J98726MP CHANNEL UNIT EXTENDER
DESCRIPTION AND OPERATION
D4 CHANNEL BANK
DIGITAL TRANSMISSION SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the J98726MP channel unit extender (Fig. 1) for use with the D4 channel bank. This plug-in extender assembly allows mounting a channel unit outside the bank for jack access and adjustments and contains test circuitry for manual signaling tests toward the carrier or trunk circuit. Other documents referenced in Part 6 of this practice furnish information on the various D4 channel units and procedures for testing the channel units.

1.02 Whenever this practice is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The D4 channel units serve as the interface between the office connecting circuits or customer loops and the D4 channel bank digital transmission circuitry. There are 48 channel slots in the D4 bank. These are equipped with the channel units for the application and become part of the vf circuits going to switching machines, customer loops, or to another tandem channel. Inside the channel units, transmission and signaling circuitry produces digital signals corresponding to the vf and signaling conditions in the transmit direction and demultiplex digital channel information in the receive direction. This channel unit circuitry includes transmission level attenuators and operating options which must be set per the application and circuit design.

1.04 Over 20 different types of channel units are available to match the metallic interface and provide various transmission and signaling circuitry required for all applications. The J98726MP extender is designed to allow testing and adjusting the channels and circuits while still connected in the circuit. Signaling test circuitry in the extender allows monitoring the digital signaling in each direction and al-

lows controlling the digital signaling to send and receive corresponding signaling conditions (e.g., loop closure, tip ground).

1.05 The J98726MP extender will mount and provide backplane connections for any of the D4 channel units (CU). Options and controls can be reached while the unit is mounted in the extender and the hinged daughter board on special service units can be opened. Switches and indicators in the signaling test circuitry are provided for both the A and B signaling channels to allow testing 2- and 4-state signaling. Jacks provide line and drop access to the metallic interface on 2- and 4-wire units and additional pin jacks provide contact to individual leads and circuit points in the units.

1.06 Since there are no separate signaling circuits in the transmission only (TO) program and dataport units, the signaling portion of the extender is not used for these units. Furthermore, J98726MM and MN test extenders are available for ES2 and ES3 direct interface units. These other extenders allow checking and controlling the status of the switch peripheral decoder and facility and drop scanner leads, thereby permitting more meaningful testing of the ES2 and ES3 units.

2. APPLICATIONS

2.01 The J98726MP extender offers signaling test capabilities not available in other D4 test equipment and is a useful addition to a D4 office. It is preferred over the original J98726MF extender because of the additional test capabilities and improved channel unit accessibility; but if jack access is the primary concern, the MF extender will suffice. Although the MP extender will provide signaling path test set (SPTS) functions, the SPTS plug-in is more easily moved between slots for carrier tests. Below is a summary of the functions of the equipment available for testing D4 channels:

SPTS - Fits in channel slot and allows testing carrier transmission and A and B signaling buses.

MBTS - The maintenance bank test set allows programmed tests of CU tranmission and signaling circuits in the D4 maintenance bank for trouble verification or before installation in the D4 channel bank.

J98726MF - This channel unit extender allows mounting a CU outside the D4 bank and provides jack access; it does not permit accessing all options and controls on hinged daughter boards.

J98726MP - This channel unit extender provides the functions of the MF extender with more circuit accessibility and contains signaling test circuitry with greater capability than with the SPTS.

J98726MM and MN - These channel unit extenders are especially designed for testing ES2 and ES3 direct interface units and the direct interface trunk circuits.

2.02 The principle uses for the MP extenders are described in the following paragraphs.

2.03 ***Jack Access:*** The 2-way jack access allows connection of an external oscillator and detector toward the drop side for transmission level tests over the customer loop or cross-office tests between pulse link repeater or tandem channel units. Attenuators and options can be adjusted while the unit is in the extender. Pin jack access to the balance network in 2-wire units allows office capacitance and buildout adjustment.

2.04 ***Drop-Side Signaling Tests:*** Switches allow sending signaling conditions toward the drop and indicators show received signaling states. Pin jacks also allow dc measurements on the leads and at 4-wire simplex points. These capabilities allow trouble sectionalization without the need for another tester at the far end of the carrier to send signaling.

2.05 ***Signaling State Monitoring:*** The extender can be used to ensure that channel units are held in the required through conditions for overall circuit tests. If the through condition does not exist in dial pulse, foreign exchange (FX), or duplex (DX) units, the transmission path will be disabled or modified by the action of signaling relays.

3. PHYSICAL DESCRIPTION

3.01 The MP extender (Fig. 1) goes into a channel unit slot and provides the support framework and slot connections for mounting and operating a CU outside the bank. Bold black and yellow stripes on the side panels call attention to the extender as it protrudes beyond the front of the D4 bank. Construction of the extender consists of two printed wiring boards, one for connections to the channel bank backplane and one for the signaling test circuitry. This double-board construction partially obscures the adjacent right slot so that its CU cannot be removed. Power for the CU under test and the signaling test circuitry is obtained from the channel slot connection. The signaling test circuitry requires 60 mA at +5V, 0.7 mA at +12V, and 1.25 mA at −12V. An external umbilical cord running under the extender is used to access the E1 and EX1 points at the TST jack on the tandem (TDM) CU because these points do not appear on the backplane connector.

3.02 On the front of the extender are jacks for line and drop access to the T/R, T1/R1 and E/M leads and the switches and LED indicators for the signaling test circuitry. The jacks are 239AM jacks which accept the tip-ring-sleeve plug commonly used on patch/test cords. The switches are 3-position toggle type and the LEDs are the 549 replaceable type. A small bracket at the bottom and a captive screw at the top form a mounting arrangement for the overlay cards which are provided as an aid for making signaling tests. There is a separate plastic overlay card for each type CU and this card gives the interpretation of the switch setting and LED indications during the tests. These cards are mounted in the card holder assembly on top of the extender.

3.03 On the left side of the extender are pin jacks which are listed in Table A to allow contacting the designated circuit points and leads in the units. Slide switches on this side panel are labeled D4-SLC 96, RPO IN-OUT, and E2/M2-NET and condition the extender for different applications and selectable measurements. These will be discussed in Parts 4 and 5.

