

**MODEL T346
UNIVERSAL TEST LINE/RESPONDER
OPERATING INSTRUCTION MANUAL**

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1.0 GENERAL

The Wilcom Model T346 UNIVERSAL TEST LINE & RESPONDER combines the test line and responder functions required for most far-end network testing, and operates with a wide variety of automatic or manual test systems.

1.1 Description

The test-line function, or line interface, is available in two configurations: 2-wire loop and 4-wire E & M. The 2-wire loop-start/ground-start interface answers in response to ringing voltage and returns OFF-HOOK by connecting a dc hold circuit. The 2-wire interface also originates calls on either the loop-start or ground-start circuits. The 4-wire E&M interface answers by responding to an OFF-HOOK M-Lead condition (negative voltage) and returns OFF-HOOK. The 4-wire interface originates calls on the E-lead. The T346 is strappable for either Type I or Type II E & M.interface.

The responder function is available in either the basic or full Universal Mini Responder (UMR) hardware configuration. In the basic responder configuration, the T346 responds to DTMF digit commands and returns measurement data in a tone-level analog format. The basic unit will also provide:

- 4-wire return loss measurement (ERL, SRL Low, and SRL High).
- 4-wire loopback with and without attenuation.
- P/AR test signal generation and transmission.

NOTE

— Return loss and loopback require the 4-wire line interface.

The T346 returns measurement data in a DTMF digit code instead of the tone-level analog when special DTMF command codes (Section 4) are activated.

In the full UMR configuration, the T346 includes all of the basic-configuration capability with the added ability to emulate a CAROT-compatible combination of 105-type test line with 52-type, or 56A responder; with this combination responding to MF digit commands and transmitting measurement data in a guard-data-guard FSK format where the data-tone time duration is an analog representation of the data. The T346 full UMR configuration can be commanded to operate in either the basic DTMF-compelled mode or in the CAROT-compatible MF-compelled mode. The default mode chosen when a call is answered is dip-switch selectable. The return loss and loopback functions (but not P/AR) are included in the MF-compelled (guard-data-guard data reporting) UMR operating mode, but not in the CAROT compatible MF mode.

Provision is included for setting test signal levels and measurement ranges for non-zero TLP at the installation point, and for compensating for both send and receive losses in the installation access line.

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: 2 Wire — 600 and 900 Ω , switch selectable
4 Wire — 600 Ω
Electronic Hold: 23 mA minimum through 1700 Ω
46 mA maximum through 400 Ω
Ringer Equivalence: 0.6 A
DTMF Signaling: meets EIA specification RS-464
DTMF or MF Receiver: 15 dB Signal to Noise Ratio

2.4 EnvironmentalOperational

Temperature: 15 to 35 ° C
Relative Humidity: 10 - 95% non-condensing
Altitude: 16,000 ft (5,000 m)

Non-Operational

Temperature: -40 to 75 ° C
Relative Humidity: 10 - 95% non-condensing
Altitude: 50,000 ft (15,000 m)

2.5 Electrical

115 Vac, 50/60 Hz or -48 Vdc

2.6 Physical

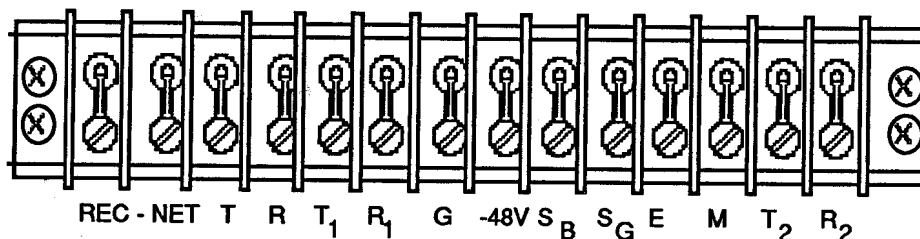
Width: 17.1 in. (435 mm)
Height: 3.5 in. (89 mm)
Depth: 7.9 in. (201 mm)
Weight: 6.9 lb. (3.13 kg)

3.0 PANEL CONTROLS AND CONNECTIONS

This section describes the controls and connectors that are necessary for system connection and operation. A line drawing is inserted at the beginning of each group to facilitate location on the back panel.

3.1 Barrier Terminal Strip

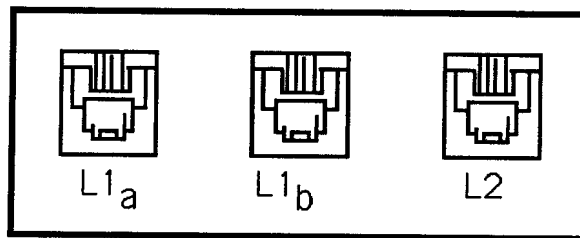
The rear panel barrier terminal strip provides external connections as follows:



REC-NET	Receive Network (Horizon Type)
T, R:	Tip, Ring (4-wire send pair or 2-wire interface)
T ₁ , R ₁ :	Tip ₁ , Ring ₁ (4-wire receive pair)
E, M:	4-wire Type I signaling
S _B , S _G , E, M:	4-wire Type II signaling
G:	Ground
-48 V:	Office battery
T ₂ , R ₂ :	Line 2 (not used at this time)

3.2 Modular Connectors

The rear panel modular connectors utilize modular phone connections to provide external connection as follows:



L1 _a	2-wire modular phone connection T (Tip)—Green R (Ring)—Red T ₁ (Tip ₁)—Yellow G (Ground)—Black
L1 _b	4-wire modular phone connection E (Receive)—Green M (Transmit)—Red -48 V—Yellow G (Ground)—Black
L2	4-wire modular phone connection S _B —Green S _G —Red T ₂ (Tip ₂)—Black R ₂ (Ring ₂)—Yellow

3.3 Fuse

A twist lock fuse holder for ac and dc power protection accommodates a 0.5 ampere fuse.

3.4 ac Power Receptacle

A three prong plug which supplies ac power to the unit through the line cord provided. It also serves as an ON/OFF connection for the responder.

4.0 INSTALLATION

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

It is the installer's responsibility to the telephone company to comply with Part 68 of the FCC rules before the T346 is connected into the telephone network.

There are various types of installation applications associated with the SMART™ System. The Wilcom model T346 is the basic unit, additional items and options are necessary to implement full installation.

4.1 2-Wire Installation Procedure

Tools Required: 1 — small flathead screwdriver
 1 — small Phillips screwdriver

Parts List: 1 — modular to modular telephone cord

Procedure:

1. Remove the top cover of the unit by removing the 2 Phillips screws located on the back panel.
2. With the back of the unit facing you, locate Switch **S4** (Figure 4-1). This switch is labeled **600Ω/900Ω** and resides on the top P.C. board.

