
DIGITAL TRANSMISSION SYSTEMS
D3 CHANNEL BANK
SIGNALING TESTS AND TROUBLE LOCATION

This section provides procedures for out-of-service testing of the signaling functions of the D3 channel bank and associated channel units and for locating signaling troubles.

This section is reissued to make corrections in Chart 2, which are indicated by arrows. This reissue does not affect the Equipment Test List.

When performing the tests in this section, the Digital Transmission System using D3 channel banks as terminals must be functioning normally and the trunk processing unit (TPU) must be in the nonoperated state.

The procedures in this section relate to single channel testing from end to end. However, they may be performed independently at the two terminal locations by patching the bank under test to another bank in the same or in an adjacent bay. This patching may be performed at a DSX-1 patch and cross-connect panel at the office repeater bay or by cross-connections at the central cross-connect field. Complementary channel units must be used for the designated originating and terminating banks. End-to-end tests are not required if both end terminals meet the requirements of the single end tests.

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APPARATUS:

- 1—Milliwatt Supply
- 1—KS-14510, L5 Volt-Ohm-Milliammeter (VOM)
- 4—KS-19531, L2 Pin Plugs, Hook-up Wire, and Varnished Cambric (see Fig. 1 and 2)
- 1—1200-Ohm Resistor (144E type, or equivalent; see Fig. 2)
- 1—12-inch Test Lead equipped with Alligator Clips that have rubber covers (needed for Test F only)
- 1—542G Capacitor (needed for Test F only)

CHART 1

TRUNK TESTS

STEP	PROCEDURE
1	Verify that the appropriate channel unit options have been selected and that the channel units have been wired to the office equipment at both ends.
2	Verify that the D3 banks at both ends have been tested per Section 365-150-501.
3	Make the appropriate standard signaling tests (outlined in the 333 division of the BSPs) from the outgoing trunk (OGT) test frame or an equivalent access point.
4	If any of the signaling tests fail, proceed to Chart 2.

CHART 2

CHANNEL TESTS

To determine whether the trouble is a multiple channel failure, several channels should be tested. If there is a multiple channel failure, the trouble is probably in the common equipment of the D3 bank (assuming auxiliary voltages -48F, -48S, and 20 Hz are being supplied). Single channel failures are probably due to the channel unit. To clear the trouble, refer to Table A for the recommended plug-in unit replacement sequence.

If replacing plug-in units fails to clear the trouble, the following test procedure should be used to isolate the problem. This end-to-end procedure is done on individual channels taken out-of-service. If no trouble is found, the functioning of the connecting circuits should be investigated.

CHART 2 (Cont)

These channel tests should be made after the Digital Transmission System is connected through and with the office trunk circuits disconnected. When making these tests, the trunk processing unit should be in the nonoperated state.

All requirements for resistance measurements are based on the use of a VOM, such as the KS-14510, L5, which has positive internal battery connected to its negative lead when used as an ohmmeter. Any other meter arrangement may produce erroneous test results. However, the X10000 resistance range on the KS-14510, L5 VOM should not be used because this range utilizes an internal 30-volt battery which may cause false channel unit relay operation.

When a channel unit or common equipment plug-in unit is removed because it is suspected of being defective but its replacement does not correct the trouble, the original channel unit or plug-in should be reinserted in the slot from which it was removed before changing any other channel unit or plug-in.

The T, R, E, and M pin jacks referred to in these tests are located on the face of the channel unit; the INPUT GRD and -48V pin jacks are located on the power converter unit (PCU).

Caution 1: *When making a connection between a pin jack on the channel unit and the -48V pin jack on the PCU, the connection must be made on the channel unit pin jack first to avoid blowing a fuse.*

Caution 2: *When removing a connection between a pin jack on the channel unit and the -48V pin jack on the PCU, the connection on the -48V pin jack must be removed first to avoid blowing a fuse.*

The special test cord and termination assembly required for use in the following procedures can be built locally in accordance with Fig. 1 and 2. Table A lists the circuit board replacement sequence that should be used in locating various signaling troubles. The test arrangements are shown in Fig. 3 through 7.

STEP	PROCEDURE
A. DP or SDP ORIG and DP TERM Channel Unit Tests	
Note: There should be no trunk circuit or other connection to the T and R pin jacks on the channel unit at either end except as specified in the following tests.	
DP ORIG or SDP ORIG End	
1a	Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows: + lead to T - lead to R.
Requirement: 48 \pm 5 volts.	
1b	If the requirement is not met, see Table A and repeat Step 1a.

