

**OC3 TO DS3 CLIMATE-HARDENED PLUG-IN UNIT  
WITH MODULAR OPTICS CAPABILITY  
O3D3-MO**



CONFORMS TO  
UL STD 60950-1  
CERTIFIED TO  
CSA STD C22.2  
# 60950-1

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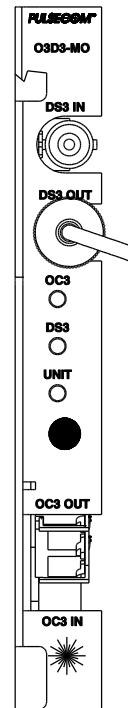


Figure 1. O3D3-MO

**1. INTRODUCTION**

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This practice describes the Pulsecom® 200 Mechanics® O3D3-MO, an OC3 to DS3 Climate-Hardened Plug-In Unit with Modular Optics Capability [1310 nm, 1550 nm, Coarse Wave Division Multiplexing (CWDM), and bidirectional (single) fiber]. See Figure 1. Installation instructions and engineering references are included.

**A. Reason for Reissue**

**Manual**

This practice has been reissued to update the ETL Listed labeling and contact information. SFPs that are no longer available have been identified.

**Equipment**

Compared to the original O3D3 Family, the O3D3-MO:

- Reduces power consumption to minimize costs and extend battery backup times
- Can operate from +24 VDC or -24 VDC as well as from -48 VDC
- Includes LC optical connectors rather than SC connectors to support small form-factor pluggable (SFP) optics
- Does **not** include optical transceivers

**B. Description**

The O3D3-MO is designed to derive a DS3 circuit from an OC3 synchronous optical network (SONET) facility. STS-1 #1 is used to carry the DS3 payload. Ordering codes for the O3D3-MO board as well as for available SFP optical transceivers are shown in Table 1.

**Table 1. O3D3-MO Board and OC3 Transceiver Ordering Codes**

Ordering Code	CLEI™ Code	Wave-length	Link Loss Budget	Maximum Output Level	Maximum Input Level	Number of Fibers	Type of Fiber
<b>A. Board (Without Transceiver)</b>							
O3D3-MO	SOCNV02A	–	–	–	–	–	–
<b>B. Available Optical Transceivers</b>							
SFP-OC3-1471-30	SOOTAGGM	1471 nm*	29 dB	0 dBm	-8 dBm	2	Single-Mode
SFP-OC3-1491-30	SOOTAGKM	1491 nm*					
SFP-OC3-1511-30	SOOTAGLM	1511 nm*					
SFP-OC3-1531-30	SOOTAGMM	1531 nm*					
SFP-OC3-1551-30	SOOTAGNM	1551 nm*					
SFP-OC3-1571-30	SOOTAGPM	1571 nm*					
SFP-OC3-1591-30	SOOTAGRM	1591 nm*					
SFP-OC3-1611-30	SOOTAGSM	1611 nm*					
SFP-OC3-1310-19	SOOTAGTM	1310 nm	19 dB	-8 dBm	-7 dBm	2	
SFP-OC3-1550-29	SOOTAGUM	1550 nm	29 dB	0 dBm	0 dBm		
SFP-OC3-SF13-13	SOOMAB8A	1310 nm	13 dB	-8 dBm	0 dBm	1	
SFP-OC3-SF15-13	SOOMAB9A	1550 nm					
SFP-OC3-MM13-10	SOOTAHMM	1310 nm*	10 dB	-14 dBm	-14 dBm	2	Multi-Mode
*These SFPs are no longer available from Engenuity/Pulsecom							

### **C. Features**

The O3D3-MO unit provides the following features:

- Standard 200 Mechanics to permit installation in conventional, inexpensive, central office (CO), digital loop carrier (DLC) remote terminal (RT) or customer-premises equipment (CPE) wall, shelf, or self-contained housings
- Can be powered from +24 VDC or –24 VDC supplies for cell site applications as well as from standard –48 VDC sources
- Climate-hardened for unrestricted deployment in outside plant (OSP) cabinets
- Available CWDM optics as well as 1310 nm and 1550 nm optics
- Standard fiber pair as well as single fiber transport support
- Long-range optics to support up to a 29 dB link loss budget
- Standard DS3 75-ohm male BNC connections
- Standard fiber female LC interface connectors
- Extremely low power to minimize costs and extend battery reserves
- Local contact closure alarms for DS3 and OC3 status
- Front-panel OC3, DS3, and UNIT status LEDs
- Exceptionally simple plug-and-play installation and use
- Compatible with existing O3D3 modules

## **2. APPLICATIONS**

The O3D3-MO unit provides an efficient way to address fiber exhaustion issues. Figure 2 shows the units delivering DS3 circuits from a remote terminal to multiple wireless carriers. Figure 3 illustrates the same service being provided from a central office. Figure 4 shows subscribers making a fiber-efficient transition from DS1 to DS3.