Select one of the impedance options as applicable to the 2-wire station that the unit will be connected to (typically 600 Ω).

If uncertain about which setting to use, consult your PBX/switch vendor for the information.

3. Locate dip switch **S2** (Figure 4-1). This switch is an eight position dip switch which resides on the center P.C. board just inside the back panel.

Each of the eight positions on the dip switch must be either OPEN (switch in the UP position) or CLOSED (switch in the DOWN position). Refer to Appendix (Table A.1) for switch setting descriptions to aid in obtaining the appropriate settings

4. Locate dip switch **S3** (Figure 4-1). This switch is an eight position dip switch which resides on the center P.C. board next to dip switch **S2**.

Each of the eight positions on the dip switch must be either OPEN (switch in the UP position) or CLOSED (switch in the DOWN position). Refer to Appendix (Table A.2) for switch setting descriptions to aid in obtaining the appropriate settings

4.1 2-Wire Installation Procedure (cont.)

5. Plug one end of the power cord into the T346. The plug receptacle is located in the lower right hand corner of the back panel.

Plug the other end of the power cord into an AC power outlet.

Power is now applied to the T346 TEST LINE/RESPONDER.

6. Connect the 2-wire circuit to the unit. There are two methods of making this connection, both of which are described below and referenced in Figure 4-1.

A. Using a Modular to Modular telephone cord, plug one end of the cord into the T346 back panel modular jack labeled L1a, and the other end of the cord into the modular jack of the line to test.

B. Using a Modular to Spaded telephone cord, connect the spaded end of the cord to the terminal strip located on the back panel of the T346 as follows:

Green wire to T

Red wire to R

Yellow wire to T₁

Black wire to R₁

Plug the modular end of the cord into the modular jack of the line to test.

7. If Access Line Loss Compensation is required, refer to Section 5.0 and make appropriate adjustments.

.....
.....
CAUTION
.....
.....

— Access Line Loss Compensation should not be performed on units configured as CAROT compatible responders.

8. Replace the top cover and secure the Phillips screws removed in Step 1.

9. The T346 UNIVERSAL TEST LINE/RESPONDER is now fully operational.

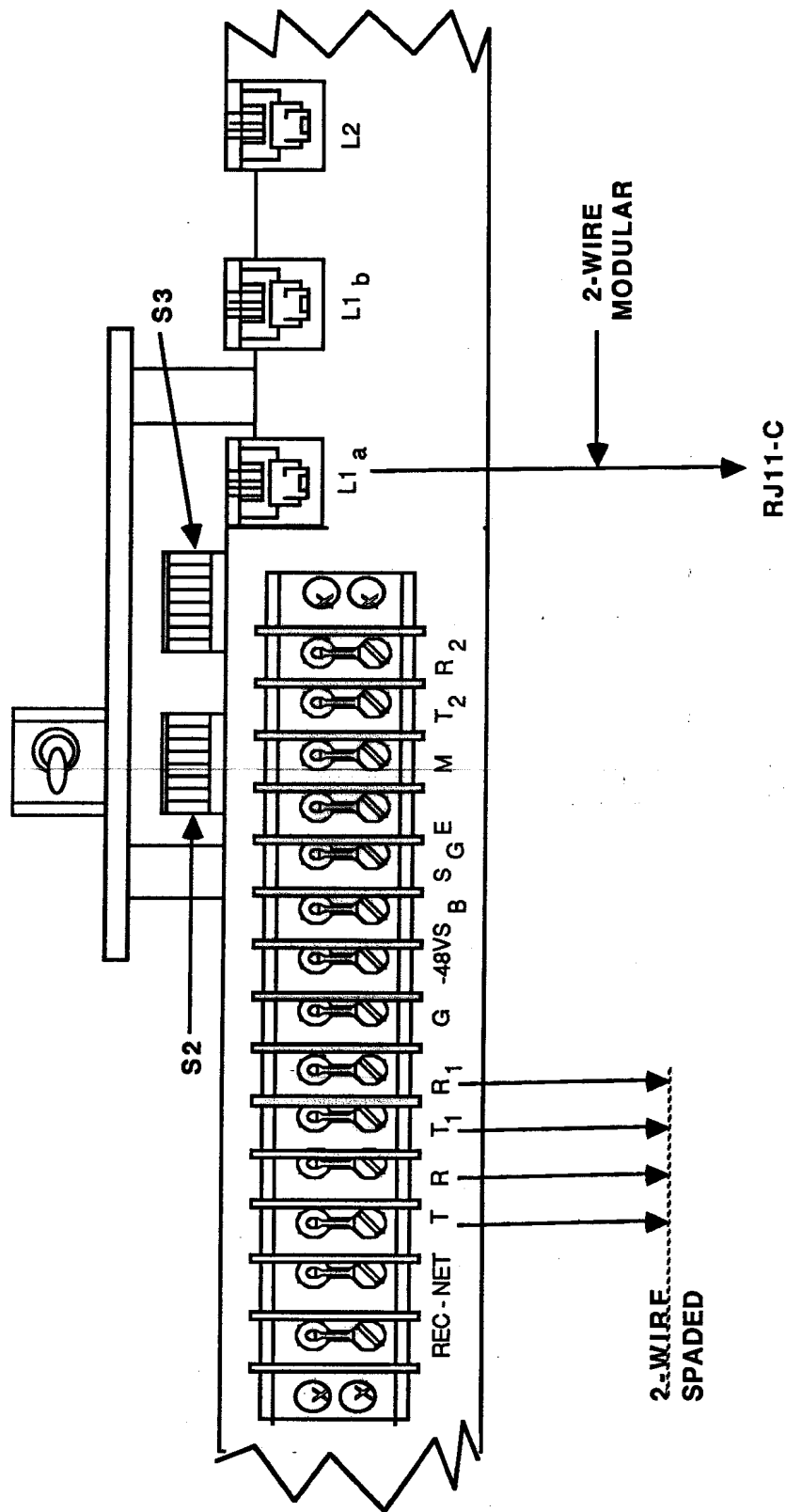


Figure 4-1 — T346 2-WIRE INSTALLATION

4.2 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 signaling used.
(Variable length dependent upon distance of T346 from the line interface.)

Procedure:

1. Remove the top cover of the unit by removing the 2 Phillips screws located on the back panel.
2. With the back of the T346 facing you, locate the E&M type selection jumpers. These jumpers are on the right side of the upper mounted P.C. Board (Figure 4-2). Once located, select the applicable jumper arrangement for either Type I or Type II E&M Signaling of the circuit interface (Figure 4-2).
3. Locate dip switch S2 (Figure 4-1). This switch is an eight position dip switch which resides on the center P.C. board just inside the back panel.