CHART 2 (Cont)

STEP

PROCEDURE

TABLE A

**PLUG-IN UNIT REPLACEMENT
SEQUENCE TO BE USED IN
CLEARING SIGNALING TROUBLES**

Channel Units (CU)
Transmitter (TU)
Receiver (RU)

Note 1: Before the TU and RU are replaced, the D3 bank *must* be out of service. All plug-in units removed while troubleshooting but found not to be defective should be reinserted in the original slot from which they were removed.

Note 2: If trouble persists after replacing the plug-in units, there may be mechanical or electrical problems in the bay frame and wiring.

SDP ORIG End Only

- 1c If the SDP ORIG unit is used in an SXS office, set the VOM to the X1000 scale and connect the VOM leads between the sleeve-holding relay lead (S lead) and the INPUT GRD pin jack.

Requirement: Not less than 100,000 ohms.

- 1d If the requirement is not met, see Table A and repeat Steps 1a and 1c.

DP TERM End

- 1e Set the VOM to the X1000 scale and connect the VOM to the channel unit as follows:

- lead to T
- + lead to R.

Requirement: Not less than 35,000 ohms.

- 1f If the requirement is not met, see Table A and repeat Step 1.

CHART 2 (Cont)

STEP

PROCEDURE

DP ORIG or SDP ORIG End

- 2a Connect a 1200-ohm resistor between the T and R pin jacks as shown in Fig. 3. Set the VOM to the 60-Vdc scale and connect the VOM across the resistor as follows:

+ lead to T

– lead to R.

Requirements:

TYPE OF CHANNEL UNIT	VOLTAGE DROP
DP ORIG	21 ± 3
SDP ORIG	34 ± 3

- 2b If the applicable requirement is not met, see Table A and repeat Steps 1 and 2a.

SDP ORIG End Only

- 2c If the SDP ORIG unit is used in an SXS office, set the VOM to the X1 scale and connect the VOM leads between the sleeve-holding relay lead (S lead) and the INPUT GRD pin jack.

Requirement: Less than 5 ohms.

- 2d If the requirement is not met, see Table A and repeat Steps 2a and 2c.

DP TERM End

- 2e With the 1200-ohm resistor still connected at the DP ORIG or SDP ORIG end, set the VOM to the X100 scale and connect the VOM to the channel unit as follows:

– lead to T

+ lead to R.

Requirement: 600 to 700 ohms.

- 2f If the applicable requirement is not met, see Table A and repeat Steps 1 and 2.

DP ORIG or SDP ORIG End

- 3a The 1200-ohm resistor should still be connected between the T and R pin jacks as specified in Step 2a.

CHART 2 (Cont)

STEP	PROCEDURE
<i>DP TERM End</i>	
3b	Connect the R pin jack to the INPUT GRD pin jack and the T pin jack to the -48V pin jack as shown in Fig. 4.
<i>DP ORIG or SDP ORIG End</i>	
3c	With the VOM set to the 60-Vdc scale, connect the VOM across the resistor as follows: <ul style="list-style-type: none"><li>- lead to T<li>+ lead to R.
<i>Requirements:</i>	
TYPE OF CHANNEL UNIT	VOLTAGE DROP
DP ORIG	21 ±3
SDP ORIG	34 ±3
3d	If the applicable requirement is not met, see Table A and repeat Steps 1, 2, and 3.
<i>DP ORIG or SDP ORIG End</i>	
4a	The 1200-ohm resistor should still be connected between the T and R pin jacks as specified in Step 2a.
<i>DP TERM End</i>	
4b	Reverse the polarity of the voltage applied to the T and R pin jacks specified in Step 3b by reversing the connections at the PCU only (T to INPUT GRD and R to -48V).
<i>Caution: To avoid blowing a fuse, do not reverse the connections at the T and R pin jacks on the face of the channel unit.</i>	
<i>DP ORIG or SDP ORIG End</i>	
4c	With the VOM set to the 60-Vdc scale, connect the VOM across the resistor as follows: <ul style="list-style-type: none"><li>+ lead to T<li>- lead to R.