## **3. FUNCTIONAL DESCRIPTION**

The following paragraphs provide a functional description of the O3D3-MO. See Figure 5.

### **A. Receive Path**

Optical data is received at the OC3 Transceiver as a 1310 nm, 1550 nm, 1471 nm, 1491 nm, 1511 nm, 1531 nm, 1551 nm, 1571 nm, 1591 nm, or 1611 nm wavelength (depending upon installed SFP module). The optical signal is converted to an electrical differential signal. A clock and serial data are recovered. The recovered clock is phase-aligned with recovered serial data.

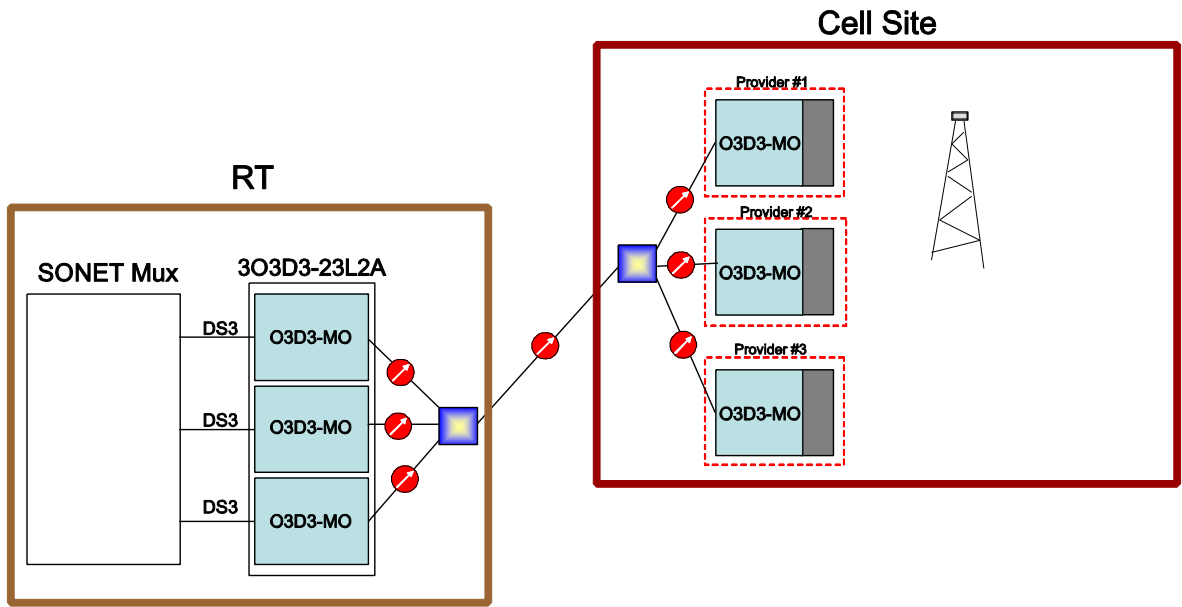


Figure 2. Typical O3D3-MO Applications – Cell Site DS3 Transport from an RT

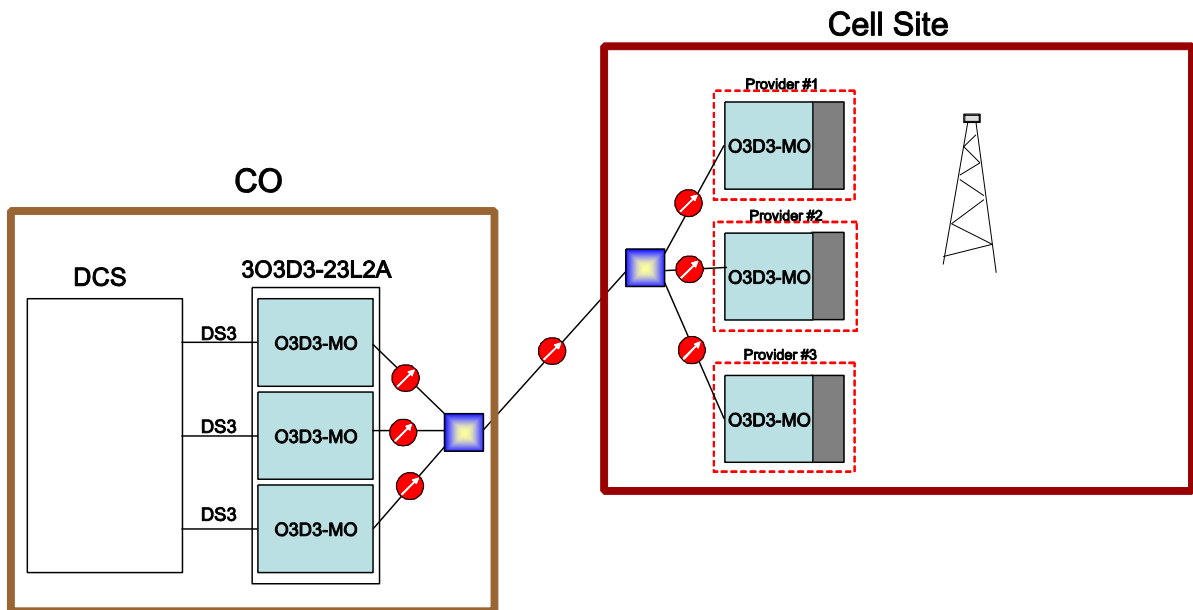


Figure 3. Typical O3D3-MO Applications – Cell Site DS3 Transport from a CO