Each of the eight positions on the dip switch must be either OPEN (switch in the UP position) or CLOSED (switch in the DOWN position). Refer to Appendix A for dip switch setting descriptions to aid in obtaining the appropriate settings

4. Locate dip switch S3 (Figure 4-1). This switch is an eight position dip switch which resides on the center P.C. board next to dip switch S2.

Each of the eight positions on the dip switch must be either OPEN (switch in the UP position) or CLOSED (switch in the DOWN position). Refer to Appendix B for switch setting descriptions to aid in obtaining the appropriate settings

5. Using the 22/24 AWG wire, make the appropriate cross-connections between the terminal strip located on the back panel of the T346 and the line interface (Figure 4-3).
 - A. For Type I E & M, cross connect signals T, R, T₁, R₁, E and M.

NOTE

— GND and -48 Vdc must be supplied to the T346 for Type I E&M signaling. See Figure 4-3.

B. For Type II E & M, cross connect T, R, T₁, R₁, E, M, S_B, and S_G.

4.2 4-Wire Installation Procedure (cont.)

6. Plug one end of the power cord into the T346. The plug receptacle is located in the lower right hand corner of the back panel.

Plug the other end of the power cord into an AC power outlet.

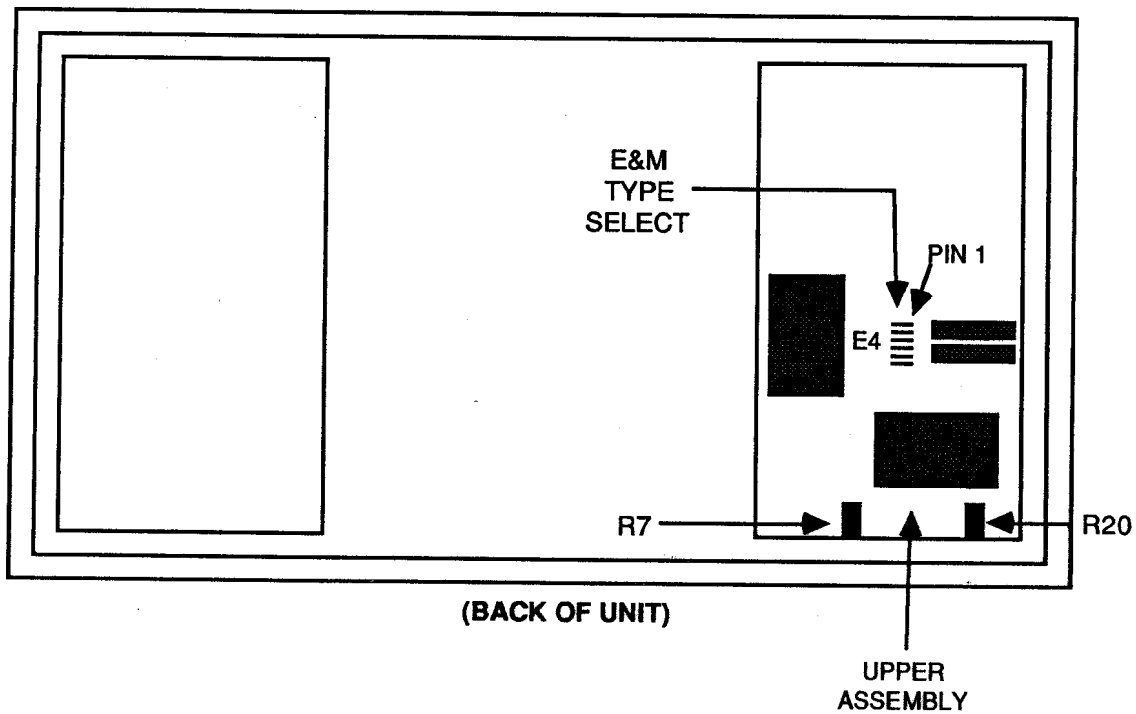
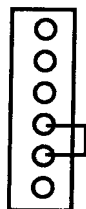
Power is now applied to the T346 TEST LINE/RESPONDER.