CHART 2 (Cont)

STEP	PROCEDURE
<i>Requirements:</i>	
TYPE OF CHANNEL UNIT	VOLTAGE DROP
DP ORIG	21 ±3
SDP ORIG	34 ±3
4d	If the applicable requirement is not met, see Table A and repeat Steps 1 through 4.
<i>Both Ends</i>	
5	Remove all test connections.
B. RP ORIG and RP TERM Channel Unit Tests	
Note: There should be no trunk circuit or other connection to the T and R pin jacks on the channel unit at either end except as specified in the following tests.	
<i>RP ORIG End</i>	
1a	Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows: <ul style="list-style-type: none"> – lead to T + lead to R.
Requirement: 40 ±5 volts.	
1b	If the requirement is not met, see Table A and repeat Step 1a.
<i>RP TERM End</i>	
1c	Set the VOM to the X1000 scale and connect the VOM to the channel unit as follows: <ul style="list-style-type: none"> – lead to T + lead to R.
Requirement: Not less than 35,000 ohms.	
1d	If the requirement is not met, see Table A and repeat Step 1.

CHART 2 (Cont)

STEP	PROCEDURE
<i>RP ORIG End</i>	
2a	Connect a 1200-ohm resistor between the T and R pin jacks as shown in Fig. 3. Set the VOM to the 12-Vdc scale and connect the VOM across the resistor as follows: <ul style="list-style-type: none"><li>– lead to T<li>+ lead to R.
<i>Requirement:</i> $\blacklozenge 2.5 \blacklozenge \pm 0.5$ volts.	
2b	If the requirement is not met, see Table A and repeat Steps 1 and 2a.
<i>RP TERM End</i>	
2c	With the 1200-ohm resistor still connected at the RP ORIG end, set the VOM to the X100 scale and connect the VOM to the RP TERM channel unit as follows: <ul style="list-style-type: none"><li>– lead to T<li>+. lead to R.
<i>Requirement:</i> $\blacklozenge 900 \blacklozenge \pm 100$ ohms.	
2d	If the requirement is not met, see Table A and repeat Steps 1 and 2.
<i>RP ORIG End</i>	
3a	All connections should be as in Step 2a except that the VOM should be set to the 60-Vdc scale.
<i>RP TERM End</i>	
3b	Connect the R pin jack to the INPUT GRD and the T pin jack to the –48V pin jack of the PCU (see Fig. 4).
<i>RP ORIG End</i>	
<i>Requirement:</i> 20 ± 3 volts.	
3c	If the requirement is not met, see Table A and repeat Steps 1, 2, and 3.
4a	The 1200-ohm resistor should still be connected between the T and R pin jacks as specified in Step 2a.
<i>RP TERM End</i>	
4b	Reverse the polarity of the voltage applied to the T and R pin jacks specified in Step 3b by reversing the connections at the PCU only (T to INPUT GRD and R to –48V).

CHART 2 (Cont)

STEP	PROCEDURE
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Caution: To avoid blowing a fuse, do not reverse the connections at the T and R pin jacks on the face of the channel unit.

RP ORIG End

4c With the VOM set to the 60-Vdc scale, connect the VOM across the resistor as follows:

+ lead to T

– lead to R.

Requirement: 20 ± 3 volts.

4d If the requirement is not met, see Table A and repeat Steps 1 through 4.

Both Ends

5 Remove all test connections.

C. 2- or 4-Wire E&M and 2- or 4-Wire E&M Channel Unit Tests

Note 1: There should be no trunk circuit or other connection to the E and M lead pin jacks on 2- or 4-wire E&M units at either end except as specified in the following tests.

Note 2: If the E and M leads are not used for signaling, this test need not be performed.

Note 3: On 2- or 4-wire E&M units the E option screw must be down.

Note 4: For the purpose of this test, designate one end of a 2-way E&M trunk as the originating end and the other as the terminating end.

Both Ends

1a Set the VOM to the X1000 scale and connect the leads of the VOM between the E lead and the INPUT GRD pin jack.

Requirement: Not less than 100,000 ohms.

1b If the requirement is not met, see Table A and repeat Step 1a.

Originating End

2a Connect the M lead to the –48V pin jack (see Fig. 5).

Terminating End

2b Set the VOM to the X1 scale and connect the leads of the VOM between the E lead and the INPUT GRD pin jack.