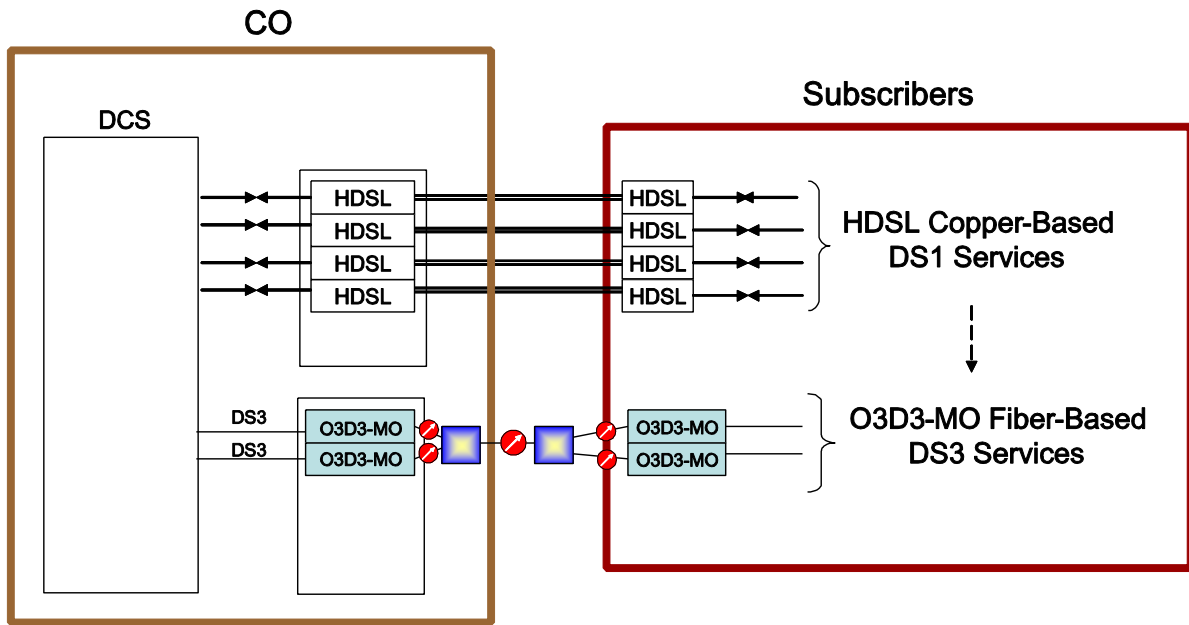


Figure 4. Typical O3D3-MO Applications – Transition to DS3

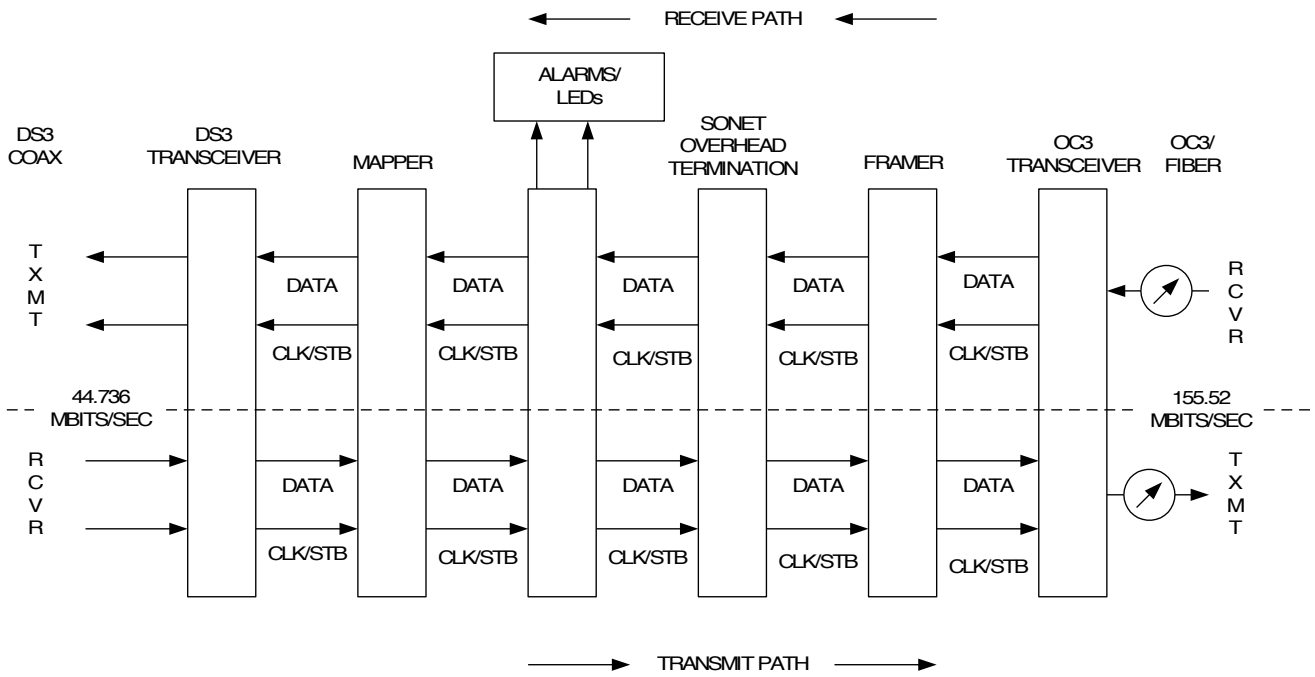


Figure 5. O3D3-MO Functional Block Diagram

Optical signal synchronization is established when the Framer has located and locked on to the Synchronous Transport Signal (STS-1) framing pattern. Should there be a loss of frame synchronization, an alarm would be generated.

The recovered data contains payload as well as Section, Line, and Path Overhead (POH). The Section and Line Overhead are collectively considered Transport Overhead (TOH). TOH processing takes place by the processing of the B2 byte, Bit Interleaved Parity (BIP-8), and Line Far-End Block Error (FEBE). Finally, a detection of Line Remote Defect Indication (RDI) and Line Alarm Indication Signal (AIS) is performed.

Pointer tracking is performed by analyzing the H1/H2 bytes to determine the location of the J1 POH byte. Loss Of Pointer (LOP) and AIS alarms are provided for the STS-1 #1 signal. The B3 BIP-8 is checked for parity, and the number of bit or block errors is counted. The G1 byte is checked, and RDI status and the number of FEBEs are counted. All Section and Line Overhead bytes are processed at this time.

The DS3 data located in STS-1 #1 is extracted and passed into a resynchronization block, where it uses a Phase-Lock Loop (PLL) to transmit data into a synchronous DS3 format. A reference clock is used to remove systematic jitter, and Bipolar 3-Zero Substitution (B3ZS) encoding takes place.