7. If Access Line Loss Compensation is required, refer to Section 5.0 and make appropriate adjustments.

8. Replace the top cover and secure the Phillips screws removed in Step 1.

9. The T346 UNIVERSAL TEST LINE/RESPONDER is now fully operational.

T346 TOP VIEW

STRAPPING OPTIONSTYPE I

— 1 —
— 2 —
— 3 —
— 4 —
— 5 —
— 6 —

TYPE II

Figure 4-2 — E&M TYPE SELECTION JUMPERS

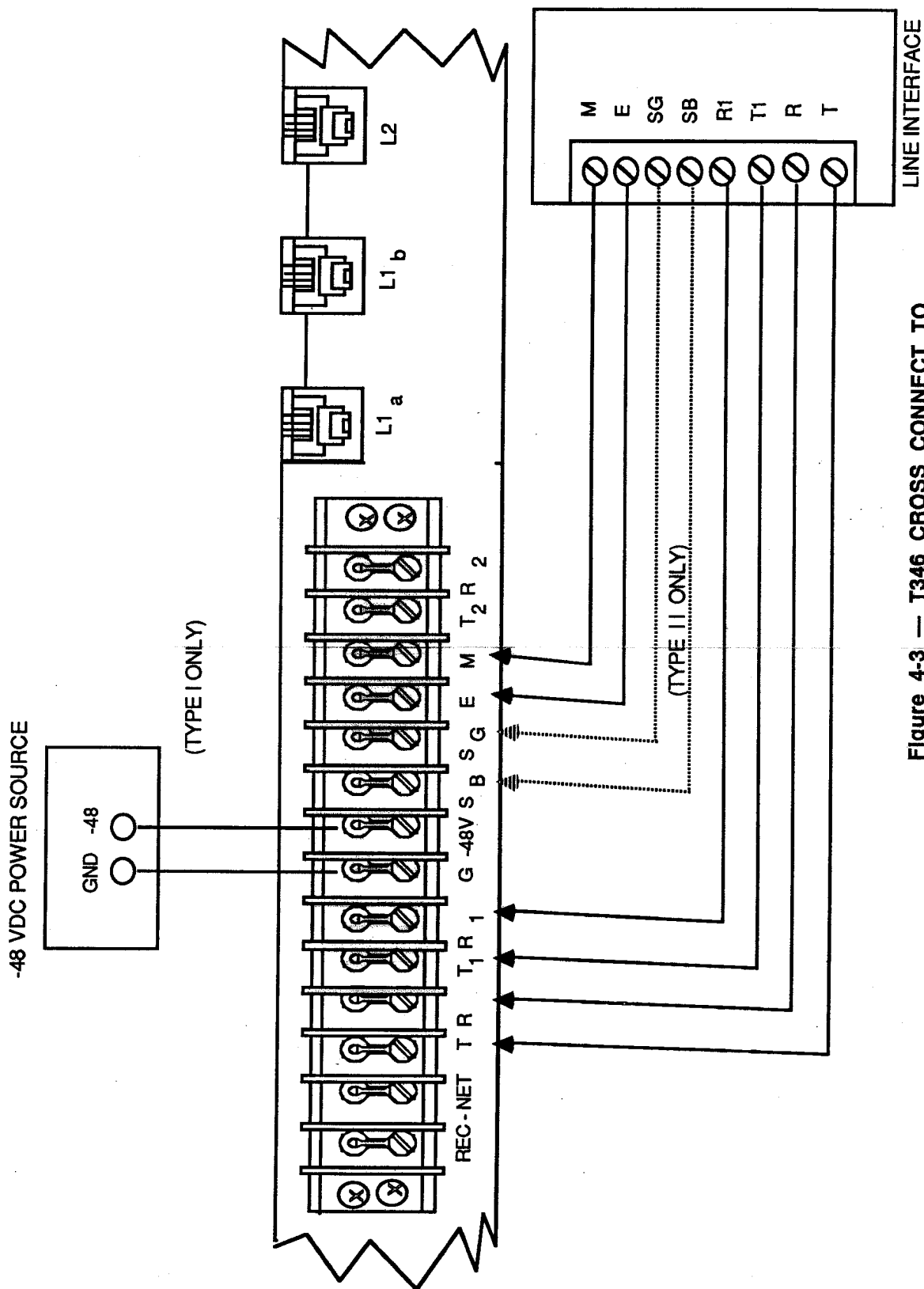


Figure 4-3 — T346 CROSS CONNECT TO
LINE INTERFACE

5.0 FIELD ADJUSTMENTS

The T346 Send and Receive can be separately adjusted to compensate for losses in the access line between nominal TLP at the switch and the T346 itself.

Range: -2 dB loss (2 dB gain) to 8 dB loss.

5.1 Procedure for Access Line Compensation

The same basic procedure is used to perform access line loss compensation for either 2-wire or 4-wire interface units. The 2-wire compensation procedure adjusts the send and receive calibration on the analog PC Assembly using R18 and R54. The 4-wire procedure adjusts separate calibration levels on the 4-Wire Interface PC Assembly using R20 and R7.

CAUTION

— Access line compensation for both send and receive in the T346 is factory set to 0 dB. Any change in the settings of either R54 or R18 will affect the response data for any of the CAROT-mode self-check commands. Also, R54 and R18 will not compensate for access line loss in any of the 4-wire loop back functions.

1. Install the T346 according to the installation instructions covered in Section 4.
2. Remove the top cover by removing the two Phillips screws located on the back of the unit.
3. Set the **NORM/COMP ADJ** switch S1 (rear panel) to the **COMP/ADJ** position. This will enable the calibrate function with indicator lamps, and will also cause the T346 to override the default operating mode dip-switch settings.
4. Using a DTMF push button telephone on the another line to the same switch (second line), dial through to the the T346.
5. When the T346 answers ringing or M lead signaling and goes OFF HOOK, enter the office milliwatt test line number into the T346 memory using the DTMF push button telephone. Digits must be sent at a rate faster than one digit per second. After one second has elapsed without a digit being received, the T346 will go ON-HOOK, delay for 100 ms, go OFF-HOOK and DTMF pulse the office or switch milliwatt test line number.
6. Hang up the telephone on the second line.
7. The T346 in its calibrate function will measure the milliwatt signal and indicate by means of three indicator lamps whether the measurement is low (LO), right on (CAL) or high (HI).

5.1 Procedure for Access Line Compensation (cont.)**CAUTION**

- the adjustment for a 2-wire interface (R54) is located on the Analog PC Assembly.
- the adjustment for a 4-wire interface (R20) is located on the 4-Wire Interface PC Assembly.

8. Adjust either **R54** (2-wire) or **R20** (4-wire) clockwise if LO is on, counterclockwise if HI is on, until the **CAL** indicator remains on. The T346 will time out and go ON HOOK in 4 minutes. If adjustment is not complete in this time, repeat the procedure from step 3.
 9. The receive access-line compensation adjustment is now complete. Place the **NORMAL/COM. ADJ** switch in the **NORMAL** position.
 10. Connect a transmission measuring set with dial-through provision to the second line and dial up the same office or switch milliwatt.
 11. Measure the received milliwatt level. The difference between 0 dBm and this reading is the office-to-measuring-set loss in the second line. Make a note of this loss.
 12. Drop the line. Then from the level measuring set, dial through to the T346.
 13. If the T346 responds with 2225 Hz test Progress Tone (CAROT mode), send DTMF digit 4 to cause the T346 to switch to DTMF mode.
 14. When T346 sends 1004 Hz reference tone, send it the DTMF digits 77 (long time-out) and 33 (send 1004 Hz at reference level).
 15. Measure the level received at the level measuring set. It should be the T346 DTMF mode send reference level (-10 dBm, -15 dBm or -16 dBm as selected, APPENDIX A — SWITCH S2) minus the second line loss noted in step 11.
- CAUTION**

 - The adjustment for a 2-wire interface (R18) is located on the Analog PC Assembly.
 - The adjustment for a 4-wire interface (R7) is located on the 4-Wire Interface PC Assembly.
16. Adjust either **R18** (2-wire) or **R7** (4-wire) in the T346 until the correct reading is obtained on the level measuring set.