CHART 2 (Cont)

STEP	PROCEDURE
	Requirement: Less than 5 ohms.
2c	If the requirement is not met, see Table A and repeat Steps 1 through 2b.
2d	Repeat Steps 2a and 2b in the other direction of transmission.
3	Remove all test connections.
	D. DP or SDP ORIG and 2- or 4-Wire E&M Channel Unit Tests
	Note 1: There should be no trunk circuit or other connection to the T and R pin jacks on DP or SDP ORIG units or on the E and M pin jacks on 2- or 4-wire E&M units except as specified in the following tests.
	Note 2: On 2- or 4-wire E&M units the E option screw must be down.
	DP ORIG or SDP ORIG End
1a	Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows: + lead to T - lead to R.
	Requirement: 48 \pm 5 volts.
1b	If the requirement is not met, see Table A and repeat Step 1a.
	SDP ORIG End Only
1c	If the SDP ORIG unit is used in an SXS office, set the VOM to the X1000 scale and connect the VOM leads between the sleeve-holding relay lead (S lead) and the INPUT GRD pin jack.
	Requirement: Not less than 100,000 ohms.
1d	If the requirement is not met, see Table A and repeat Steps 1a and 1c.
	E&M Terminating End
1e	Set the VOM to the X1000 scale and connect the leads of the VOM between the E lead and the INPUT GRD pin jack.
	Requirement: Not less than 100,000 ohms.
1f	If the requirement is not met, see Table A and repeat Step 1.

CHART 2 (Cont)

STEP	PROCEDURE
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DP ORIG or SDP ORIG End

- 2a Connect a 1200-ohm resistor between T and R pin jacks as shown in Fig. 3. With the VOM set to the 60-Vdc scale, connect the VOM across the resistor as follows:

+ lead to T

– lead to R.

Requirements:

TYPE OF CHANNEL UNIT	VOLTAGE DROP
DP ORIG	21 ± 3
SDP ORIG	34 ± 3

- 2b If the applicable requirement is not met, see Table A and repeat Steps 1 and 2a.

SDP ORIG End Only

- 2c If the SDP ORIG unit is used in an SXS office, set the VOM to the X1 scale and connect the VOM leads between the sleeve-holding relay lead (S lead) and the INPUT GRD pin jack.

Requirement: Less than 5 ohms.

- 2d If the requirement is not met, see Table A and repeat Steps 2a and 2c.

E&M Terminating End

- 2e With the VOM connected between the E lead on the channel unit and the INPUT GRD pin jack, set the VOM to the X1 scale.

Requirement: Less than 5 ohms.

- 2f If the requirement is not met, see Table A and repeat Steps 1 and 2.

DP ORIG or SDP ORIG End

- 3a The 1200-ohm resistor should still be connected between the T and R pin jacks as specified in Step 2a.

E&M Terminating End

- 3b Connect the M lead of the channel unit to the –48V pin jack (see Fig. 5).

CHART 2 (Cont)

STEP PROCEDURE

DP ORIG or SDP ORIG End

3c With the VOM set to the 60-Vdc scale, connect the VOM across the resistor as follows:

– lead to T

+ lead to R.

Requirements:

TYPE OF CHANNEL UNIT	VOLTAGE DROP
DP ORIG	21±3
SDP ORIG	34±3

3d If the applicable requirement is not met, see Table A and repeat Steps 1 through 3.

Both Ends

4 Remove all test connections.

E. 2- or 4-Wire E&M to DP TERM Channel Unit Tests

Note 1: There should be no trunk circuit or other connection to the E and M pin jacks on 2- or 4-wire E&M units or to the T and R pin jacks on DP TERM units except as specified in the following tests.

Note 2: On 2- or 4-wire E&M units, the E option screw must be down.

E&M Originating End

1a Set the VOM to the X1000 scale and connect the leads of the VOM between the E lead and the INPUT GRD pin jack.

Requirement: Not less than 100,000 ohms.

1b If the requirement is not met, see Table A and repeat Step 1a.

DP TERM End

1c Set the VOM to the X1000 scale and connect the VOM to the channel unit as follows:

– lead to T

+ lead to R.

 CHART 2 (Cont)

STEP

PROCEDURE

Requirement: Not less than 35,000 ohms.

1d If the requirement is not met, see Table A and repeat Step 1.

E&M Originating End

2a Connect the M lead to the -48V pin jack (see Fig. 5).

