

ACCESS POINT APPLICATION GUIDELINES AND TESTING METHODS TO PERMIT SARTS
TESTING OF CIRCUITS AT ACCESS POINTS BETWEEN TANDEM CHANNEL UNITS

This document provides interim methods of using SARTS to remotely test Tandem Channel Units (TDMs) in a back-to-back arrangement. This method should be used until SARTS Development group provides a better solution to this testing problem.

If an Operating Company elects to apply these procedures the following assumptions are made:

1. Circuit Design Standards group shall develop a 6 wire Access Point (6W AP) in circuit designs and apply these guidelines.
2. Central Office Equipment Engineering shall provide 6W APs in offices requiring TDM applications.
3. Circuit Provision Bureaus shall design circuits using these guidelines.
4. Network Operations shall wire 6W APs using these guidelines.
5. Special Services testing entities shall apply manual SARTS test commands (i.e., do not use macro tests) contained herein.

TANDEM INTERFACE CONFIGURATION:

Voice frequency transmission between TDMs is four wire 600 ohm. Signaling and supervision is carried through the connection on separate signaling leads as well as simplex on transmissions leads. Two signaling states are transmitted on signaling leads and two states are transmitted on the simplex voice pair as shown in Figure 1 on page 2.

Standard "E&M" operation employs either an open or ground on the "E" lead, and either ground or battery on the "M" lead. However, TDMs wired back-to-back employ signaling leads designated "E" and "Ex", rather than "E" and "M", as shown in Figure 1 on page 2. Also, the only operational states on "E" and "Ex" leads are ground or open.

WARNING!

NEVER PERFORM STANDARD E&M TESTING ON TDM UNITS AS 48V WILL DESTROY THE UNIT!

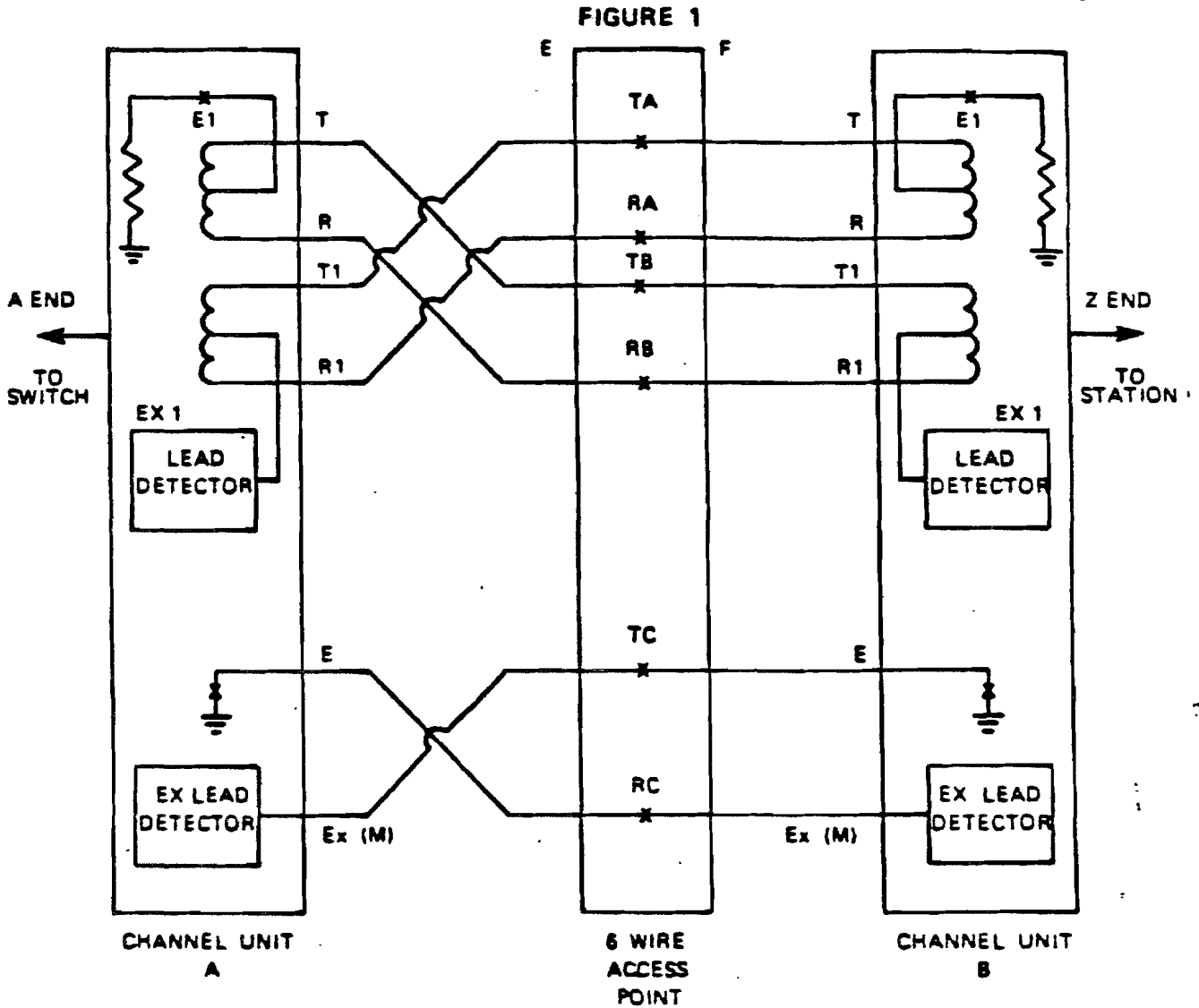
Signaling between TDMs is accomplished as follows:

- (1) Over Voice Path (i.e., Simplex T and R to T1 and R1 leads) - The "E1" lead of either TDM uses the simplex voice path to the opposing TDMs "Ex1" detector; the simplex signal is unidirectional in this respect.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

- (2) Over "E" and "Ex" Leads - These leads work similar to "E&M" leads, however, the "Ex" lead (designated as "M") is signaled with grounds only. "Ex" leads are carried out of the channel bank as designated "M" leads and will appear on the designated "M" terminal of distributing frame terminal blocks. Remember however, that even though designated as an "M" lead, it is in fact the "Ex" lead of the TDH (see WARNING on page 1).



**BACK-TO-BACK TANDEM CHANNEL UNIT CONNECTIONS
ACCESS CODE MBA; SIG FORMAT CODE L4S**

SMAS 6W APs should always be used between TDHs. The switch end should always be at A-end of the circuit with "EF" orientation. Voice Frequency connections, carried through A and B paths of the 6W APs, are wired with the transition (i.e., frogging) on Equipment (E) side between 6W AP and channel unit (See Figure 1 above.)

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

"E" and "Ex" leads, unique to TDMs, also require special handling. They will be connected to TC and RC paths of 6W AP with "E" lead of each channel unit cross connected to "Ex" lead of the other. Transition of "E" and "Ex" leads is also done on Equipment (E) side of the 6W AP (See Figure 1 on page 2).

MBA access configuration code should always be used with "EF" orientation code. Use of MBA code provides "E&M" signal testing commands and sets the screen for "E&M" testing.

SIGNALING FORMAT

It is recommended that Signaling Format be shown as "NON" on 703 line of Access Point data. This should give tester a clue this is a unique 6W AP and requires special testing techniques. Tester should replace "NON" with "L4S" Signaling Format (i.e., treat transmission paths as a 4 wire circuit) before sending 703 line.

WIRING CONFIRMATION TESTS:

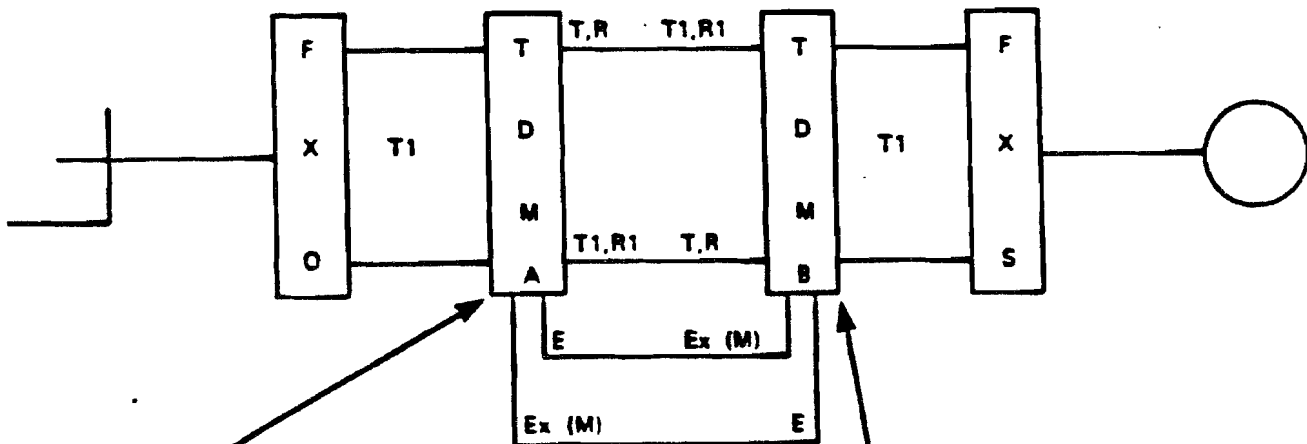
Since use of "E" and "Ex" leads may lead to confusion, wiring of 6W AP should be confirmed as part of pre-service circuit testing. This is done by verifying Equipment (E) side channel "Ex" lead is wired to "E" lead of Facility (F) side channel unit at "TC" of 6W AP and that Equipment (E) side "Ex1" lead is simplexed on "A" pair at TA and RA of 6W APs. These checks are made by splitting the leads and measuring for DC voltage on these leads in the Equipment (E) direction.