4. FUNCTIONAL DESCRIPTION

4.01 ***Extender Jacks:*** When connection is made to a 239-type jack, the normal through-circuit connection is broken and the tip-ring-sleeve contacts of the plug connect to the circuit on the desired side (line or drop). The pin jacks simply contact the individual leads or points in the circuitry for voltmeter or ohmmeter tests. In the case of the 4W SX pin jacks and the E1 and EX1 jacks, connection to the pair of jacks contacts the simplex circuit formed by the center tap of the transformers in 4-wire units. To contact the E1 and EX1 simplex, the extender umbilical is needed to connect to the front panel TST jack of the TDM unit since these circuit points do not appear on the backplane.

4.02 ***Transmit Signaling:*** Associated with the transmit signaling test circuitry are the TSA and TSB switches and the TA and TB indicators. The switches are located within the LINE portion of the extender front panel because these allow either monitoring or controlling what is sent to the D4 bank on the A and B signaling buses. This control is achieved by having the CU digital signaling pass through the extender circuitry before being applied to the D4 bank. Operating a switch to 0 or 1 will cause that logic state to be sent regardless of the signaling condition present on the drop side. Plastic overlay cards for the extender give the interpretation of the logic state for the CU; i.e., the corresponding signaling condition that would produce that state. The TA and TB indicators show the logic state applied to the A and B buses respectively; when lighted, an LED indicates a logic 1. In the center, monitor position, the TSA and TSB switches allow the respective indicator (TA and TB) to show the digital signaling state produced by the CU in response to the existing signaling condition on the drop. For other switch positions, the LEDs show the signaling state applied by the associated switches. Since the TA and TB indicators show the logic resulting from signaling on the drop side, these LEDs are in the DROP portion of the front panel.

4.03 ***Receive Signaling:*** Associated with the receive signaling test circuitry are the RA and RB switches and the RDA and RDB indicators. The switches are located within the DROP portion of the extender front panel because these allow either monitoring or controlling what logic state is applied to the CU signaling receivers on the A and B signaling buses. This control is achieved by having the received signaling data pass through the extender circuitry before being connected to the CU signaling receivers. Operating a switch to 0 or 1 will force that logic state regardless of the signaling condition received from the D4 bank. Plastic overlay cards for the extender give the interpretation of the logic state for the CU;

i.e., the signaling condition that corresponds to that state. The RDA and RDB indicators show the logic state applied to the A and B signaling receivers respectively; when lighted, an LED indicates a logic 1. In the center, monitor position, the RA and RB switches allow the respective indicator (RDA and RDB) to show the digital signaling state received by the CU in response to the signaling condition transmitted from the far end of the carrier. For other switch positions, the LEDs show the signaling state forced by the associated switches. Since the RDA and RDB indicators show the signaling from the far end, these LEDs are in the DROP portion of the front panel.

4.04 ***RPO Switch:*** This switch connects an additional circuit into the receive signaling portion of the detector for use in testing the revertive pulse originating (RPO) unit. This added circuit modifies the action of the RDB indicator so that when the logic states on the A and B buses are 1 and 0, respectively, the RDB indicator will light. Lighting of the RDB indicator with this combination of logic states is interpreted as detection of revertive pulses from the other end. For all other logic states, the RDB indication will follow the RDA indication and is meaningless.

4.05 ***D4-SLC 96 Switch:*** This switch controls connections to terminal pairs 25,52 and 45,46 at the channel slot. Normally, the switch is set to the D4 position; but when the NET pin jacks are to be used or when the extender is placed in a SLC® 96 remote terminal, the switch must be set to SLC 96. This prevents connection to terminal pairs 45,46 and establishes connection to pairs 25,52. Terminals 45,46 are used for E&M leads in the D4 bank, but are used for other channel signals in the SLC 96 remote terminal. Terminals 25,52 are vacant on the backplane channel connector of both the D4 bank and SLC 96 remote terminal, but are used in the extender to access the network buildout capacitors in 2-wire units. When the switch is set to SLC 96, the E&M leads are disconnected at the extender.

5. OPERATIONAL CONSIDERATIONS

5.01 The operation of the extender has been simplified by the clear identification of the jacks and by the use of plastic overlay cards for the signaling test switches. The jacks provide access equivalent to a vf patch bay and a slot connector extender with commonly used terminology for the designations. Although the 20-Hz jack has a current limiting resistor to prevent hazards with this 100-volt signal, care should be exercised to avoid a surprise shock. There is an individual overlay card for each CU with signaling to be tested in the extender. When placed over the signaling test switches and indicators, this card gives the interpretation of the switch settings and LED indications during testing. The information on these cards is compiled in Table B for reference in case the overlays are not available.

5.02 Power for the extender and the CU under test is obtained through the channel slot connection. The only other connection needed is for accessing the E1 and EX1 points on the TDM unit in which case the extender umbilical cord must be connected to the TST jack on the TDM unit. No warmup is needed before using the extender and no routine maintenance or alignment is required. Table C gives information on extender switch settings. If the operation of the extender is questioned, trouble can usually be verified by comparative tests before the extender is repaired/replaced. Any LED not lighting should be replaced before sending the extender out for repairs.

5.03 A frequently used application of the extender is to ensure that FXO, FXS, and DX units be seized and held during transmission level measurements and adjustments on the circuits. This can be accomplished using the extender as follows.

2FXS	- Install in extender and set RA to 1 (up, tip grd) and set RB to 0 (down, no ringing). Both the TA and TB indicators should be off showing loop closure and no ring grd from customer.
2FXO	- Install in extender and set RA to 0 (down, loop closed) and RB to 0 (down, no ring grd).
2DX	- Install in extenders at both ends and have far-end customer location send off-hook condition. The off-hook is verified at each unit when the RDA and TA indicators are off.

6. REFERENCES

6.01 The schematic drawing/circuit description for the J98726MP extender is SD/CD 7C333-01. Other documents relating to D4 channel units and the extender are listed below.