DP TERM End

2b Set the VOM to the X100 scale and connect the VOM to the channel unit as follows:

+ lead to T

- lead to R.

Requirement: 600 to 700 ohms.

2c If the requirement is not met, see Table A and repeat Steps 1 and 2.

E&M Originating End

3a The M lead should be connected as in Step 2a.

DP TERM End

3b Connect the T pin jack to the INPUT GRD pin jack and the R pin jack to the -48V pin jack (see Fig. 4).

E&M Originating End

3c Set the VOM to the X1000 scale and connect the leads of the VOM between the E lead and the INPUT GRD pin jack.

Requirement: Not less than 100,000 ohms.

3d If the requirement is not met, see Table A and repeat Steps 1 through 3.

DP TERM End

4a Reverse the T and R pin jack connections to the INPUT GRD and -48V pin jacks specified in Step 3b (R to INPUT GRD and T to -48V).

Caution: To avoid blowing a fuse, do not reverse connections at the T and R pin jacks.

CHART 2 (Cont)

STEP	PROCEDURE
	<i>E&M Originating End</i>
4b	Set the VOM to the X1 scale and measure the resistance between the E lead and the INPUT GRD pin jack.
	<i>Requirement:</i> Less than 5 ohms.
4c	If the requirement is not met, see Table A and repeat Steps 1 through 4.
	<i>Both Ends</i>
5	Remove all test connections.
	F. FX OFF and FX SUB Channel Unit Tests
	<i>Note 1:</i> There should be no trunk circuit or other connection to the T and R pin jacks on the channel units at either end except as specified in the following tests.
	<i>Note 2:</i> For this test the LX-1 and LX-2 option screws on FX OFF units must be up.
	<i>FX OFF End</i>
1a	Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows: <ul style="list-style-type: none"> – lead to T + lead to INPUT GRD.
	<i>Requirement:</i> 36 ± 5 volts dc.
1b	If the requirement is not met, see Table A and repeat Step 1a.
1c	Set the VOM to the X1000 scale and connect the VOM as follows: <ul style="list-style-type: none"> – lead to R + lead to INPUT GRD.
	<i>Requirement:</i> Not less than 100,000 ohms.
1d	If the requirement is not met, see Table A and repeat Steps 1a and 1c.
	<i>FX SUB End</i>
1e	Set the VOM to the 12-Vdc scale and connect the VOM to the channel unit as follows:

CHART 2 (Cont)

STEP	PROCEDURE
	<p>+ lead to T</p> <p>– lead to R.</p> <p>Requirement: 0 volt dc.</p>
1f	<p>If the requirement is not met, see Table A and repeat Step 1.</p> <p>FX OFF End</p>
2a	<p>Connect the T pin jack to the INPUT GRD pin jack (see Fig. 6).</p> <p>FX SUB End</p>
2b	<p>Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows:</p> <p>+ lead to T</p> <p>– lead to R.</p> <p>Requirement: 45 \pm5 volts dc.</p>
2c	<p>If the requirement is not met, see Table A and repeat Steps 1 and 2.</p> <p>FX OFF End</p>
3a	<p>▶With the ground still connected to the T pin jack, connect a test lead equipped with alligator clips (that have rubber covers) between terminals 29 (R lead) and 1 (20-Hz ringing) on the channel unit connector on the rear of the bay.</p> <p>Caution: <i>With the bank 20-Hz fuse installed in the power distribution panel, 100-volt, 20-Hz negative superimposed ringing is connected to terminal 1 of the channel unit connectors.</i>▶</p> <p>FX SUB End</p>
3b	<p>Set the VOM to the 60-Vdc scale and connect the VOM to the channel unit as follows:</p> <p>– lead to R</p> <p>+ lead to T.</p> <p>Requirement: 34 to 56 volts dc.</p>
3c	<p>If the requirement is not met, see Table A and repeat Steps 1 through 3.</p>
3d	<p>Set the VOM to the 300-Vac scale, connect the positive lead of the VOM to the T pin jack on the channel unit, and connect the negative lead of the VOM to the R pin jack through a 542G capacitor (see Fig. 8).</p>

CHART 2 (Cont)