These tests are made on the TA/RA of the "A" pair, and the "TC" of the "C" pair toward the Equipment (E) side of the 6W AP. Expected voltage readings at these points at the 6W AP is approximately -34 volts (D1 and D4 channel banks), or -9 volts (D3 channel banks) - see Figure 1 on page 2.

CHANNEL UNIT OPTIONS FOR FXO-FXS:

Testing procedures given assume TDMs are correctly optioned as shown in Figure 2 below.

Figure 2

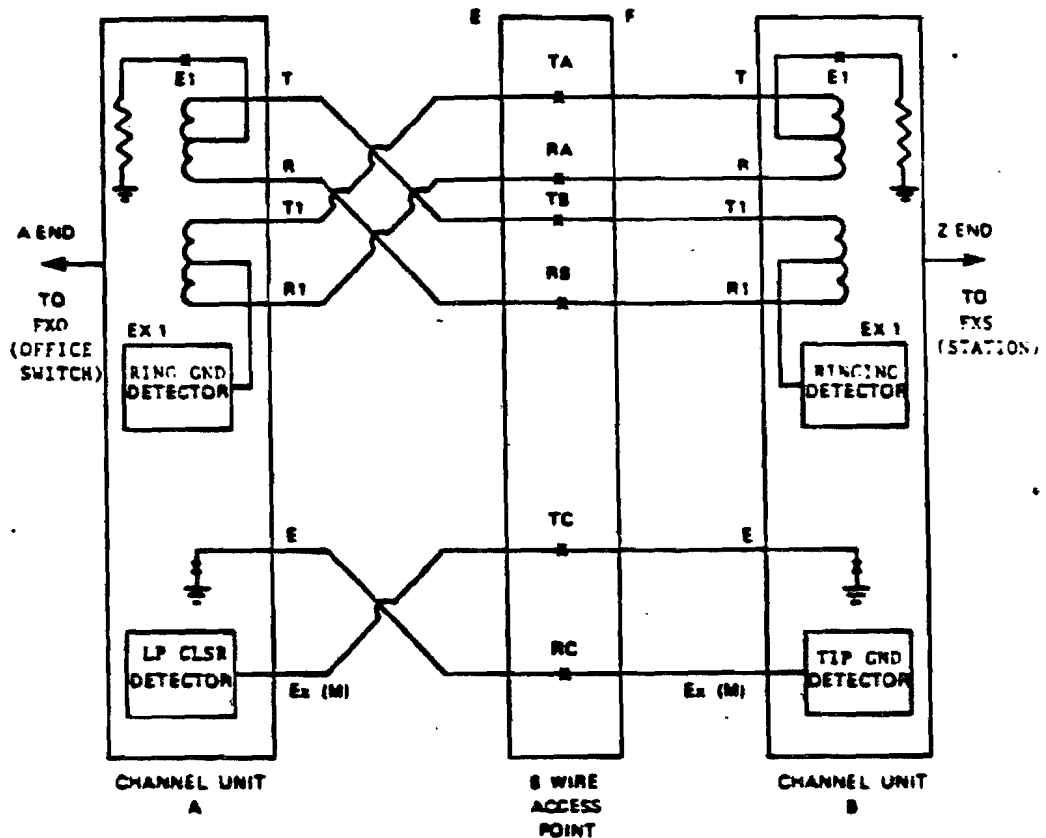


- TDM A OPTIONS:
- D4 OPT: E, S, V, W, Y -
 - D3 OPT: (E, S, V, W, Y)
 - D1A OPT: R, S, X, Y, Z
 - D1D OR D13 OPT: S, X, Y, Z

