

## E220 NEBS Shelf 23-inch HDSL System Shelf Installation and Maintenance

### CONTENTS

1. GENERAL .....	1
2. INSTALLATION .....	2
3. INSTALLATION OPTIONS .....	7
4. INSTALLATION OF PLUG-INS .....	7
5. MAINTENANCE .....	10
6. SPECIFICATIONS .....	10
7. WARRANTY AND CUSTOMER SERVICE ..	11

### FIGURES

Figure 1. E220 NEBS Shelf 23-Inch HDSL System Shelf .....	1
Figure 2. Backplane Terminal Strip Connections ...	2
Figure 3. Backplane Wiring Arrangement .....	3
Figure 4. HTU-C Slot Wire Wrap Connections .....	4
Figure 5. HFAC Controller Slot Wire Wrap Connections .....	4
Figure 6. Signal I/O Pinouts for AMP-Type Connectors .....	5
Figure 7. Signal I/O Connector Locations .....	6
Figure 8. HFAC Slot Pin Assignments .....	8
Figure 9. HCOT / HTU-C Slot Pin Assignments ....	9
Figure 10. HTU-C Slots 2 through 11 Pin Assignments .....	10

### TABLES

Table 1. Compliance Codes .....	5
Table 2. E220 NEBS Shelf HDSL 23-Inch System Shelf Specifications .....	10

### 1. GENERAL

This practice is an installation and maintenance guide for the ADTRAN E220 NEBS Shelf 23” HDSL System Shelf. **Figure 1** is a front view of the shelf with all slots empty.

#### Features

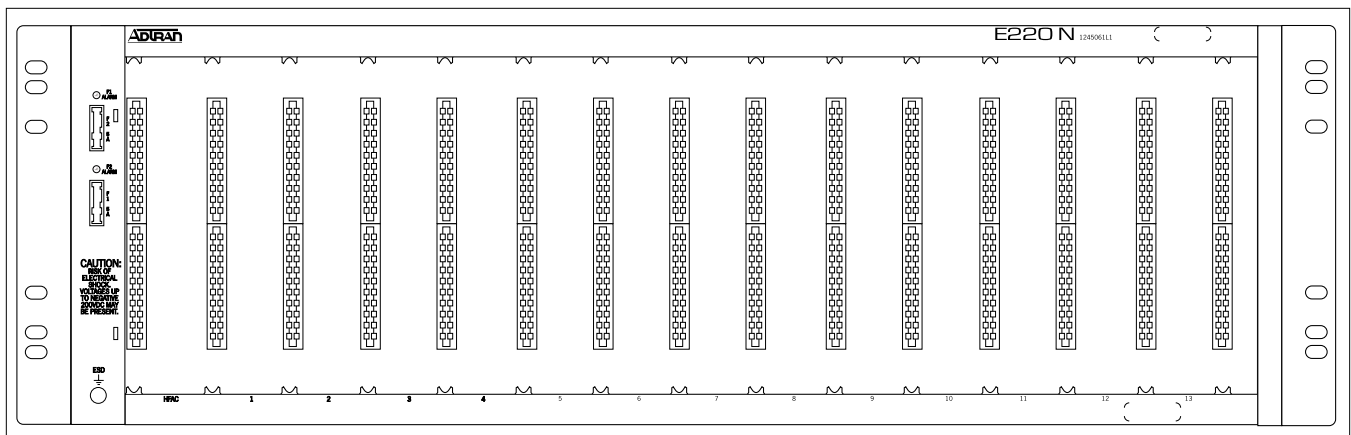
ADTRAN E220 NEBS Shelf HDSL 23” System Shelf features include:

- Wire-wrap terminations
- Modular connector terminations
- Offset connector arrangement to ensure correct plug-in of the HFAC
- Adjustable side brackets for mounting the shelf in a bay
- Redundant power supply capability
- Visual fuse failure indication

#### Description

The ADTRAN E220 NEBS Shelf is designed for use in applications where it is beneficial to replace a series of T1 repeaters with HDSL transceiver technology.

While the shelf is designed primarily to accept ADTRAN HTU-C or H2TU-C units, the shelf can also accommodate 231 type T1 repeater cards or a combination of HTU-C or H2TU-C units and 231 repeaters. T1 repeater cards can be loaded into slots 1 through 13.