STEP	PROCEDURE
	Requirement: 64 to 130 volts ac.
3e	If the requirement is met, remove the 542G capacitor. If the requirement is not met, see Table A and repeat Steps 1 through 3b. FX SUB END Caution: When making the connections in Step 4a, the leads of the resistor should be well insulated to avoid physical contact with the 20-Hz ringing voltage.
4a	Connect a 1200-ohm resistor between the T and R pin jacks on the channel unit (see Fig. 3).
4b	Read the VOM. Requirement: Less than 5 volts dc. FX OFF End
4c	Remove the 20-Hz ringing from the R lead. Set the VOM to the X10 scale and connect the VOM to the channel unit as follows: + lead to T - lead to R. Requirement: 500 to 800 ohms if LX1 option screw is up 70 to 110 ohms if LX1 option screw is down
4d	If the requirement is not met, see Table A and repeat Steps 1 through 4c.
5a	Remove all existing connections from the T and R pin jacks. FX SUB End
5b	Remove all existing connections from the T and R pin jacks. Connect the INPUT GRD pin jack to the R pin jack (see Fig. 7). FX OFF End
5c	Set the VOM to the X1 scale and connect the VOM as follows: - lead to R + lead to INPUT GROUND Requirement: Less than 5 ohms.
5d	If the requirement is not met, see Table A and repeat Steps 1 through 5. Both Ends
6	Remove all test connections.