- TDM B OPTIONS:
- D4 OPT: E, T, V, W, Z
 - D3 OPT: E, T, V, W, Z
 - D1A OPT: R, T, V, W, Y, Z
 - D1B OR D1D OPT: T, V, W, Y, Z

SIGNALING STATES:

Signaling states for correctly wired FX circuits, viewed at the 6W AP between TDMs, are listed in Table 1 below. For each sequence of loop or ground start operation, all four logic states must be in either an open or grounded condition as shown on the chart.



LEAD	Primary Signaling Facing Switch		Secondary Signaling Facing Station	
	E	Ex (M)	E1	Ex1
FOR LOOP START				
Idle	Grnd	Open	Open	Open
Station off Hook	Grnd	Grnd	Open	Open
C.O. Ringing	Grnd	Open	♠ Grnd	Open
Station Answer - Ring Trip	Grnd	Grnd	* Grnd	Open
Busy State	Grnd	Grnd	Open	Open
FOR GROUND START				
Idle	Open	Open	Open	Open
FBX Seizure	Open	Open	Open	Grnd
C.O. Dial Tone - TG Closer	Grnd	Grnd	Open	Open
C.O. Seizure - And Ringing	Grnd	Open	♠ Grnd	Open
Station Answer - Ring Trip	Grnd	Grnd	* Grnd	Open
Busy State	Grnd	Grnd	Open	Open

* When ringing is tripped in CO., this lead will change to open.
 ♠ This lead is grounded only during the ringing interval.

Table 1 PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

TESTING TOWARDS SWITCH:

Following are methods designed to draw dial-tone from the switch in order to test FX circuits. Methods are given for both loop and ground start circuits.

Loop Start Circuit:

Steps to draw dial-tone and dial pulse to switch are given in Chart 1 (page 6). Chart 2 (page 7) lists steps required to draw dial-tone and TOUCHTONE® to switch.

Ground Start Circuits:

Steps to draw dial-tone and dial pulse to switch are given in Chart 3 (page 8). Chart 4 (page 9) gives procedure to draw dial-tone and TOUCHTONE® to switch.

TESTING TOWARDS STATION:

Procedures for ringing station end of an FX circuit are given in Chart 5 (page 10) for loop start, and Chart 6 (page 11) for ground start circuits.

MIDPOINT SIGNALING TESTS TO SWITCH/STATION:

Chart 7 (page 12) describes method of testing signaling towards the switch or station from the 6W AP.

TRANSMISSION TESTS:

To perform transmission tests on FXs, circuit must be put in an off-hook state. For measurements between TDM and office end of circuit the "E" lead must be grounded in the direction of office end channel unit; this gives a loop closed signal to office-end channel unit. To make measurements towards station end, "M" (i.e., Ex) lead must be grounded in the direction of the station; this will be recognized by station end channel unit as a tip ground signal and cause station end channel unit to close the tip lead to provide continuity on transmission leads.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 1

<u>DIAL PULSE TO SWITCH (LOOP START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
G01/E/SX/	Establish test direction towards switch.
L01/LP/CLSD/RL/	Split V. F. circuit.
G07/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
E01/E/E/GRD/	Grounds "E" (i.e., Ex) lead towards switch causing loop closure to switch and drawing dial tone. (Tester should hear dial tone.)
E03/E/S/TEL #/10/58X BRK/	<ol style="list-style-type: none">1. Releases and then seizes "E" (i.e., Ex) lead towards switch (this should draw dial-tone); dial-tone is detected then dial pulsed addressing is sent towards office end channel unit.2. Tester should hear audible ring followed by answer.
G09/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 2

<u>TOUCHTONE® TO SWITCH (LOOP START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
G01/E/SX/	Establish test direction towards switch.
L01/LP/CLSD/RL/	Split V. F. circuit.
G07/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
E01/E/E/GRD/	Grounds "E" (i.e., Ex) lead towards switch causing loop closure to switch and drawing dial tone. (Tester should hear dial tone.)
E04/S/TEL #/SUPVN E/	<ol style="list-style-type: none">1. Releases and then seizes "E" (i.e., Ex) lead towards switch (this should draw dial-tone); dial-tone is detected then TOUCHTONE® addressing is sent toward office end channel unit.2. Tester should hear audible ring followed by answer.
G09/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 3