**Figure 1. E220 NEBS Shelf 23-Inch HDSL System Shelf**

The E220 NEBS Shelf is functionally similar to the E220 Shelf, P/N 1244061L1, but with these additional features:

- A protective backplane cover.
- Redundant power capability via backplane diode circuitry that load-shares incoming power from two independent sources thus providing seamless switching from one to the other in the event one fails.

The ADTRAN E220 NEBS Shelf measures 23 inches wide (17.40 inches minus the mounting brackets), 12 inches front-to-back, and 7.0 inches (standard 4U) high. The shelf weighs 15 pounds, 7 ounces.

Each shelf is wired and tested and contains provisions for power connection, fusing, and connections to office alarms.

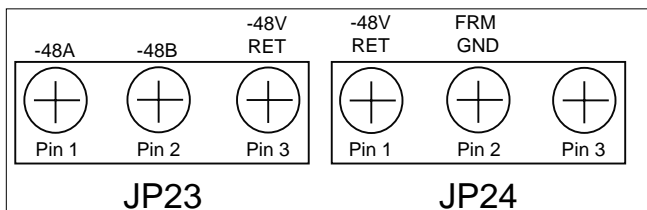
The shelf is equipped with adjustable side brackets for mounting the shelf in the bay. The brackets will permit flush, 4-inch, and 5-inch recessed mounting. Two sets of mounting holes in the side plates conform to standard rack mechanics. Choose the appropriate set of holes for the specific mounting requirement.

The E220 NEBS Shelf uses an offset connector arrangement to ensure that only the correct card type can be plugged into a particular slot.

The shelf has a backplane containing fifteen 50-pin connectors. These connectors are interconnected with printed circuit copper traces for voltage and ground distribution. Power and ground connections, and certain office alarms are available on two 3-position terminal strips on the backplane (see **Figure 2**). Input/output signals and alarm dry contact terminations are made using wire-wrap connections to allow special purpose configurations to be wired. These features are explained later in this practice.

### Revision History

This document has been revised to clarify and illustrate backplane wiring arrangement plus style and format revisions.



**Figure 2. Backplane Terminal Strip Connections**

## 2. INSTALLATION



### NOTES

- This unit shall be installed in accordance with the requirements of NEC NFPA 70.
- This unit is intended for installation in Restricted Access Locations only.

After unpacking the unit, inspect it for damage. If damage is noted, file a claim with the carrier, then contact ADTRAN. See *Warranty and Customer Service*.

Before installing the E220 NEBS Shelf in a communications bay, remove all plug-in cards that may have been shipped in the shelf.

To remove the cards, grasp the metal latch at the bottom of the card and pull the latch downward. This ejects the unit from its connector. Temporarily place these units in an ESD protected area.

Prior to initial installation, ensure that the bay frame for the shelf is installed, the -48 Vdc power source and alarm cabling to the bay is installed, and that any special backplane wiring is complete.

### Fuses

Two 5-amp GMT fuses shipped with the unit insert in holders F1 and F2 on the front left side of the shelf. F1 supplies slots 1 through 7 and F2 supplies slots 8 through 13. HFAC and HCOT cards are fused on the card itself.

### NOTE

Fuses F1 and F2 do not have redundant power capability. Removal or failure of either fuse will cause a loss of power to the associated half of the shelf.

Each power feed to the terminal strip on the backplane should be fused at 10 amps, since at any one time only one feed could be supplying current to the shelf. The 4 diodes associated with the other feed will be reverse biased and in an off condition.

### Mounting

The E220 NEBS Shelf can now be mounted in the 23-inch equipment bay. The shelf mounting brackets have two sets of holes that conform to standard 23-inch bay mechanics. Position the shelf at the desired location and align the mounting holes. Secure the shelf with appropriate size screws (not provided).

After securing the shelf in the bay, remove the back cover that protects the wire-wrap pins in preparation for wiring connections.

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#### NOTE

To meet requirements of Bellcore NEBS level 3, ADTRAN blank plugs (P/N 1245067L1) must be installed in empty slots. The blank plugs are purchased separately.

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### Shelf Cards

The shelf can be populated with thirteen ADTRAN HTU-C or H2TU-C transceivers. These units are loaded into slots 1 through 13. For these slot locations, the DSX-1 and HDSL loop wiring will be made on the corresponding backplane connector, or wire-wrap pins.