5.1 Procedure for Access Line Compensation (cont.)

17. The send access line compensation adjustment is now complete. Send DTMF code 83 (ON-HOOK). Drop the second line.

18. Replace the top cover.

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

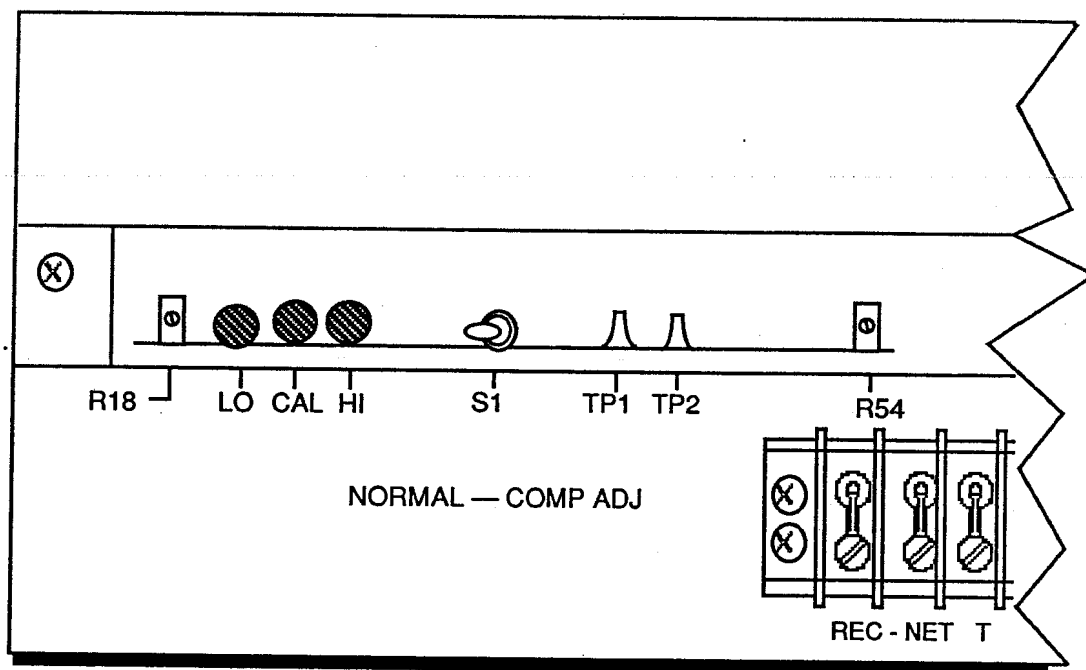


Figure 5-1 — T346 BACK PANEL (Left Side)

6.0 OPERATIONAL FUNCTIONS

6.1 General

Installation procedures, outlined in Section 4.0, should be followed; and one of the four modes of operation switch-selected as per Appendix B, switch S3. The four possible configurations are as follows:

- T346 (Equipped for DTMF mode only)
- UMR Non-optional Format
- UMR optional Format
- CODE 105

NOTE

— Each of the configurations listed above is available with or without Return Loss Measurements when purchased.

6.2 T346 Automatic Operation

When the T346 is dialed from a DTMF push button telephone, the reply by the T346 will be automatic. If a T328 makes the call, the T328 is programmed with the information regarding unit being called. The T346 replies automatically as configured during installation. Codes for the T346 are determined by setting switch S3 to the position in Table A-2 labeled Equipped for DTMF Mode only.

With switch S3 in the DTMF mode, the T346 Test Line will answer either ringing voltage with a two-wire unit or appropriate E&M supervision with a four-wire unit. After 2.7 seconds it will send a 1004 Hz tone, at the reference level selected when configuring switch S2, for 30 seconds. During the 30 seconds of operation the T346 waits for the first command. If no command is received within the 30 second time period, the T346 goes ON-HOOK. If during the 30 second time period the T346 receives the DTMF digits, 24, the T346 goes into the automatic test sequence described in the following paragraphs of Table 6-1.

TABLE 6-1
T346 AUTOMATIC TEST SEQUENCE

Measurement Direction	T346 Responder	Test Equipment
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 of 404 Hz.	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 of 2804 Hz	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 dBmC)
	(15) Transmit C-Message Noise Registered Level (+30 dB of the C-Message Noise)	(Add +60 dB algebraically to convert to dBmC)
N to F	(16) Go Quiet	Transmit White Noise and Measure EPL
	(17) Go "ON-HOOK"	

* F = Far
N = Near

6.3 T346 Manual Operation

To initiate the test and measurement sequence manually, apply either a "ringing voltage" to the two-wire or appropriate E&M signaling to the four-wire T346. After 2.7 seconds the T346 sends a 1004 Hz tone at the reference level selected when configuring switch S2 for 30 seconds. From hereon, the individual DTMF digit codes indicated in Appendix C must be sent before the 30 second period ends to perform each function. If a longer time out is required, refer to table 6-2 DTMF codes 72 thru 77. If a valid DTMF command is not received before the time out period ends, the T346 goes "ON-HOOK".

6.4 CAROT Compatible and UMR (Universal Mini Responder)

Configuring the T346 to emulate another type of responder is accomplished by setting switch S3 in either the CAROT compatible or one of the UMR modes outlined in Appendix B. When configured in this way, the T346 answers a call with a post seizure delay and Test Progress Tone (TPT). The delay time and the TPT tone duration are set by configuring switches S2 and S3 to the proper state (Appendix A and B). Routines performed by emulated responders are compelled by MF tones as described in Appendix D.

If an MF command is not received for 18 seconds, the T346 disconnects from the line. With a 2-Wire interface, the T346 goes ON-HOOK. With a 4-Wire interface, the T346 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.

Appendices E through G are used to interpret the test codes. After each measurement routine, the T346 goes through the following sequence to report the measurement result:

- 430 ms of guard tone
- data tone
- 50 ms of guard tone

The data tone timing conforms to the Data Formulas shown in Appendix H entitled *RESPONDER DATA FORMATS*.

7.0 Repair

Should the equipment require service, the unit may be sent to the following repair facility in accordance with the WARRANTY instructions in the front of this manual.

Wilcom Products

P.O. Box 508

Laconia, NH 03247

ATTN: Repair Dept.

Phone: (603) 524-2622

8.0 TECHNICAL ASSISTANCE

Should technical assistance be necessary, contact our Applications Engineers at the following number:

Laconia, NH

1-800-521-TEST

APPENDIX A T346 DIP SWITCH S2 SETTINGS

Switch Closed (down): 0

Switch Open (up): 1

Either State: x

Switch Position								Function
1	2	3	4	5	6	7	8	
0	0	0	x	x	x	x	x	400 ms
1	0	0	x	x	x	x	x	500 ms
0	1	0	x	x	x	x	x	600 ms
1	1	0	x	x	x	x	x	700 ms
0	0	1	x	x	x	x	x	800 ms
1	0	1	x	x	x	x	x	900 ms
0	1	1	x	x	x	x	x	1000 ms
1	1	1	x	x	x	x	x	1500 ms
x	x	x	0	0	x	x	x	-16 dBm0
x	x	x	1	0	x	x	x	-10 dBm0
x	x	x	0	1	x	x	x	-15 dBm0
x	x	x	1	1	x	x	x	-16 dBm0
x	x	x	x	x	x	0	x	30 Second Timeout
x	x	x	x	x	x	1	x	18 Second Timeout
x	x	x	x	x	1	x	x	Additional 2 Second TPT Delay
x	x	x	x	x	0	x	x	Normal Delay
x	x	x	x	x	x	0	x	30 Second Time-out (MF mode)
x	x	x	x	x	x	1	x	18 Second Time-out (MF mode)
x	x	x	x	x	0	x	x	500 msec TPT Delay + S3 (MF mode)
x	x	x	x	x	1	x	x	2.5 msec TPT Delay + S3 (MF mode)