<u>DIAL PULSE TO SWITCH (GROUND START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
GO1/E/SX/	Establish test direction towards switch.
LO1/LP/CLSD&GRD/RL/	Split V. F. circuit. <u>Note:</u> Tester will receive "clicks" of dial-tone until circuits "E" lead is seized.
GO7/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
EO1/E/E/GRD/	Grounds "E" (i.e., Ex) lead towards switch causing loop closure to switch and drawing dial-tone. (Tester should hear "steady" dial-tone.)
EO3/E/S/TEL #/10/58Z BRK/	<ol style="list-style-type: none">1. Releases and then seizes "E" (i.e., Ex) lead towards switch (this should draw dial-tone); dial-tone is detected then dial pulsed addressing is sent towards switch end channel unit.2. Tester should hear audible ring followed by answer.
GO9/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 4

<u>TOUCHTONE® TO SWITCH (GROUND START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
G01/E/SX/ L01/LP/CLSD&GRD/RL/	Establish test direction towards switch. Split V. F. circuit. <u>Note:</u> Tester will receive "clicks" of dial-tone until circuits "E" lead is seized.
G07/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
E01/E/E/GRD/	Grounds "E" (i.e., Ex) lead towards switch causing loop closure to switch and drawing dial-tone. (Tester should hear dial-tone).
E04/S/Tel #/SUPVN E/	<ol style="list-style-type: none">1. Releases and then seizes "E" (i.e. Ex) lead towards switch (this should draw dial-tone); dial-tone is detected then TOUCHTONE® addressing is sent towards switch end channel unit.2. Tester should hear audible ring followed by answer.
G09/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 5

<u>RING TOWARDS STATION (LOOP START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
G01/F/SX/	Establish test direction towards station.
L01/LP/CLSD/RL/	Split V. F. circuit.
G07/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
E01/M/F/GRD/	Grounds "M" (i.e., Ex) lead towards station; provides battery and ground toward Station at FYS (i.e., Z-end) end of circuit.
L01/BAT&GRD/-48/NORM/RL/	Conditions Access Point toward station for ringing.
L02/NN/86V/	Applies ringing toward station with number of rings selected in "NN" field of command.
G09/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

CHART 6

<u>RING TOWARDS STATION (GROUND START)</u>	
<u>COMMAND</u>	<u>RESULT</u>
G01/F/SX7	Establish test direction towards station.
L01/LP/CLSD/RL/	Split V. F. circuit.
G07/TLK/	Establish talk line.
H12/	Set up Talk & Listen paths.
E01/M/F/GRD/	Grounds "M" (i.e., Ex) lead towards PBX; provides battery and ground toward PBX at FXS (i.e., Z-end) end of circuit.
L01/BAT&GRD/-48/NORM/RL/	Conditions Access Point toward station for ringing. Note: This command may cause operation of some ground start circuits at PBXs that will ring the attendant; if this occurs wait 30 seconds for attendant to answer before invoking L02 command.
L02/NN/86V/	Applies ringing toward station with number of rings selected in "NN" field of command.
G09/	Restores circuit to monitor condition.