DOCUMENT	TITLE
365-170-000	D4 Channel Bank TOP (includes channel drop tests; Iss. 5 will cover use of J98726MP extender)
365-170-100	D4 Channel Bank Description
365-170-101	D4 General Channel Unit Description (and references to individual CU practices)
IL 83-12-144	Channel Unit Extender (description and signaling test procedures).

7. EXTENDER SIGNALING TEST PROCEDURES

7.01 This portion contains the procedures for making signaling tests (and talk tests on FX circuits) on various channel unit circuits using the CUE (channel unit extender) with STC (signaling test circuitry). These procedures were obtained from IL 83-12-144 and are printed here to make them generally available for use. The tests are organized into separate charts with headings to allow finding the desired procedure.

A. Extender Installation

STEP	PROCEDURE
1	Determine that channel to be tested is not in service.
2	Set extender **LINE** and **DROP A** and **B** switches to the center position and the **RPO IN-OUT** switch to **RPO OUT**.
3	On the extender side panel, set switches as follows: **D4-SLC 96** to **D4** (S5) **E2/M2-NET** to **NET** (S7).
4	Remove channel unit to be tested.
5	Insert extender in channel position.
6	Insert channel unit in extender.
7	Insert extender cord connector in channel unit test jack.
8	Select faceplate card for channel unit type being tested.

B. FXS Signaling With STA Customer Location Test

STEP	PROCEDURE
1	Carrier location tester conditions extender **DROP** switches to send NO TIP GND (**RA** down) and NO RINGING (**RB** down) to STA.
2	Establish communication with STA customer location.
3	STA customer location tester removes equipment to OPEN the cable pair. If channel unit being tested is an FXS-LS, go to Step 11.
4	STA customer location tester applies RING ground (R GND) on RING of cable pair.
5	Carrier location tester observes DROP LED RING GROUND (**TB** lighted) and NO LOOP CLOSURE (**TA** lighted) from STA.
6	Carrier location tester conditions extender **DROP** switch to send TIP GROUND to STA (**RA** up) and observes RING GROUND off (**TB** dark) and LOOP CLOSURE (**TA** dark) from STA.
7	STA customer location tester removes ground on RING.
8	Carrier location tester observes DROP LED NO LOOP CLOSURE (**TA** lighted).
9	STA customer location tester arranges ohmmeter to observe ground on TIP of cable pair.
10	Carrier location tester sets extender **DROP** switch to send T GND (**RA** up) to STA.
11	STA customer location tester observes minimum resistance (ground) on ohmmeter connected to TIP of cable pair. (FXS-LS testing continues with this step.)
12	STA customer location tester removes ohmmeter connection and connects ON-HOOK customer telset to cable pair to observe RINGING.
13	Carrier location tester sets extender **DROP** switches to send TIP GROUND (**RA** up) and RINGING (**RB** up) to STA.
14	STA customer location tester observes RINGING, answers (LOOP CLOSURE), and observes RINGING TRIP.
15	Carrier location tester observes LOOP CLOSURE (**TA** dark) from STA.
16	Carrier location tester restores extender **DROP** switch to NO RINGING (**RB** down) to STA.
17	Transmission tests with the STA may be performed using TIP GROUND (**RA** up) and NO RINGING (**RB** down) to STA. STA tester must provide HOLD feature LOOP CLOSURE (**DROP TA** dark) during alignment testing.

Note: Carrier location tester can confirm correct operation or sectionalize faults in DC TIP or RING GROUND, LOOP CLOSURE conditions and RINGING by observing conditions at the extender pin jack side panel, extender front panel splitting jacks, or at intermediate equipment locations.

STEP	PROCEDURE

Valid initial LED conditions for idle circuit are (extender at FXS or TDM - CO side location):

	FROM STA
Loop-Start	No Loop Closure (TA lighted) No Ring Ground (TB dark)
Ground-Start	No Loop Closure (TA lighted) No Ring Ground (TB dark)
	FROM CO END
Loop-Start	Tip Ground (RDA lighted) No Ringing (RDB dark)
Ground-Start	No Tip (RDA dark) No Ringing (RDB dark)

C. FXO Signaling With CO or CO Customer Location Test

STEP	PROCEDURE
	CO/Customer Location Equipment Disconnected
1	Carrier location tester sets extender **DROP** switches to NO LOOP CLOSURE (**RA** up) and NO RING GROUND (**RB** down) to CO end.
2	Carrier location tester establishes communication with CO or CO/customer location tester.
3	CO/customer location tester removes equipment to OPEN the cable pair. If channel unit being tested is an FXO-LS, go to Step 13.
4	CO/customer location tester applies TIP GROUND (T GND) on TIP of cable pair.
5	Carrier location tester observes TIP GROUND (**TA** lighted) and NO RINGING (**TB** dark) from CO end.
6	CO/customer location tester applies GROUND on RING of cable pair.
7	Carrier location tester observes TIP GROUND (**TA** lighted) from CO.
8	CO/customer location tester removes ground on RING.
9	CO/customer location tester arranges ohmmeter to observe −Vdc battery on RING of cable pair and observes −20 to −30 volt dc battery from ground sense circuits in FXO unit.
10	Carrier location tester sets extender **DROP** switches to send RING GROUND (**RB** up) and NO LOOP CLOSURE (**RA** up) to the CO end.

STEP	PROCEDURE
11	CO/customer location tester observes 0-volt direct current on RING of cable pair.
12	Carrier location tester restores extender DROP switch to NO RING GROUND (**RB** down).
13	CO/customer location tester arranges ohmmeter to observe loop closure across cable TIP and RING. (FXO-LS testing continues with this step. TIP GROUND LED [**TA**] will be lighted if testing an FXO-LS.)
14	Carrier location tester sets extender **DROP** switches to send LOOP CLOSURE (**RA** down) and NO RING GROUND (**RB** down) to the CO end.
15	CO/customer location tester observes ohmmeter change from OPEN to LOOP CLOSURE across TIP and RING of cable pair.
16	Carrier location tester restores extender **DROP** switches to NO LOOP CLOSURE (**RA** up) and NO RING GROUND (**RB** down).
17	Transmission tests with the CO end may be performed using extender **DROP** switches to send necessary LOOP CLOSURE (**RA** down) and NO RING GROUND (**RB** down) to the CO end during alignment.