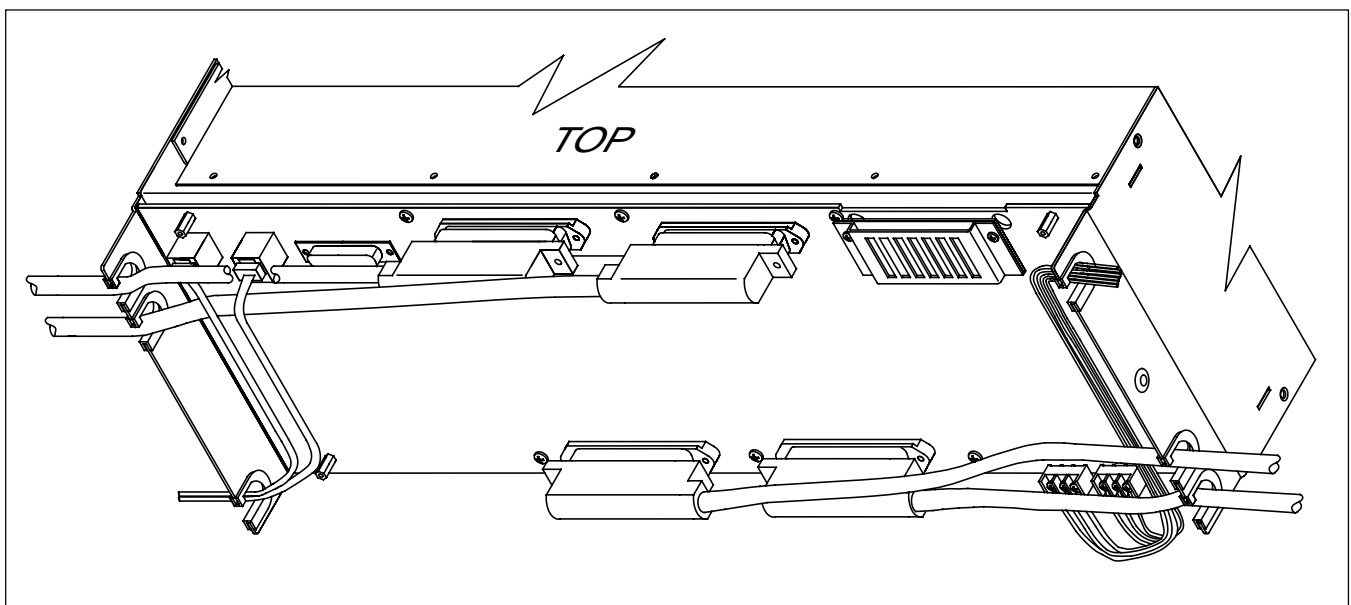
The far left slot in the shelf is reserved for an ADTRAN HFAC shelf controller card, part number: 1240008LX, 1244051LX, or 1221051LX.

Slot 1 is reserved for either an ADTRAN HCOT system controller card, ADTRAN part number: 1240009LX, 1244052LX, or 1221052LX, or the standard HTU-C or H2TU-C channel bank card.

A shelf controller (HFAC) or system controller (HCOT-CTL) is not required for normal HTU-C operation unless performance monitoring and/or advanced alarm processing functions are desired.

### Wiring Arrangement

During wiring installation, refer to **Figure 3** for the correct wire route arrangement. Three wire portals with protective grommets on each side of the backplane accommodate the exiting wires. When all wiring connections to the backplane are complete, dress and lace the wire runs to accepted workmanship standards.