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

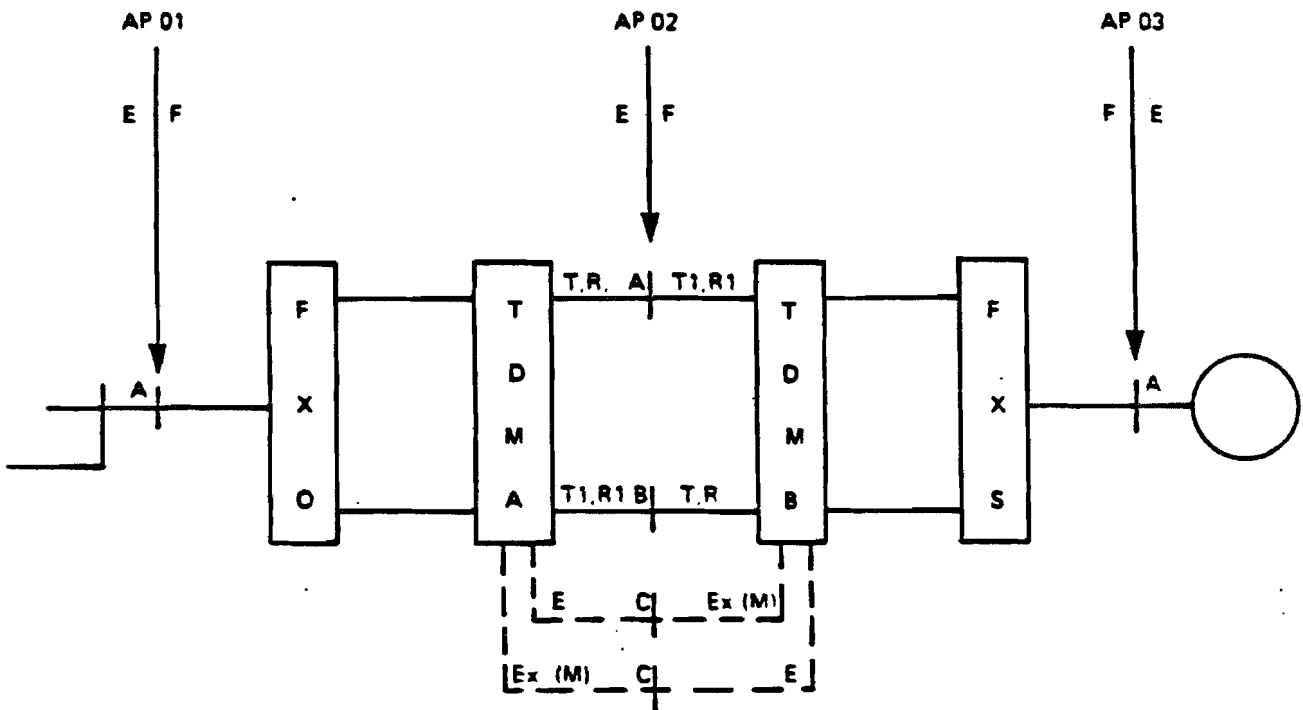
CHART 7

MIDPOINT SIGNALING TEST TO SWITCH/STATION			
Note: These tests performed only in event of end-to-end signal failure!			
STEP	ACC FT	COMMAND	RESULT
Midlink to Switch Test Using APs 01 and 02 (see diagram page 13)			
1	02	E01/E/E/OPN/	Opens "E" (i.e., Ex) lead toward switch.
2	02	E01/M/E/OPN/	Opens "M" (i.e., E) lead toward switch.
3	02	SPM/E/LP OPN/SX/ (for loop start); or SPM/E/CLSD&GRD/SX/ (for ground start)	Splits talk paths. <u>Note:</u> On ground start circuits tester will receive "clicks" of dial-tone prior to "E" lead seizure.
4	02	E09/M/E/	Should read 15 -50 ohms; this is "A" bus signaling A - Z (indicates tip ground at FXO).
5	02	E01/E/E/GRD/	Grounds "E" (i.e., Ex) lead toward switch; tester should hear dial-tone.
6	01	M04/R/DC/	If DC current is less than 23 m.a. trouble is indicated; FXO defective (Note: If FXO is PBX terminated verify cable loss meets circuit requirements).
7	01	SPM/F/LP OPN/RL/	Opens 2 wire path between switch and FXO.
8	02	E09/M/E/	Measurement to ground should read greater than 2,000 K ohms.
9	Signaling test completed between midlink and "A" end of circuit.		
Midlink to Station Test Using APs 02 and 03 (see diagram page 13)			
1	02	E01/E/F/OPN/	Opens "E" (i.e., E) lead toward station.
2	02	E01/M/F/OPN/	Opens "M" (i.e., Ex) lead toward station.
3	03	SPM/F/LP OPN/SX/	Opens APO3 to Carrier.
4	03	M12/T/F/	Should be open; measurement should read greater than 2,000 K ohms.
5	02	E01/M/GRD/	Grounds "M" (i.e., Ex) lead at 6W AP.
6	03	M12/T/F/	Should read tip ground measurement 75-250 ohms.
7	02	E09/E/F/	Should be open; measurement should read greater than 2,000 K ohms.
8	03	L01/LP CLSD/RL/	Closes loop at 2 wire between FXS and station.
9	02	E09/E/F/	Measurement should be 18-50 ohms.
10	Signaling test completed between midlink and "Z" end of circuit.		

PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.

END-TO-END SIGNALLING TEST ACCESS POINT CONFIGURATION



PROPRIETARY - BELLCORE AND AUTHORIZED CLIENTS ONLY

This document contains proprietary information that shall be distributed or routed only within Bell Communications Research (Bellcore) and its authorized clients, except with written permission of Bellcore.