Note 1: Carrier location tester can confirm correct operation or sectionalize faults in dc conditions and RINGING by observing conditions at the extender pin jack side panel, the front panel splitting jacks, or at intermediate equipment locations.

Note 2: CO/customer location RINGING features and CO functions cannot be verified while equipment is disconnected. RINGING features and CO functions verified below require that CO/customer location equipment be reconnected to the cable pair.

CO/Customer Location Equipment Connected

1	LOOP-START begins with Step 3. Carrier location tester sets extender **DROP** switches for ground start tests to send NO LOOP CLOSURE (**RA** up) and NO RING GROUND (**RB** down) to CO end and observes NO TIP GROUND (**TA** dark) and NO RINGING (**TB** dark) from CO end.
2	Carrier location tester sets extender **DROP** switches to send RING GROUND (**RB** up) and NO LOOP CLOSURE (**RA** up) to the CO end and observes change to TIP GROUND (**TA** becomes lighted) and NO RINGING (**TB** dark) from the CO end.
3	Carrier location tester sets extender **DROP** switches to send NO LOOP CLOSURE (**RA** up) and NO RING GROUND (**RB** down) to the CO end and observes NO TIP GROUND (**TA** becomes dark) if GROUND-START, or TIP GROUND (**TA** standing lighted) if LOOP-START, and NO RINGING (**TB** dark).
4	Carrier location tester sets extender **DROP** switches to send LOOP CLOSURE (**RA** down) and NO RING GROUND (**RB** down) to CO end and observes returned DIAL TONE at the CUE with STC pin jack side panel T-R pins.

STEP	PROCEDURE
5	Carrier location tester sets extender **DROP** switches to send NO LOOP CLOSURE (**RA** up) and NO RING GROUND (**RB** down) to release DIAL TONE request. If service is GROUND-START, NO LOOP CLOSURE restores CO end to NO TIP GROUND (**TA** dark).
6	Carrier location tester observes that DIAL TONE is removed.
7	Carrier location tester arranges for FX NNX = XXXX to be dialed and observes TIP GROUND (**TA** lighted) and RINGING (**TB** alternating light/dark with 20 Hz) from the CO end.
8	Carrier location tester sets extender **DROP** switches to send LOOP CLOSURE (**RA** down) and NO RING GROUND (**RB** down) to the CO end and observes RINGING TRIP (**TA** dark). Valid initial LED conditions for idle circuit are (CUE with STC at FXO or TDM - STA side location):

FROM CO END

Loop-Start	Tip Ground (TA lighted) No Ringing (TB dark)
Ground-Start	No Tip Ground (TA dark) No Ringing (TB dark)

FROM STA

Loop-Start	No Loop Closure (RDA lighted) No Ring Ground (RDB dark)
Ground-Start	No Loop Closure (RDA lighted) No Ring Ground (RB dark)

D. FX End-To-End Signaling and Talk Tests

STEP	PROCEDURE
	Note: Circuit alignment and overall transmission testing should be complete.
1	Carrier test conditions all extender switches to monitor (center).
2	Carrier location tester verifies initial condition for:

GROUND-START
FROM STA

No Loop Closure	A LED lighted
No Ringing	B LED dark

STEP	PROCEDURE

LOOP-START FROM STA

No Loop Closure	A LED lighted
No Ringing	B LED dark

STA To CO End

3 STA tester requests DIAL TONE and carrier location tester monitors signaling progress:

FROM CO END

Ground Start	Ring Ground (B LED lighted) Tip Ground (A LED lighted)
Loop Start	Loop Closure (A LED dark) No Ring Ground (B LED dark)

FROM STA

Ground Start	Loop Closure (A LED dark) No Ring Ground (B LED dark)

4 STA tester confirms DIAL TONE, dials number for test, and evaluates during talk test for level, noise, and stability.

5 STA releases call (ON-HOOK) and carrier location tester confirms return to idle signaling states in Step 2.

CO End To STA

6 Carrier location tester confirms initial GROUND-START or LOOP-START signaling states from STA and from CO end shown in Step 2.

7 STA tester arranges for FX circuit to be accessed from the CO end and carrier location tester monitors signaling progress:

CO END

T GRD	A LED lighted
RINGING	B LED lighted (during ringing cycle)

8 STA tester observes RINGING and answers. Carrier location tester observes RINGING TRIP and LOOP CLOSURE (A LED dark) from STA.

9 STA tester evaluates circuit quality during talk test for level, noise, and stability.

STEP	PROCEDURE
10	STA releases call (ON-HOOK) and carrier location tester confirms return to idle signaling states shown in Step 2.

E. Back-To-Back TDM or PLR Test

STEP	PROCEDURE

TDM Back-To-Back (3-State)

Note: This test confirms cross-office signaling voltages between tandem units arranged for 3-state FX signaling. Signaling can also be confirmed by testing with CUE and STC through the distributing frame interface to the STA or CO end of an FX circuit (select extender faceplate card for STA FXS or CO end FXO as appropriate).

1 Carrier location tester should verify initial (idle) FX signaling conditions for GROUND-START or LOOP-START circuits and verify direct current voltages at CUE with STC pin jacks, the channel unit pin jacks (D1, D3) or TST jack (D4), or the central office distributing frame.

