loss, High
A3	LB8	8 dB Loopback
A4	RN	Near-End Noise Test
A5	RL	Release
A6	L4SC	Loss (-16 dBm, 404 Hz)
A7	LBO	0 dB Loopback
A8	SLRSC	Singing Return Loss Self-Check
A9	LC10	Loss (-16 dBm, 1004 Hz) Test Through C-Message Filter
AA	NEFT	Not Equipped For Test (preceded by quiet period)
AB	NTSC	Noise With Tone Self-Check
AC	ERLSC	Echo Return Loss Self-Check
AD	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
AE	L28SC	Loss (-16 dBm, 2804 Hz) Self-Check

TABLE 6-5
RESPONDER DATA FORMATS

Test	Data Formula (milliseconds)	Self-Check Variable ms	Variable Range
Loss 0 dBm	2(160 - 10L)-1	L=0dBm 317-321	-5 to +15.8 dB
Loss -16 dBm	2(210 - 10L)-1	L=0dBm 415-423	-5 to +20.8 dB
C-Msg Noise	2(N - 13)-1	N=23dBrnC 17 -21	15 to 55 dBrnC
C-Notch Noise	2(N - 32)-1	N=74dBrnC 81-85	34 to 74 dBrnC
Return Loss	2(42 -RL)-1	RL= 0 dB 81-85	0 to 40 dB

6.6.05 If an MF command is not received for 18 seconds, the unit will disconnect from the line. With a 2-Wire interface, the unit goes on-hook. With a 4-Wire interface, the unit removes ground on the "E" lead and returns to the idle state when the "M" lead, at the far end, goes on hook (ground condition) in response to the disconnect.

6.6.06 The abbreviations used in Tables 6-2, 6-3 and 6-4 are explained as follows:

TEST	EXPLANATION
L, L4, L10, L28	At the trailing edge of the MF command the T346 transmits the appropriate level and frequency for 430 ms. It then waits a maximum of 2.56 seconds for a signal of sufficient amplitude to be received. It samples the signal for 430 ms. Then it goes to guard tone, data tone, guard tone sequence (G-D-G).
NEFT	Two seconds of quiet and then the unit transmits 1000 ms of guard tone, 1000 ms of data tone, 50 ms guard tone.
NT	The unit transmits 430 ms of -16 dBm, 1004 Hz tone, then waits a maximum of 2.56 sec. for 430 ms of tone of sufficient amplitude. During this time the unit measures noise through C-Message and C-Notch filters. It then goes through G-D-G sequence.
N	The unit measures noise through its C-Message filter for 375 ms then goes through G-D-G.
LSC, L28SC, L10SC, L4SC, NTSC, NSC	The unit goes quiet for 860 ms (430 ms for NSC) then goes to G-D-G.
RL	The unit goes on hook.
RN, RNSC	The unit goes quiet for 430 ms, then attaches MF receiver waiting for another command.
LAYER	Causes receiver to advance to next layer.

SRL, SRLHI, ERL	<p>Two-wire units - the unit goes quiet for 2.56 seconds, then transmits 430 ms of guard tone, 3 ms data tone, 50 ms guard tone.</p> <p>Four-wire units - the unit goes quiet for 2.56 seconds, then it sends echo canceller tone (2150 Hz, -10 dBm) for 550 ms, goes quiet for a maximum of 100 ms, sends the appropriate Return Loss signal for a maximum of 2 seconds (which it measures). 2.56 seconds after the start of the echo canceller tone, it goes to the G-D-G sequence.</p>
SRIM, SRLHIM, ERLM	<p>Two-Wire units - same procedure as for SRL, SRLHI, ERL</p> <p>Four-Wire units - the unit sends echo canceller tone (2150 Hz, -10 dBm) for 550 ms, goes quiet for a maximum of 100 ms, and sends the appropriate Return Loss signal for a maximum of 2 seconds (which it measures). 2.56 seconds after the start of the echo canceller tone it goes to the G-D-G sequence.</p>
SRLSC, SHISC, ERLSC	<p>Two-Wire units - the unit goes quiet for 2.56 seconds, then transmits 430 ms of guard tone, 83 ms of data tone, 50 ms guard tone.</p> <p>Four-Wire units - after 5.1 seconds of quiet the unit goes to G-D-G sequence.</p>
SRLSCM, SHISCM ERLSCM	<p>Two-Wire units - same procedure as for SRLSC, SHISC, ERLSC</p> <p>Four-Wire units - after 2.56 seconds of quiet the unit goes to G-D-G sequence.</p>
LL10	Transmit a continuous 1004 Hz at -16 dBm.
LBO	Two-wire units respond with NEFT. Four-wire units insert 0 dB attenuation between receive and transmit until another command is received.
LB8	Same as LBO except 8 dB attenuation.
LB18	Same as LBO except 18 dB attenuation.
LC10	Same procedure as L, L4, L10, L28 except it measures the incoming signal through a C-Message filter.