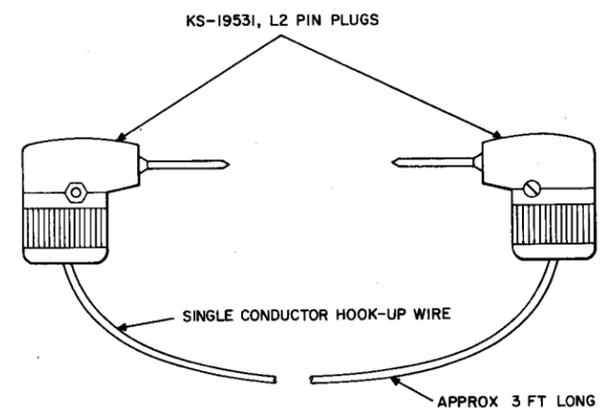


Fig. 1—Test Lead Assembly

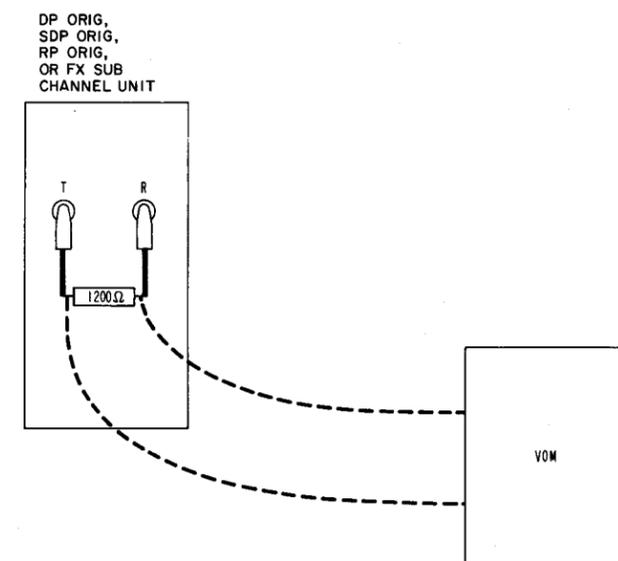


Fig. 3—Test Connections for DP ORIG, SDP ORIG, RP ORIG, or FX SUB Channel Units

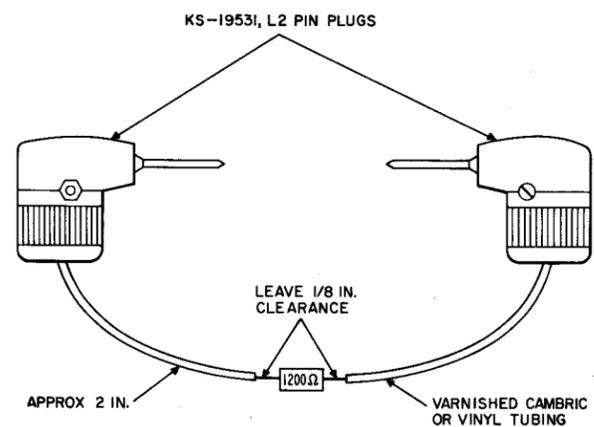


Fig. 2—Test Resistor Assembly

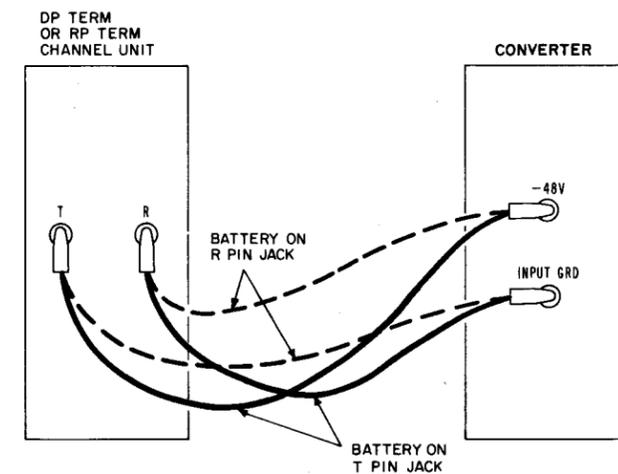


Fig. 4—Test Connections for DP TERM or RP TERM Channel Units

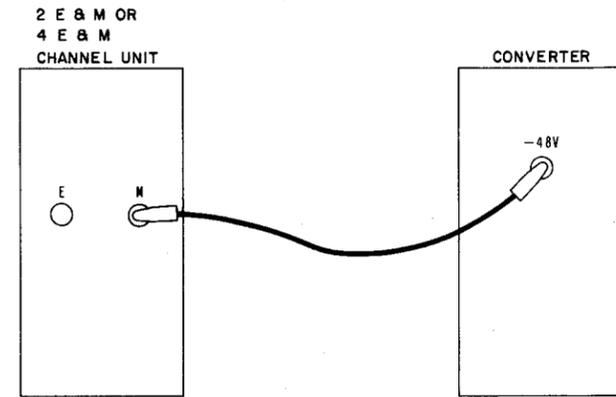


Fig. 5—Test Connections for 2W-EM or 4W E&M Channel Units

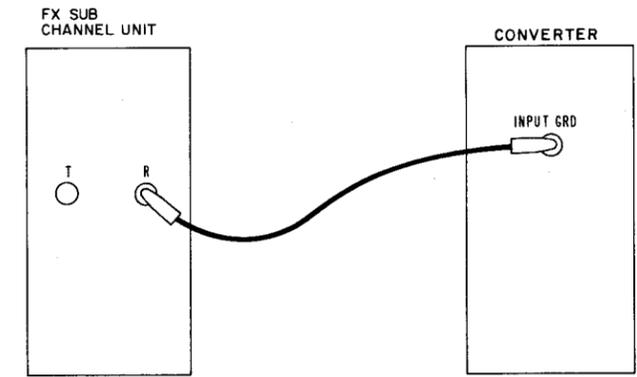


Fig. 7—Test Connections for FX SUB Channel Unit

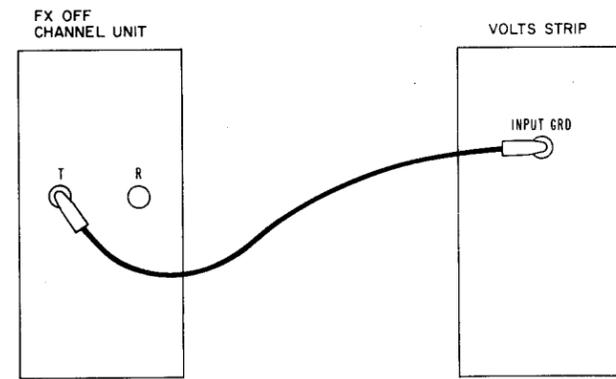


Fig. 6—Test Connections for FX OFF Channel Units

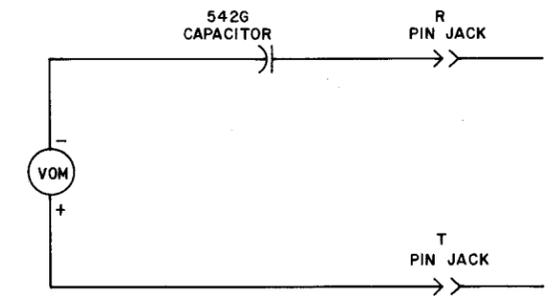


Fig. 8—VOM Circuit for FX Channel Unit Test