IDLE CONDITION	CO SIDE TDM
(A) NO TG	E=−Battery (Grd Start)
(A) T GRD	E=OV (Loop Start
(B) NO RGG	E1=−Battery
(A) NO LOOP	EX=−Battery
(B) NO RG	EX1=−Battery

IDLE CONDITION	STA SIDE TDM
(A) NO TG	EX=−Battery (Grd Start)
(A) T GRD	EX=OV (Loop Start)
(B) NO RGG	EX1=−Battery
(A) NO LOOP	E=−Battery
(B) NO RG	E1=−Battery

STEP	PROCEDURE

2 Carrier location tester should verify FX signaling for operated signaling states as necessary according to the following condition tables:

LED INDICATIONS

TIP GRD	A LED lighted
RINGING	B LED lighted
LOOP CLOSURE	A LED dark
RING GRD	B LED lighted

CO SIDE TDM

TIP GRD	E=0 volt dc
RINGING	E1=0 volt dc
LOOP CLOSURE	EX=0 volt dc
RING GRD	EX1=0 volt dc

STA SIDE TDM

TIP GRD	EX=0 volt dc
RINGING	EX1=0 volt dc
LOOP CLOSURE	E=0 volt dc
RING GRD	E1=0 volt dc

STEP	PROCEDURE

TDM Back-To-Back 2-State and PLR-EM Back-To-Back 2-State

1 Carrier location tester should verify 2-state signaling conditions for message or special-service circuits in the ON-HOOK (idle) or OFF-HOOK (seized) states according to the table below and verify direct current conditions at the extender pin jacks, channel unit pin jacks (D1, D3), and TST jack (D4) or at the central office distributing frame.

LED INDICATIONS

ON-HOOK	A LED lighted
OFF-HOOK	A LED dark
ON-HOOK	A LED lighted
OFF-HOOK	A LED dark

TDM/PLR

ON-HOOK	E/M=−BATTERY
OFF-HOOK	E/M=0 volt dc
ON-HOOK	EX/E=−BATTERY
OFF-HOOK	Ex/E=0 volt dc

STEP	PROCEDURE
	TDM/4EM
	ON-HOOK EX/M=−BATTERY OFF-HOOK EX/EM=0 volt dc
	ON-HOOK E/E=−BATTERY OFF-HOOK E/E=0 volt dc

F. DX With Metallic Far End Test

STEP	PROCEDURE
	Metallic End Equipment Connected
1	Carrier location tester sets extender switches to monitor signaling and observes LEDs to verify the initial ON-HOOK conditioning in both directions.
2	Establish communication between testers at carrier location and metallic far-end location.
3	Metallic far-end location tester arranges test equipment to observe initial ON-HOOK from carrier location. T, R, or TR-SX (NORM), T1, R1 or T1, R1-SX (REV) at 0-volt direct current.
4	Carrier location tester sets extender **DROP** RA switch to OFF-HOOK (RA=0) and confirms that metallic far-end location tester observes incoming OFF-HOOK seizure. Access pin jacks at −24 volts direct current.
5	Metallic far-end location tester applies an outgoing OFF-HOOK seizure to the circuit. Access pin jacks at −48 volts direct current.
6	Carrier location tester observes the DROP A and B LED OFF-HOOK seizure (TA=0).
7	Carrier location tester releases outgoing seizure (DROP RA=1) and restores circuit to ON-HOOK idle. Access pin jacks at −24 volts direct current.
8	Metallic far-end location tester releases outgoing seizure to return to ON-HOOK idle. Access pin jacks at 0 volt direct current.
9	Carrier location tester observes the DROP TA LED ON-HOOK idle.
10	If OFF-HOOK cannot be confirmed in both directions, check CU option settings per TOP and proceed with next test (metallic disconnected).

STEP	PROCEDURE
	Metallic End Equipment Disconnected
1	Carrier location tester sets extender switches to monitor signaling and observes LEDs to verify the initial ON-HOOK conditioning in both directions.
2	Establish communication between testers at carrier location and metallic far-end location.
3	Metallic far-end tester removes equipment to OPEN the cable pair(s) and arranges a dc voltmeter to read –dc volts to ground ont he dc signaling lead as follows: 2 DX (NORMAL) CABLE PAIR ***TIP (T)*** 2 DX (REVERSED) CABLE PAIR ***RING (R)*** 4 DX (NORMAL) SIMPLEX or ***CHANNEL XMT PAIR (T or R)*** 4 DX (REVERSED) SIMPLEX or ***CHANNEL REC PAIR (T1 or R1)***
4	Carrier location tester sets extender DROP A and B switches to ON-HOOK (A and B=1) and confirms that the metallic end location tester measures 0-volt direct current.
5	Carrier location tester sets extender DROP A and B switches to OFF-HOOK (A and B=0) and confirms that metallic end location tester measures approximately –48 volt direct current.
6	Carrier location tester sets extender DROP A and B switches to ON-HOOK (A and B-1) and confirms that metallic end location tester measures 0-volt direct current.
7	If trouble is not cleared, sectionalize by repeat testing at near-end channel unit-cable pair interface using dc pin jack access in CUE with STC extender.

G. Message Trunk Signaling Verification Test

STEP	PROCEDURE
1	Determine that the channel to be tested is not in service.
2	Set extender **LINE** and **DROP** A and B switches to MONITOR (center) position and the **RPO IN/OUT** switch to **OUT**.
3	On extender side panel, set switches as follows: **D4-SLC 96** to **D4** (S5) **E2/M2-NET** to **NET** (S7).
4	Remove channel unit to be tested and insert extender in the channel slot.

STEP	PROCEDURE

5 Insert channel unit in extender and connect the extender cord connector into the channel unit TST connector.

6 Select the extender faceplate template which applies to the type of channel unit inserted in the extender.

7 Observe the LINE and DROP A and B LED indicators to verify the initial IDLE signaling states present from both ends of the circuit being tested.

8 Obtain VOM and arrange to measure −Vdc.

9 Confirm that drop-side equipment is connected.

10 Select the correct procedure for the channel unit to be tested from the following table.

If the channel type is:

EM, EMER, EMD	then go to Step 11
DPO, DPMO, RPO, SDPO, 4LSXO	then go to Step 23
DPT, RPT	then go to Step 39
RSCO	then go to Step 47.