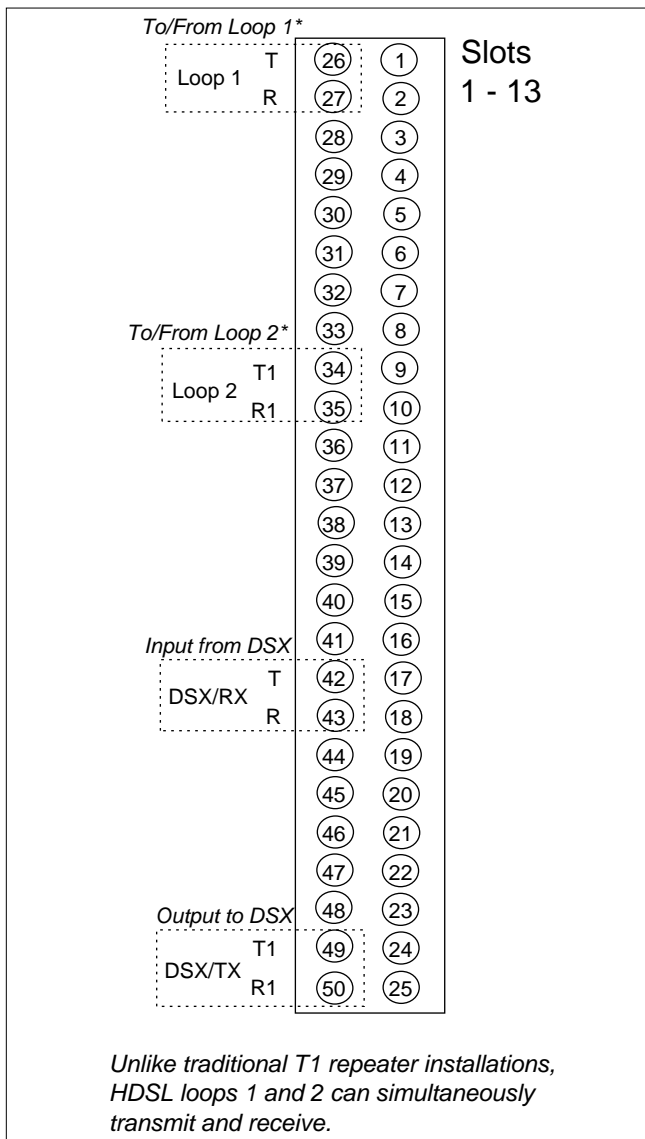


**Figure 3. Backplane Wiring Arrangement**

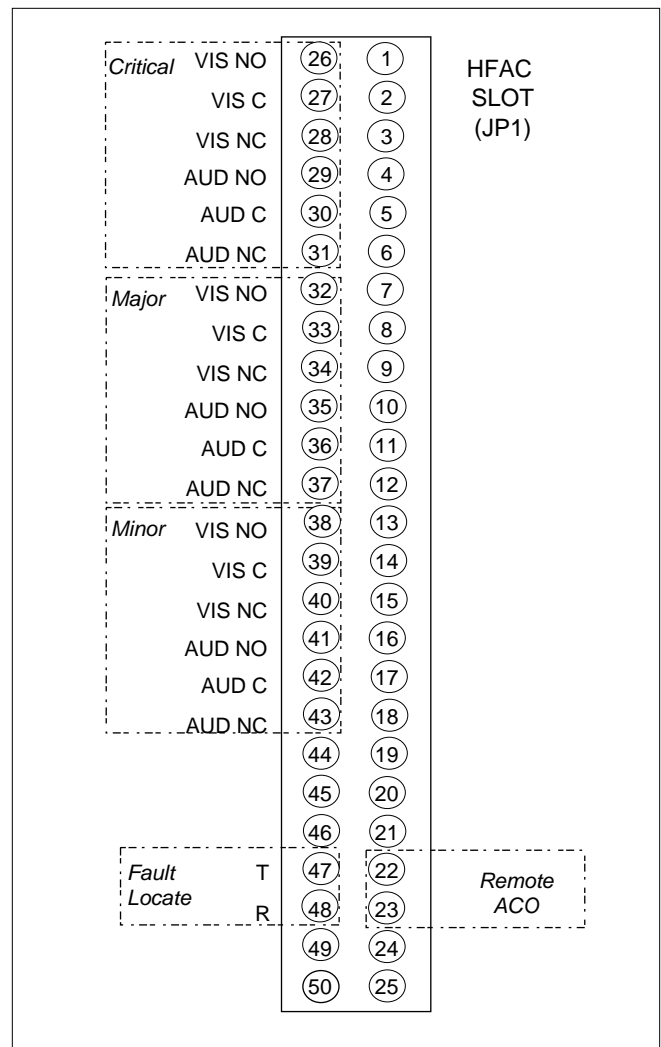
## Backplane Connections

### Locations

Power and ground connections are on JP23 and JP24, two 3-position terminal strips in the lower right corner of the backplane (see Figure 2). The local alarm connection lugs for fuse and Bipolar Violation (BPV)/ Loss of Signal (LOS) alarms are on wire-wrap terminals (P7) at the upper right corner of the backplane (see Figure 6). Controller-to-shelf communication ports (JP6 and JP7) are at the upper left corner of the backplane along with a DB25 connector that serves as a DCE/DTE configurable communications port (see Figure 6). All other connections to the shelf can be made directly to each wire wrap connector (see **Figure 4** and **Figure 5**), as required by the application.