Test Progress

Tone Duration

(MF-Mode Only)

Send Reference Level

(DTMF-Mode Only)

MF Only

APPENDIX B **T346 DIP SWITCH S3 SETTINGS**

Switch Closed (down): 0
Switch Open (up): 1
Either State: x

<u>Switch Position</u>								<u>Function</u>
1	2	3	4	5	6	7	8	
0	0	0	x	x	x	x	x	200 ms
1	0	0	x	x	x	x	x	300 ms
0	1	0	x	x	x	x	x	400 ms
1	1	0	x	x	x	x	x	500 ms
0	0	1	x	x	x	x	x	600 ms
1	0	1	x	x	x	x	x	700 ms
0	1	1	x	x	x	x	x	800 ms
1	1	1	x	x	x	x	x	not used
x	x	x	0	x	x	x	x	Equipped with 2-wire interface
x	x	x	1	x	x	x	x	Equipped with 4-wire interface
x	x	x	x	0	0	0	0	CAROT-compatible; no R.L. or loopback (MF)
x	x	x	x	1	0	0	0	not used
x	x	x	x	0	1	0	0	not used
x	x	x	x	1	1	0	0	not used
x	x	x	x	0	0	1	0	Equipped for DTMF-Mode only
x	x	x	x	1	0	1	0	not used
x	x	x	x	0	1	1	0	not used
x	x	x	x	1	1	1	0	not used
x	x	x	x	0	0	0	1	UMR, with Loopback & Modified R.L. (MF)
x	x	x	x	1	0	0	1	UMR Optional, un-modified R.L. (MF)
x	x	x	x	0	1	0	1	not used
x	x	x	x	1	1	0	1	not used
x	x	x	x	0	0	1	1	not used
x	x	x	x	1	0	1	1	not used
x	x	x	x	0	1	1	1	not used
x	x	x	x	1	1	1	1	not used

APPENDIX C

DTMF CODES

<u>DTMF Code</u>	<u>Description</u>
4	When in the Code 105 UMR mode this digit places the unit in the T346 DTMF operation mode. (This is a special code and should be send as a single digit.
*00	Send a 1004 Hz tone, at the reference level selected with S2 , for 5.5 seconds followed by a quiet termination for the duration of the time out.
*10	Sent to the T346 <u>prior to</u> any requests for measurement. When received, the T346 sends 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 three 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.
*15	Switch to Type 105 routine.
*16	Send a P/AR signal at the preset reference level for a duration of 3 seconds
*17	ERL — per IEEE Std. 743-1984 (4-wire units <u>only</u>).
*18	SRL High — per IEEE Std. 743-1984 (4-wire units <u>only</u>).
*19	SRL Low — per IEEE Std. 743-1984 (4-wire units <u>only</u>).
*20	The Callback command must be the last command sent to the T346 before disconnect. Input DTMF digits *20 (number to be called), up to 48 digits. The callback number is a first in first dialed sequence. The DTMF digit "B" (with 4-column DTMF pad) may be included to introduce a three second pause in the the dialing sequence. Digits must be sent at a rate faster than one digit per second. After one second has elapsed without a digit being received, the T346 will go ON HOOK. After a 100 ms delay the T346 will go OFF HOOK and DTMF pulse the digits received following the *20. The T346 then waits 25 seconds for a DTMF digit # before going ON HOOK. If a DTMF digit # is received, the T346 waits 30 seconds for a valid DTMF function code comand before going ON HOOK.

DTMF CODES (cont.)

- | | |
|----|---|
| 24 | Start automatic sequence as described in Table 6-1. |
| 32 | Transmit 404 Hz. |
| 33 | Transmit 1004 Hz. |
| 34 | Transmit 2804 Hz. |

NOTE

— The above frequencies are transmitted according to reference level settings made at switch S2.

- | | |
|-----|---|
| 42 | Measure 404 Hz Level. |
| 43 | Measure 1004 Hz Level. |
| 44 | Measure 2804 Hz Level. |
| *45 | Broadband Noise band limited to between 500 and 2000 Hz (ERL), transmitted at the reference level selected when configuring switch S2, for a duration of 3 seconds. |
| 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

- The analog response is limited to a level of -10 dBm.
 - The DTMF response can go to 0 dBm.
 - Output level for returned signal is limited to -10 dBm and the DTMF response will return the actual value measured range up to 55 dBm.
-

- | | |
|-----|---|
| *50 | Loopback with 0 dB attenuation (4-wire only). |
| *51 | Loopback with -8 dB attenuation (4-wire only). |
| *52 | Loopback with -18 dB attenuation (4-wire only). |

DTMF CODES (cont.)

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.
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.
79	Places the T346 into an infinite time out.
82	Quiet Termination.
83	Terminate call; go ON HOOK.

DTMF CODES (cont.)***90**

Returns the program version installed in the T346 and also the switch settings as follows:

XXX, *, YYY, *, ZZZZ

XXX — a three digit code indicating the version installed (ie: 203 is version 2.03).

***** — star digit used as a format separator.

YYY — 3 digit octal code indicating the switch position for switch S2.

First digit represents switch positions 1,2 and 3.

Second digit represents switch positions 4 and 5.

Third digit represents switch positions 6,7 and 8.

(Open position appears as a 1 while a closed position appears as a 0)

***** — star digit used as a format separator.

ZZZZ — 4 digit octal code indicating the switch position for switch S3.

First digit represents switch positions 1,2 and 3.

Second digit represents switch position 4.

Third digit represents switch positions 5, 6 and 7.

Fourth digit represents switch position 8.

(Open position appears as a 1 while a closed position appears as a 0)

NOTE

— In cases where a command is not received properly, the T346 does not respond (ie: if an undefined command is received, the T346 does not respond, it waits for the next recognizable command).