Test EM-Type Channel Unit

11 Set extender switch to ON-HOOK (**RA** up).

12 Insert arranged VOM at **E** pin jack on extender side panel.

13 Measure −48 volt dc battery from connected equipment.

14 Set extender **DROP** switch to OFF-HOOK (**RA** down) and observe that VOM indicates 0-volt direct current.

15 If measurements are not obtained, check channel unit E lead ground options, distributing frame wiring, and connected equipment for trouble.

16 Restore extender **DROP** switch to Monitor (**RA** center).

17 Insert VOM at M pin jack on extender side panel.

18 Observe conditions on extender **TA** LED lamp:

If VOM reads −Vdc, **TA** LED should be dark (OFF-HOOK).

If VOM reads 0-volt direct current, **TA** LED should be lighted (ON-HOOK).

STEP	PROCEDURE
19	Arrange for drop-side tester to change M lead signaling state and verify the corresponding TA LED lamp changes.
20	If measurements are not obtained, check channel unit using maintenance bank; check distributing frame wiring and connected equipment for trouble.
21	Remove VOM.
22	If testing an EMD channel unit, set E2/M2-NET switch to **E2/M2** and repeat Steps 11 through 21.
	Test Originating Channel Unit
23	Insert a patch cord end or phenolic open plug in the extender **TR LINE** jack and observe LOOP OPEN (**TA** LED lighted) condition.
24	If channel unit is an RPO, set **RPO** switch to **IN**.
25	Set extender **DROP** switch to NORMAL (**RA** up).
26	Insert arranged VOM at **R** pin jack (4LSXO-*SX* option T1, R1-SX jack, or LP option **E** jack) on extender side panel.
27	Measure −48 volt dc battery on channel unit ring.
28	Remove VOM.
29	Set extender **DROP** switch to REVERSED (**RA** down).
30	Insert VOM at T pin jack on extender and observe that ROM indicates −48 volts direct current.
31	Remove VOM.
32	Set **DROP** switch to NORMAL (**RA** up).
33	Place a shorting cord between pin jacks **T** and **R** on extender side panel and observe LOOP CLOSED (**TA** LED dark) condition.
34	Remove the shorting cord between pin jacks **T** and **R** and observe LOOP OPEN (**TA** LED lighted) condition.
35	Remove patch cord end or phenolic open plug from TR LINE jack.
36	If testing an SDPO channel unit, verify SLEEVE GROUND. Arrange VOM to measure −48 volt dc battery and insert at SDPO BSY pin jack on extender side panel. Repeat Step 33 and observe that 0-volt direct current on SDPO BSY pin jack occurs with the **TA** LED lighted (LOOP CLOSED) condition.

STEP	PROCEDURE
37	If testing an RPO channel unit, verify REVERTIVE PULSES. Arrange VOM to measure −Vdc and insert at R jack on extender side panel. Condition extender **DROP** switch to **NO** REVERTIVE PULSES (**RA** down) and observe that VOM drops from −48 volts direct current.
38	If details of this test are not met, check channel unit in maintenance bank; check distributing frame wiring and connected equipment for trouble.
	Test Terminating Channel Unit
39	Confirm that extender **TA** LED lamp is lighted (NORMAL).
40	Set extender **DROP** switch to LOOP OPEN (**RA up**).
41	Insert arranged VOM at R pin jack on extender side panel.
42	Measure −48 volt dc battery on RING from connected equipment.
43	Set extender **DROP** switch to LOOP CLOSED (**RA** down) and observe that VOM indicates 0-volt direct current.
44	Remove VOM.
45	Arrange for drop-side tester to change the trunk state and confirm that extender TA LED lamp is dark (REVERSED).
46	If testing an RPT channel, verify REVERTIVE PULSES. Place a grounded pin plug at R pin jack on extender side panel. Observe that the **TB** LED lamp is lighted (REVERTIVE PULSES).
	Test RSCO Channel Unit
47	Insert a patch cord end or phenolic open plug in the extender **TR LINE** jack.
48	Set the extender **DROP** switch to LOOP CLOSED (**RA** down).
49	Arrange a VOM to measure ohms (SHORTED T-R) and insert in **T-R** pin jacks at extender side panel.
50	Measure 0 ohms.
51	Set extender **DROP** switch to LOOP OPEN (**RA** up) and observe that VOM reads OPEN T-R.

H. Security STA or OFC Channel Unit Test

STEP	PROCEDURE
1	Determine that circuit to be tested is not in service.
2	Remove channel unit and insert extender in channel slot and insert SECURITY channel in extender.

STEP	PROCEDURE
3	Insert phenolic 258E open plug in extender LINE T-R splitting jack to remove cable facility.
4	If SECURITY channel unit is an SEC-OFC, go to Step 14.
	Verify SEC STA Unit Signaling States
5	Arrange SEC-STA unit for state 1 (idle) condition by setting extender switches to send A=0 and B=1 (**RA** down, **RB** up) to the DROP.
6	Arrange VOM to measure −Vdc and confirm: RING = −48 volts direct current TIP = 0-volt direct current at the channel unit faceplate **T, R** pin jacks.
7	Set extender switches to send STATE 2 (Double Battery, **RA** up, **RB** up) to the DROP, and confirm: RING = −48 volts direct current TIP = −24 volts direct current at the channel unit faceplate **T, R** pin jacks.
8	Set extender switches to send STATE 3 (Loopback **RA** down, **RB** down) to the DROP and confirm (1) OPEN RING, OPEN TIP at the channel faceplate pin jacks, (2) transmitting A=1, B=0 (**TA** lighted, **TB** dark), and (3) faceplate GND LED lighted. Remove VOM.
9	Set extender switches to send STATE 1 NORMAL BATTERY A=0, B=1 (**RA** down, **RB** up) to the DROP and confirm OPEN T,R A=1, B=1 (**TA** lighted, **TB** lighted).
10	Place SHORTING CORD between faceplate **T** and **R** pin jacks and confirm LOOPED T,R A=0, B=1 (**TA** dark, **TB** lighted) and channel unit faceplate LC LED lighted.
11	Ground SHORTING CORD placed in Step 10 and confirm GROUNDED LOOP A=1, B=0 (**TA** lighted, **TB** dark) and channel unit faceplate GND LED lighted.
	Verify SEC-OFC Unit Signaling States
12	Remove grounded SHORTING CORD, push TST switch on SEC-STA unit, and confirm A and B and LED conditions shown in Step 11.
13	End of SEC-STA test.
14	Condition SEC-OFC unit for state 1 (idle) by setting switches to send A=0, B=1 (**RA** down, **RB** up) to the DROP.