**Figure 4. HTU-C Slot Wire Wrap Connections**



**Figure 5. HFAC Controller Slot Wire Wrap Connections**

### NOTE

DSX-1 and HDSL loop signals are also available on connectors P1 through P4. See **Figure 6** and **Figure 7**.

### Frame Ground

Attach frame ground to pin 2 of JP24.

### -48 Volt Supply

The -48 Vdc office supply is connected to JP23, positions 1 or 2. The backplane power distribution is provided by the 5-Amp fuses in F1 and F2 on two separate circuits. F1 is connected to slots 1 through 7, and F2 is connected to slots 8 through 13. If one fuse fails, that half of the shelf will lose power.



**Figure 6. Signal I/O Pinouts for AMP-Type Connectors**

**LEDs**

Fuse failure is indicated by a Red LED adjacent to the fuse turning ON.

The shelf will operate with one or two -48 Vdc supplies connected (-48A and -48B). The LED next to each fuse turns ON when the corresponding fuse fails causing an open circuit. Power-share capability allows power to be supplied by either A or B or both. In the event one supply fails, current will automatically be drawn from the other supply (if connected) to keep the shelf running normally without dropouts or errors.

The HFAC controller slot has an independent power distribution and fuse circuit fed from either of the -48V connections. Spade lug terminations are recommended. The power return connects to pin 3 of JP23 and pin 1 of JP24.

**Compliance Codes**

The E220 NEBS Shelf meets Compliance Code Requirements covered in UL 1950 third edition. See **Table 1**.

**Table 1. Compliance Codes**

Code	Input	Output
Power Code (PC)	F	F
Telecommunication Code (TC)	X	X
Installation Code (IC)	E	-

**NOTE**

- Ensure all power connections are firmly secured.
- A readily accessible disconnect device, that is suitably approved and rated, shall be incorporated in the input source wiring.
- Connect to a reliably grounded -48 Vdc source which is electrically isolated from the AC source.
- The branch circuit overcurrent protection shall be a fuse or circuit breaker rated minimum 48 V, maximum 20 A.

**Alarms**

The ADTRAN E220 NEBS Shelf provides two modes of alarm reporting capability.

First, if the shelf is used for standalone HTU-C operation with no shelf controller, the alarm connections on the wire wrap terminals of P7 are used. The fuse alarm bus is on P7 (see **Figure 7**).

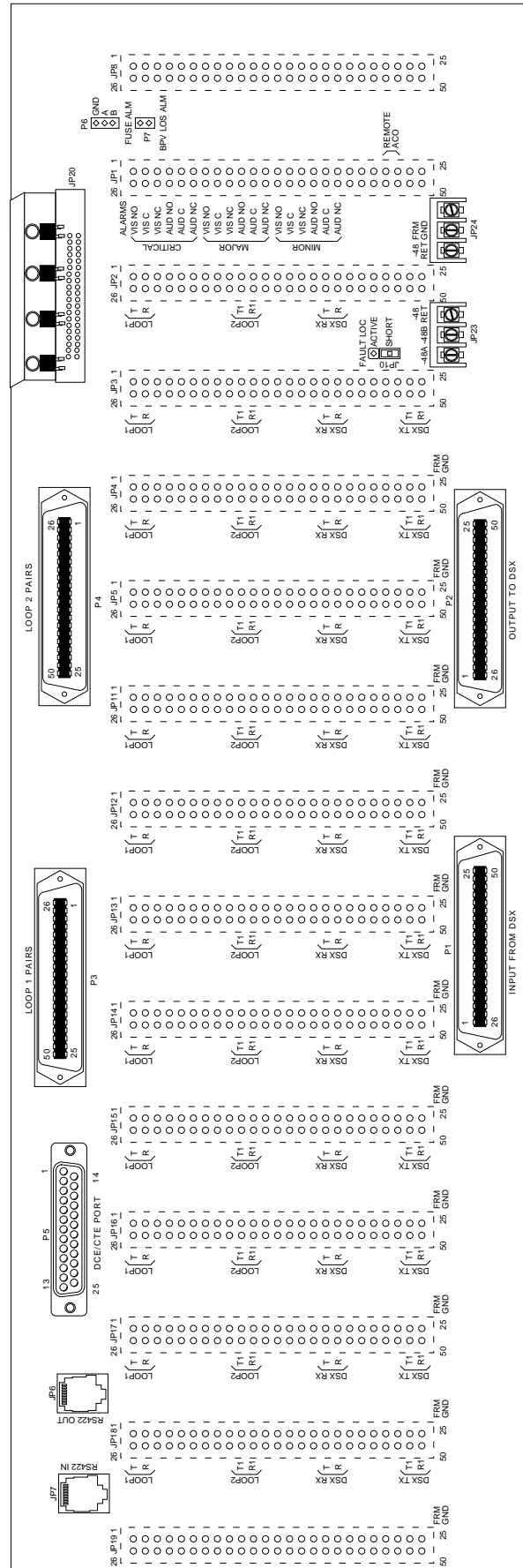
The fuse alarm connection is normally floating, but provides -48 Vdc output when a fuse is blown. The BPV/LOS connection provides a closure to -48V RET when a BPV/LOS alarm condition exists. The BPV/LOS is also on P7 (see **Figure 7**).