APPENDIX D
MF FREQUENCY TABLE

<u>Digit</u>	<u>Low Frequency</u>	<u>High Frequency</u>
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
KP	1100	1700
ST	1500	1700
ST3P	700	1700
STP	900	1700
ST2P	1300	1700

APPENDIX E **CAROT COMPATIBLE CODES**

<u>Digit</u>	<u>Test</u>	<u>Description</u>
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
KP	LAYER	Always precedes another digit to get layer 3 tests
ST	NT	Noise with Tone Test
ST3P	ERL	Echo Return Loss
STP	L10	Loss (-16 dBm, 1004 Hz) Test
ST2P	L28	Loss (-16 dBm, 2804 Hz) Test
KP0	NEFT	Not Equipped for Test (preceded by quiet period)
KP1	SHISC	Singing Return Loss, High Self-Check
KP2	SHI	Singing Return Loss, High
KP3	NEFT	Not Equipped for Test (preceded by quiet period)
KP4	NEFT	Not Equipped for Test.
KP5	RL	Release
KP6	L4SC	Loss (-16 dBm, 404 Hz) Self-Check
KP7	NEFT	Not Equipped for Test (preceded by quiet period)
KP8	SRLSC	Singing Return Loss, Self-Check
KP9	NEFT	Not Equipped for Test (preceded by quiet period)
KPKP	NTSC	Not Equipped for Test (preceded by quiet period)
KPST	NTSC	Noise with Tone Self-Check
KPST3P	ERLSC	Echo Return Loss Self-Check
KPSTP	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
KPST2P	L28SC	Loss (-16 dBm, 2804 Hz) Self-Check

APPENDIX F
USMR, WITH LOOPBACK & MODIFIED RETURN.LOSS. CODES

<u>Digit</u>	<u>Test</u>	<u>Description</u>
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 Low, Modified
9	RNSC	Near-End Noise Self-Check
KP	LAYER	Always precedes another digit to get layer 3 tests
ST	NT	Noise with Tone Test
ST3P	ERLM	Echo Return Loss, Modified
STP	L10	Loss (-16 dBm, 1004 Hz) Test
ST2P	L28	Loss (-16 dBm, 2804 Hz) Test
KP0	LB18	18 dB Loopback
KP1	SHISCM	Singing Return Loss, High Self-Check, Modified
KP2	SHIM	Singing Return Loss, High, Modified
KP3	LB8	8 dB Loopback
KP4	ERLX	Echo Canceller Test
KP5	RL	Release
KP6	L4SC	Loss (-16 dBm, 404 Hz) Self-Check
KP7	LB0	0 dB Loopback
KP8	SRLSCM	Singing Return Loss, Self-Check, Modified
KP9	LC10	Loss (-16 dBm, 1004 Hz) Test Through C-Message Filter
KPKP	NEFT	Not Equipped for Test (preceded by quiet period)
KPST	NTSC	Noise with Tone Self-Check
KPST3P	ERLSCM	Echo Return Loss Self-Check, Modified
KPSTP	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
KPST2P	L28SC	Loss (-16 dBm, 2804 Hz) Self-Check

APPENDIX G
USMR OPTIONAL, UN-MODIFIED R.L. CODES

<u>Digit</u>	<u>Test</u>	<u>Description</u>
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 Low
9	RNSC	Near-End Noise Self-Check
KP	LAYER	Always precedes another digit to get layer 3 tests
ST	NT	Noise with Tone Test
ST3P	ERL	Echo Return Loss
STP	L10	Loss (-16 dBm, 1004 Hz) Test
ST2P	L28	Loss (-16 dBm, 2804 Hz) Test
KP0	LB18	18 dB Loopback
KP1	SHISC	Singing Return Loss, High Self-Check
KP2	SHI	Singing Return Loss, High
KP3	LB8	18 dB Loopback
KP4	ERLX	Echo Canceller
KP5	RL	Release
KP6	L4SC	Loss (-16 dBm, 404 Hz) Self-Check
KP7	LB0	0 dB Loopback
KP8	SRLSC	Singing Return Loss, Self-Check
KP9	LC10	Loss (-16 dBm, 1004 Hz) Test Through C-Message Filter
KPKP	NEFT	Not Equipped for Test (preceded by quiet period)
KPST	NTSC	Noise with Tone Self-Check
KPST3P	ERLSC	Echo Return Loss Self-Check
KPSTP	L10SC	Loss (-16 dBm, 1004 Hz) Self-Check
KPST2P	L28SC	Loss (-16 dBm, 2804 Hz) Self-Check

APPENDIX H
RESPONDER DATA FORMATS

<u>Test</u>	<u>Data Formula</u> <u>(milliseconds)</u>	<u>Self Check</u>		
		<u>Variable</u>	<u>ms</u>	<u>Variable Range</u>
Loss 0 dBm	2 (160 — 10L) -1	L=0 dBm	317 - 321	-5 to +15.8 dB
Loss -16 dBm	2 (210 — 10L) -1	L=0 dBm	415 - 423	-5 to +20.8 dB
C-Msg Noise	2 (N — 13) -1	N=23 dBmC	17 - 21	15 to 55 dBmC
C-Notch Noise	2 (N — 320) -1	N=74 dBmC	81 - 85	34 to 74 dBmC
Echo Return Loss	2 (42 — RL) -1	RL=0 dB	81 - 85	0 to 40 dB

APPENDIX I

GLOSSARY

C—MSG WEIGHTING — Makes measurements of noise similar to the response of the human ear to various frequencies over a telephone circuit.

dB (decibel) — The unit used to define attenuation characteristics of a transmission facility.

dBm — decibels referenced to one milliwatt.

dBn — dB reference noise. The reference noise power is 10^{-12} watt or -90 dBn.

dBnc — dB reference noise measured with C-Message weighting.

ECHO PATH LOSS (EPL) — the loss which must be in the echo path to reduce echo to a tolerable level.

ERL (Echo Return Loss) — the ratio of the transmitted power to the reflected or received power.

ERLX — *2-wire units* — the T346 goes quiet for 2.56 seconds, transmits 430 ms of guard tone, 3 ms data tone and 50 ms guard tone.
4-wire units — the T346 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 2.56 sec (which it measures). After sending the Return Loss signal, the T346 goes quiet for 50 ms, sends ERL for a maximum of 2.56 seconds, the T346 goes through the guard tone, data tone, guard tone sequence.

IMPEDANCE — Electrical opposition to the flow of current.

IMPULSE NOISE — Noise characterized by transient disturbances separated in time by quiescent intervals. These impulses occur as spikes or bursts of energy.

L, L4, L10, L28 — At the trailing edge of the MF command, the T346 transmits the appropriate level and frequency for 430 ms. The T346 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 goes to the guard tone, data tone, guard tone sequence.

LAYER — Causes the receiver to advance to the next layer.

GLOSSARY (cont.)