STEP	PROCEDURE
15	Arrange VOM to measure resistance and confirm LOOPED T, R at channel unit faceplate T, R pin jacks. Press T/R test and confirm GROUNDED LOOP at VOM.
16	Set extender switches to send STATE 2 (Open, **RA** up, **RB** up) to the drop and confirm OPEN T, R at the VOM.
17	Set extender switches to send STATE 3 (Grounded Loop, **RA** up, **RB** down) and confirm TIP GROUND at the VOM. Remove VOM.
18	Press LB test button and confirm transmitting A=1, B=0 (**TA** lighted, **TB** dark).
19	End of SEC-OFF test. Transmitting state tests other than LB test button require loop current at the channel unit-cable interface.

TABLE A

PIN JACKS

JACK(S)	CIRCUIT POINT
T	Tip lead
R	Ring lead
T1	Tip lead of 4-wire receive path
R1	Ring lead of 4-wire receive path
E	E signaling lead
M/EX	M or tandem EX signaling lead
E1, Ex1	Simplex points on tandem CU
SDPO BSY	Make busy lead for sleeve DPO unit
20Hz, 20Hz GRD	Ringing supply connections
4W SX-T,R T1, R1	Simplex points on metallic interface of 4-wire units
E2, M2	E2 and M2 signaling leads on dual E&M unit
NET	Connection to 2-wire hybrid balance network

TABLE B

LED AND SWITCH INTERPRETATION

CHANNEL UNIT	INTERPRETATION															
	RDA		TSA		RDB		TSB		TA		RA		TB		RB	
	ON	OFF	1	0	ON	OFF	1	0	ON	OFF	1	0	ON	OFF	1	0
E&M	E LD OPEN	E LD CLSD	M LD GRD/OPN	M LD BAT	NC	NC	NC	NC	M LD GRD/OPN	M LD CLSD	E LD GRD/LPD	E LD OPEN	NC	NC	NC	NC
DPO, SDPO DPMO, ILSXO	NORM BAT	REV BAT	LOOP OPEN	LOOP CLSD	NC	NC	NC	NC	LP OPN	LP CLSD	NORM	REV	NC	NC	NC	NC
RPO	NORM BAT	REV BAT	LOOP OPEN	LOOP CLSD	RVRTV PULS	NO PULS	NC	NC	LP OPN	LP CLSD	NORM	REV	NC	NC	PULS	NO PULS
DPT	LP OPN	LP CLSD	NORM BAT	REV BAT	NC	NC	NC	NC	NORM BAT	REV BAT	LOOP OPEN	LOOP CLSD	NC	NC	NC	NC
RPT	LP OPN	LP CLSD	NORM BAT	REV BAT	NC	NC	RVRTV PULS	NO PULS	NORM BAT	REV BAT	LOOP OPEN	LOOP CLSD	RVRTV PULS	NO PULS	NC	NC
FXS	TP GRD	NO TP GRD	LOOP OPN	LOOP CLSD	RNG (20 HZ)	NO RNG	RNG GRD	NO RNG GRD	LP OPN	LP CLSD	TP GRD	NO TP GRD	RNG GRD	NO RNG GRD	RNG (20 HZ)	NO RNG
TDM STA	E LD OPEN	E LD CLSD	EX LD GRD/LPD	EX LD OPEN	T/R PR GRD-10K	T/R PR OPEN	T/R PR GRD-10K	T/R PR OPEN	EX LD GRD/LPD	EX LD OPEN	E LD OPEN	E LD GRD/LPD	T/R PR GRD-10K	T/R PR OPEN	T/R PR GRD-10K	T/R PR OPEN
RSCO	LP OPN	LP CLSD	NC	NC	NC	NC	NC	NC	NC	NC	LOOP OPN	LOOP CLSD	NC	NC	NC	NC
TDM MSG	E LD OPEN	E LD CLSD	EX LD OPEN	EX LD GRD/LPD	NC	NC	NC	NC	EX LD OPEN	EX LD CLSD	E LD OPEN	E LD GRD/LPD	NC	NC	NC	NC
PLAP	RNG APLD	NO RNG	LOOP CLSD	LOOP OPEN	NC	NC	NC	NC	LP CLSD	LP OPN	RNG APLD	NO RNG	NC	NC	NC	NC
DX	ON-HK	OFF HK	ON-HK	OFF-HK	NC	NC	NC	NC	ON-HK	OFF HK	ON-HK	OFF-HK	NC	NC	NC	NC
PLAR-OPPLDB	NO RNG	RNG (20 HZ)	LOOP OPEN	LOOP CLSD	NC	NC	NC	NC	LP OPN	LP CLSD	NO RNG	RNG APLD	NC	NC	NC	NC
RD BRDG	-48V SG LD	NO -48V	SG LD -48V	SG LD GRD	NC	NC	NC	NC	-48V SG LD	NO -48V	SG LD -48V	SG LD GRD	NC	NC	NC	NC
SEC STA	NORM BAT	DBL BAT	LOOP CLSD	LOOP OPEN	LPBK TST	NO TST	LOOP GRD	LOOP NO GRD	LP CLSD	LP OPN	BAT DBL	BAT NORM	LP GRD	NO GRD	LPBK TST	NO TST
SEC OFC	LP CLSD	LP OPN	BAT NORM	BAT DBL	LP GRD	NO GRD	LPBK TST	NO TST	NORM BAT	DBL BAT	LOOP CLSD	LOOP OPEN	LPBK TST	NO TST	LOOP GRD	NO GRD
FXO	LP OPN	LP CLSD	TP GRD	NO TP GRD	RNG GRD	NO GRD	RNG (20 HZ)	NO RNG	TP GRD	NO GRD	LOOP OPEN	LOOP CLSD	RNG (20 HZ)	NO RNG	RNG GRD	NO GRD
TDM CO	E LD GRD/LPD	E LD OPN	EX LD GRD/LPD	EX LD OPEN	T/R PR GRD-10K	T/R PR OPEN	T/R PR GRD-10K	T/R PR OPEN	EX LD GRD/LPD	EX LD OPEN	E LD GRD/LPD	E LD OPEN	T/R PR GRD-10K	T/R PR OPEN	T/R PR GRD-10K	T/R PR OPEN