Second, if the shelf is equipped with a shelf controller, a set of alarm relay contacts is provided through backplane wire wrap connections (see **Figure 4**). Wiring can be made to appropriate pins on JP1 for normally open (NO) or normally closed (NC) connections for an alarm condition.

Connection is made to the Common (C) pin and to either the NO or the NC pin. Visible and audible contact connections are provided for critical, major, and minor alarm types. An audible alarm cutoff function is provided with the shelf controller. An audible alarm cutoff is initiated by pressing the ACO pushbutton on the HFAC controller front panel or by providing closure between the REMOTE ACO pins 22 and 23 on backplane connector JP1. The backplane is labeled with appropriate markings for the alarm and alarm cutoff connections.

**Wire Wrap Terminations**

After wiring for alarms, attach the signal wires as required. Thirteen connectors labeled 1 through 13 are provided for wire wrap connection to the signal



**Figure 7. Signal I/O Connector Locations**

wires. Use the appropriate wire size and wire-wrap tool to connect the signal wires to the .031 inch square posts (see Figure 5 for DSX-1 and HDSL loop connection pin numbers). These correspond to the standard signal connections used in T1 office repeater applications.

Other wire-wrap connections include the fault locate bus (JP1, pins 47 and 48; see Fault Locate Option), the alarm outputs (JP1, pins 26 through 43), and the remote alarm cutoff input (JP1, pins 22 and 23).

### Signal I/O Connectors

Four connectors (P1 through P4) are provided on the backplane for use in applications where wire wrap terminations are not desired. These connectors bring out the DSX-1 and HDSL loop signals from each HTU-C unit as illustrated in Figure 5.

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#### NOTE

DSX interfaces are intended for connection to intra-building wiring only.

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Figure 7 identifies the connector locations on the backplane. The P1-P4 connectors are AMP P/N 554758-1 or equivalent male plugs.

After all wiring is complete dress and lace wire runs to workmanship standards, then reinstall the protective backplane cover.

## 3. INSTALLATION OPTIONS

### Fault Locate Option

The ADTRAN E220 NEBS Shelf is equipped with a fault locate bus for use with T1 repeater cards that have fault location capability. A jumper strap (JP10) is directly above JP23 on the backplane allowing use of this function, if needed. The factory setting is the SHORT position. The strap should be left in this position unless fault location equipment is actually in use. For fault location activity, use the ACTIVE strap position.

## System Communications

Two RJ-45S jacks, JP6 and JP7, on the backplane provide shelf-to-shelf communication when the system is controlled by an HCOT-CTL system controller card. A 4-wire or 8-wire cable with RJ45S-type jacks can be used to supply these interconnections. The sequence of connections should be from the RS-422 OUT port of the shelf that contains the system controller, to the RS-422 IN port of the next shelf. Repeat this procedure for each shelf.

### OSS Interface

A DB25 connector, P5, is provided on the backplane for connection of the HCOT-CTL system controller to an operations support system interface. See the HCOT-CTL practice for more information on this port connection.

## 4. INSTALLATION OF PLUG-INS

The E220 NEBS Shelf has 14 slots available for plug-in cards. The far left slot is reserved for an HFAC shelf controller (see **Figure 8**). Slots 1 through 13 are available for HTU-C OR H2TU-C units. Slot 1 can also accept an HCOT-CTL. When inserting cards ensure the edge connector is firmly seated.