LB0 — LOOP BACK *2-wire units* — respond with NEFT.

4-wire units — insert 0 dB attenuation between receive and transmit until another command is received.

LB8 — LOOP BACK — *2-wire units* — responds with NEFT.

4-wire units — inserts 8 dB attenuation between receive and transmit until another command is received.

LB18 — LOOP BACK

2-wire units — respond with NEFT.

4-wire units — inserts 18 dB attenuation between receive and transmit until another command is received.

LC10 — At the trailing edge of the MF command, the T346 transmits the appropriate level and frequency for 430 ms. The T346 then waits a maximum of 2.56 seconds for a signal of sufficient amplitude to be received through the C-Message filter. It samples the signal for 430 ms, then goes to the guard tone, data tone, guard tone sequence.

LL10 — Transmit a continuous 1004 Hz at -16 dBm.

LSC, L28SC, L10SC, L4SC, NTSC, NSC — The T346 goes quiet for 860 ms (430 ms for NSC) then proceeds with the guard tone, data tone, guard tone sequence.

mA — milliamperes

N — symbol for NOISE — The T346 measures noise through a C-Message filter for 375 ms then proceeds with the guard tone, data tone, guard tone sequence.

NEFT — NOT EQUIPED FOR TEST — Two seconds of quiet and then the T346 transmits 1000 ms of guard tone, 1000 ms of data tone and 50 ms guard tone.

NOISE — Energy which interferes with normal transmission of information.

NOISE METALLIC — the noise measured across the tip and ring of a circuit.

NOISE REJECT — A band pass filter with cutoff frequencies of 200 and 5000 Hz.

NOISE TO GROUND — The noise measured between ground and the tip and ring conductors tied together.

GLOSSARY (cont.)

NT — NOISE WITH TONE TEST — The T346 transmits 430 ms of -16 dBm, 1004 Hz tone, waits a maximum of 2.56 sec for 430 ms of tone of sufficient amplitude. During this time the T346 measures noise through C-Message and C-Notch filters. After completion of this sequence, the T346 goes through the guard tone, data tone, guard tone sequence.

P/AR (Peak/Average Ratio) — Ratio of the absolute peak to the full-wave rectified average values of the pulse train.

RETURN LOSS — The ratio, in decibels, between the amount of power transmitted to the power reflected back to its source.

RL — RELEASE — The T346 goes ON-HOOK.

RN (NEAR-END NOISE TEST), RNSC (NEAR-END NOISE SELF-CHECK) — The T346 goes quiet for 430 ms, attaches the MF receiver, and waits for the next command.

SINGING — An undesired self-sustaining audio oscillation in a circuit usually caused by excessive gain or unbalance of a hybrid termination.

SRL (SINGING RETURN LOSS LOW), SHI (SINGING RETURN LOSS, HIGH), ERL (ECHO RETURN LOSS)

2-wire units — the T346 goes quiet for 2.56 seconds, transmits 430 ms of guard tone, 3 ms data tone and 50 ms guard tone.

4-wire units — the T346 goes quiet for 2.56 seconds, sends the appropriate Return Loss signal for a maximum of 2 seconds (which it measures). 2.56 sec after the start of the Return Loss signal, the T346 goes through the guard tone, data tone, guard tone sequence.

SRLM (SINGING RETURN LOSS LOW, MODIFIED), SHIM (SINGING RETURN LOSS, HIGH, MODIFIED), ERLM (ECHO RETURN LOSS MODIFIED)

2-wire units — same procedure as SRL, SHI, ERL.

4-wire units — T346 sends the appropriate Return Loss signal for a maximum of 2 sec (which it measures). 2.56 seconds after the start of the Return Loss signal the T346 goes through the guard tone, data tone, guard tone sequence.

SRLSC (SINGING RETURN LOSS, SELF-CHECK), SHISC (SINGING RETURN LOSS, HIGH, SELF-CHECK), ERLSC (ECHO RETURN LOSS, SELF-CHECK)

2-wire units — T346 goes quiet for 2.56 seconds, then transmits 430 ms of guard tone, 83 ms of data tone, and 50 ms guard tone.

4-wire units — after 5.1 sec of quiet, the T346 goes through the guard tone, data tone, guard tone sequence.

GLOSSARY (cont.)

SRLSCM (SINGING RETURN LOSS, SELF-CHECK, MODIFIED, SHISCM (SINGING RETURN LOSS, HIGH SELF-CHECK, MODIFIED), ERLSCM (ECHO RETURL LOSS, SELF-CHECK, MODIFIED)

2-wire units — T346 goes quiet for 2.56 seconds, then transmits 430 ms of guard tone, 83 ms of data tone, and 50 ms guard tone.

4-wire units — after 2.56 seconds of quiet, the T346 goes through the guard tone, data tone, guard tone sequence.

REVISIONS				0R6	F
LTR	DESCRIPTION	ECO	DATE	APPROVED	

T346
FIELD INSTALLATION INSTRUCTIONS
FOR THE
MF RETROFIT OPTION

1.1 Introduction

1.1.01 In a fully configured T346, the MF capabilities are combined with the DTMF capabilities to provide an extremely flexible test line/responder. The MF retrofit kit provides these combined capabilities.

1.2 Field Installation of MF Option

- a.) Remove the cover from the T346 by removing the two screws on the rear panel.
- b.) Locate the four standoffs and the header (male connector) not being used on the large top pc board.
- c.) Connect the MF Receiver pc board option to the header and secure the board to the four standoffs with four screws and lockwashers provided.
- d.) On 48 volt battery-operated units, skip steps e - h below. On 115 volt ac units install the transformer as follows:
- e.) Locate four studs next to existing transformer.
- f.) Place the mounting bracket over transformer and install transformer over studs placing the pad provided between the chassis and transformer.
- g.) Secure with four nuts and lockwashers.
- h.) Connect the added transformer to the existing one using mating connectors provided.
- i.) Place the cover on the unit and replace the screws.

inactive per ECN 2583

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS $\pm 1/64$ ANGLES $\pm 1/2^\circ$ 3 PLACE DECIMALS $\pm .005$ 2 PLACE DECIMALS $\pm .01$	T346		wilcom PRODUCTS INC. LACONIA, N.H. 03246		
	DRAWN BY SHP	DATE 6/15/84	DWS. TITLE T346 MF OPTION INSTALLATION INSTR		
MATERIAL XX	CHECKED BY SHP	DATE 6-18-84	SIZE CODE IDENT. NO. DWS. NO. REV A 51778 068-1085-7 -		
	APPROVED BY SHP	DATE 6-18-84			
FINISH XX			SCALE SHEET 1 of 1		