TABLE B (Contd)

LED AND SWITCH INTERPRETATION

CHANNEL UNIT	INTERPRETATION															
	RDA		TSA		RDB		TSB		TA		RA		TB		RB	
	ON	OFF	1	0	ON	OFF	1	0	ON	OFF	1	0	ON	OFF	1	0
IEMD	E1 LD OPEN	E1 LD CLSD	M1 LD GRD/OPN	M1 LD BAT	E2 LD OPEN	E2 LD CLSD	M2 LD GRD/OPN	M2 LD BAT	M1 LD GRD/OPN	M1 LD BAT	E1 LD OPEN	E1 LD GRD/LPD	M2 LD GRD/OPN	M2 LD BAT	E2 LD OPEN	E2 LD GRD, LPD
RD END STA	RNG APLD	NO RNG	RNG BRST	NO RNG	NC	NC	NC	NC	RNG BRST	NO RNG	RNG APLD	NO RNG	NC	NC	NC	NC
TO	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

NC means no connection or meaningless usage.

TABLE C

SWITCH SETTINGS

SWITCH	APPLICATION
RPO	IN for testing RPO channel unit. OUT for all other channel units.
D4-SLC 96	SLC 96 used when testing at SLC 96 carrier remote terminal or to gain access to hybrid balance network in D4 units. D4 used for all other applications.
E2/M2-NET	E2/M2 used to access E2/M2 leads of E&M/D unit and used to access SB and SG leads on E&M/S unit. NET used to access hybrid balance network and anytime E2/M2 function is not needed.

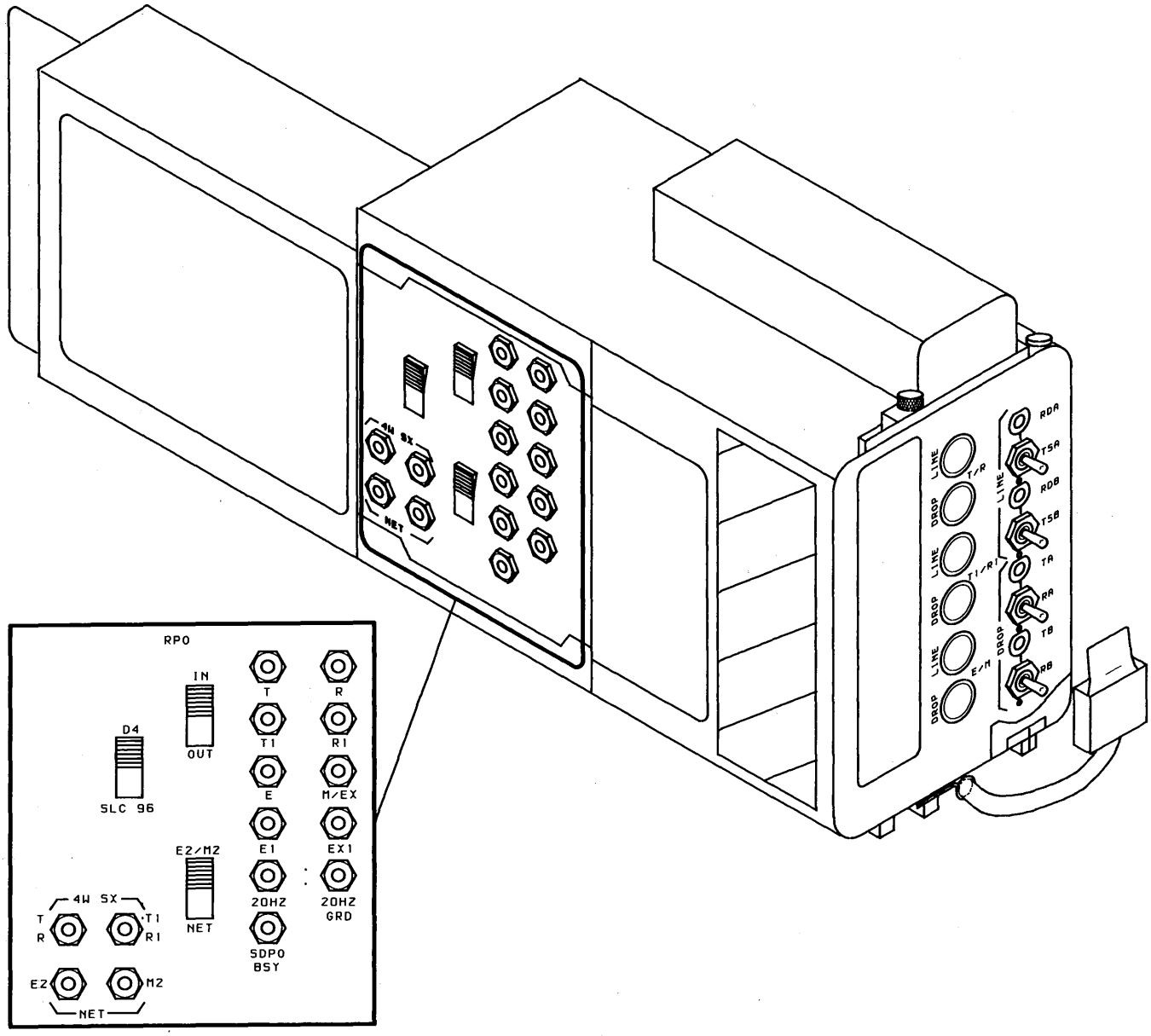

Fig. 1—J98726MP Channel Unit Extender