If the application requires a shelf controller, insert an HFAC unit into the far left slot. This slot is labeled HFAC.

These slot connectors are offset and will only accept an HFAC controller card.

JP1	
1	not used
2	RS485 TX+ (HTU-C/HFAC communications link)
3	RS485 TX- (HTU-C/HFAC communications link)
4	not used
5	not used
6	RS422 TX+ output to next shelf
7	RS422 TX- output to next shelf
8	RS422 RX+ input from next shelf
9	RS422 RX- input from next shelf
10	RS422 TX+ input from HCOT-CTL
11	RS422 TX- input from HCOT-CTL
12	RS422 RX+ output to HCOT-CTL
13	RS422 RX- output to HCOT-CTL
14	not used
15	-48V return
16	-48V return
17	-48V return
18	-48V return
19	RS485 termination
20	RS485 termination
21	Shelf ID-Open
22	Remote ACO input
23	Remote ACO input
24	HCOT-CTL detect input
25	Frame Ground
26	Visual Critical alarm/normally open
27	Visual Critical alarm/common
28	Visual Critical alarm/normally closed
29	Audible Critical Alarm/normally open
30	Audible Critical alarm/common
31	Audible Critical alarm/normally closed
32	Visual Major alarm/normally open
33	Visual Major alarm/common
34	Visual Major alarm/normally closed
35	Audible Major alarm/normally open
36	Audible Major alarm/common
37	Audible Major alarm/normally closed
38	Visual Minor alarm/normally open
39	Visual Minor alarm/common
40	Visual Minor alarm/normally closed
41	Audible Minor alarm/normally open
42	Audible Minor alarm/common
43	Audible Minor alarm/normally closed
44	Card sense 9
45	Card sense 10
46	Card sense 11
47	Fault locate tip
48	Fault locate ring
49	Card sense 12
50	Card sense 13

JP8	
1	-48 Vdc (HCOT-CTL supply)
2	
3	
4	
5	
6	
7	
8	
9	
10	BPV/LOS alarm
11	Fuse alarm
12	HCOT-CTL fuse TST
13	DCD
14	DTR
15	TXD
16	RXD
17	CTS
18	RI
19	DSR
20	RTS
21	
22	-48V return
23	-48V return
24	-48V return
25	-48V return
26	Site Manager B
27	Site Manager A
28	
29	
30	
31	
32	
33	
34	Card sense 1
35	Card sense 2
36	Card sense 3
37	Card sense 4
38	
39	
40	Circuit B fuse alarm
41	
42	
43	Circuit A fuse alarm
44	
45	
46	
47	Card sense 5
48	Card sense 6
49	Card sense 7
50	Card sense 8

Figure 8. HFAC Slot Pin Assignments



If the application requires a system controller, insert an HCOT-CTL into slot 1 (see **Figure 9**). The HCOT-CTL will physically plug into any of slots 1 through 13, but will only function properly in slot 1.

If a system controller is not used, an HTU-C or H2TU-C unit can occupy slots 1 through 13 (see **Figure 10**). Load HTU-C or H2TU-C cards according to the application.

SLOT 1 JP2	
1	BPV/LOS alarm
2	RS485 TX+ (HTU-C/HFAC communications link)
3	RS485 TX- (HTU-C/HFAC communications link)
4	-48 VDC HCOT-CTL supply
5	Used by the HFAC to detect presence of the HTU-C
6	Slot ID detect
7	Slot ID detect
8	Slot ID detect
9	Slot ID detect
10	RS422 TX+ RS422 input from HCOT-CTL
11	RS422 TX- RS422 input from HCOT-CTL
12	RS422 RX+ RS422 output to HCOT-CTL
13	RS422 RX- RS422 output to HCOT-CTL
14	not used
15	-48V return
16	-48V return
17	-48V return
18	-48V return
19	-48V return
20	DCD (HCOT-CTL/OS interface)
21	DTR (HCOT-CTL/OS interface)
22	TXD (HCOT-CTL/OS interface)
23	RXD (HCOT-CTL/OS interface)
24	not used
25	Frame Ground
26	HDSL loop 1 tip
27	HDSL loop 1 ring
28	CTS (HCOT-CTL/OS interface)
29	not used
30	not used
31	not used
32	Fuse alarm (no alarm = open; alarm = -48VDC)
33	not used
34	HDSL loop 2 tip
35	HDSL loop 2 ring
36	RI (HCOT-CTL/OS interface)
37	not used
38	HCOT-CTL presence identifier sense line
39	-48 VDC supplied from fuse 1
40	-48 VDC supplied from fuse 1
41	-48 VDC supplied from fuse 1
42	DSX-1 RX tip
43	DSX-1 RX ring
44	-48V return
45	DSR (HCOT-CTL/OS interface)
46	RTS (HCOT-CTL/OS interface)
47	fault locate tip
48	fault locate ring
49	DSX-1 TX tip
50	DSX-1 TX ring

**Figure 9. HCOT / HTU-C Slot Pin Assignments**

## SLOTS 2 - 13

1	○	BPV/LOS alarm
2	○	RS485 backplane TX+
3	○	RS485 backplane TX-
4	○	not used
5	○	Card sense
6	○	Slot prog 1
7	○	Slot prog 2
8	○	Slot prog 3
9	○	Slot prog 4
10	○	not used
11	○	not used
12	○	not used
13	○	not used
14	○	not used
15	○	-48V ret
16	○	
17	○	
18	○	
19	○	
20	○	Alarm relay 1 (normally open)
21	○	Alarm relay 2 (normally open)
22	○	not used
23	○	not used
24	○	not used
25	○	Frame ground
26	○	HDSL loop 1 tip
27	○	HDSL loop 1 ring
28	○	not used
29	○	not used
30	○	not used
31	○	not used
32	○	Fuse alarm
33	○	not used
34	○	HDSL loop 2 tip
35	○	HDSL loop 2 ring
36	○	not used
37	○	not used
38	○	not used
39	○	-48 VDC
40	○	-48 VDC
41	○	-48 VDC
42	○	DSX-1 RX tip
43	○	DSX-1 RX ring
44	○	-48 V return
45	○	not used
46	○	not used
47	○	Fault locate tip
48	○	Fault locate ring
49	○	DSX-1 TX tip
50	○	DSX-1 TX ring

**Figure 10. HTU-C Slots 2 through 11 Pin Assignments**

## 5. MAINTENANCE

The ADTRAN E220 NEBS Shelf does not require routine maintenance to operate properly. Tests and maintenance for the individual plug-ins should be connected in accordance with the recommendations and procedures prescribed by the manufacturer of specific plug-in.

ADTRAN recommends that major repairs on the shelf not be performed in the field. Repair services may be obtained by returning defective units to ADTRAN.

## 6. SPECIFICATIONS

E220 NEBS Shelf HDSL 23" System Shelf specifications are listed in **Table 2**.

**Table 2. E220 NEBS Shelf HDSL 23-Inch System Shelf Specifications**

Power	
-48 Vdc	9.0A maximum fully loaded shelf Power in the shelf is limited only by shelf fuse size (2@5A = 10A)
Physical	
Dimensions:	23" wide x 7.0" high x 12" deep
Weight:	15 lbs, 7 oz
Wire Wrap Connectors	
Backplane wire wrap pins are .031-inch square posts and will withstand 22-gauge wire with torques not exceeding 4 oz/in, per MIL-STD-1130B.	
Temperature	
Operating:	-40° to +70° C
Storage:	-40° to +85° C
Compliance	
UL 1950 Belcore GR-63-CORE Bellcore GR-1089-CORE SR-3580 (NEBS Level 3)	

## 7. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN Carrier Networks Equipment Warranty, Repair, and Return Policy and Procedure*, document 60000087-10).

Contact Customer and Product Service (CAPS) prior to returning equipment to ADTRAN.

For service, CAPS requests, or further information, contact one of the following numbers:

### **PartNumber**

1245061L1

### **ADTRAN Sales**

Pricing/Availability  
(800) 827-0807

### **ADTRAN Technical Support**

Presales Applications/Post-sale Technical Assistance  
(800) 726-8663

Standard hours: Monday-Friday, 7 a.m. - 7 p.m. CST  
Emergency hours: 7 days/week, 24 hours/day

### **ADTRAN Repair/CAPS**

Return for Repair/Upgrade  
(256) 963-8722

### **Repair and Return Address**

ADTRAN, Inc.  
CAPS Department  
901 Explorer Boulevard  
Huntsville, Alabama 35806-2807