## **B. Transmit Path**

The transmit path receives incoming DS3 data, reformats it into an STS-1, and presents it to the optical interface circuitry. All overhead is processed in this path as well.

B3ZS-encoded data is received and reformatted into a serial bit stream. The serial data is passed to a PLL to recover clock. The B3ZS signal is decoded, and coding violations are detected.

The DS3 signal is converted to parallel data, mapped into an STS-1 signal format, and placed into the STS-1 #1 location. POH bytes are appended to the frame. FEBE and Path RDI can be inserted, depending upon the status of local alarms.

Data is clocked into an expansion buffer to decouple the data. Data is relocked by a 155 MHz clock, scrambled, and presented as a differential signal to the OC3 Transceiver.

The OC3 Transceiver receives differential clock and data, and converts it to a 1310 nm, 1550 nm, 1471 nm, 1491 nm, 1511 nm, 1531 nm, 1551 nm, 1571 nm, 1591 nm, or 1611 nm optical signal (depending upon installed SFP module). Data and clock are combined and transmitted at an OC3 rate.

## 4. ALARMS

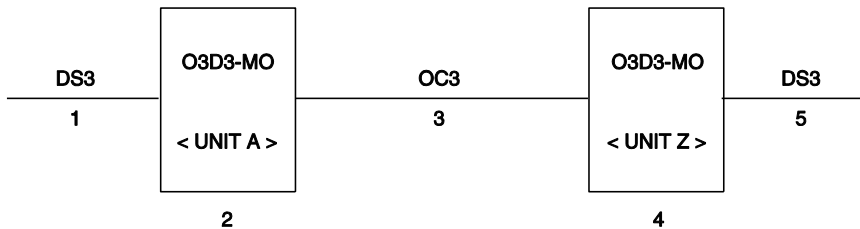
Table 2 and Table 3 provide O3D3-MO alarm contact information. See Figure 6.

**Table 2. O3D3-MO Alarm Contact Definitions**

Lead	Pin	Alarm Indication
T R	7 13	Contact closure between these leads indicates OC3 alarm
T1 R1	41 47	Contact closure between these leads indicates DS3 alarm
<b>NOTE:</b> Simultaneous T/R and T1/R1 contact closures indicate internal unit failure, OC3 and DS3 alarms, or loss of power.		

**Table 3. O3D3-MO Alarm Contact and Signal Insertion Matrix**

Fail Point (Figure 6)	O3D3-MO A		O3D3-MO Z		DS3 Output Signal
	T/R	T1/R1	T/R	T1/R1	
—	Open	Open	Open	Open	Transparent DS3 (normal state)
1	Open	Closed	Open	Open	Blue signal (AIS) on unit Z DS3 out
2	Closed	Closed	Open	Open	Blue signal (AIS) on unit A and unit Z DS3 out
3	Closed	Open	Closed	Open	Blue signal (AIS) on unit A and unit Z DS3 out
4	Open	Open	Closed	Closed	Blue signal (AIS) on unit A and unit Z DS3 out
5	Open	Open	Open	Closed	Blue signal (AIS) on unit A DS3 out
2 Power Fail	Closed	Closed	Closed	Open	Blue signal (AIS) on unit Z DS3 out
4 Power Fail	Closed	Open	Closed	Closed	Blue signal (AIS) on unit A DS3 out
1 and 3	Closed	Closed	Closed	Open	Blue signal (AIS) on unit A and unit Z DS3 out
3 and 5	Closed	Open	Closed	Closed	Blue signal (AIS) on unit A and unit Z DS3 out



**Figure 6. O3D3-MO Reference Circuit Configuration**



## 5. INSTALLATION

### DANGER

*The O3D3-MO employs Class 1 laser products. To avoid injury, do not look directly into the optical transceiver or into the fiber cable. Note that the light is invisible; the optical signal cannot be detected by the eye.*

### WARNINGS

1. *This unit includes components that are susceptible to damage from static electricity. DO NOT handle units without protection from electrostatic discharge (ESD).*
2. *When not in use, optical connectors **must** be covered by dust caps to keep airborne particles off connecting surfaces and to preserve optimum performance.*
3. ***Always** clean fiber plugs with an approved fiber-cleaning product, following appropriate procedures, before plugging the fiber into the O3D3-MO.*
4. *Use a 15 dB optical attenuator when connecting an O3D3-MO optical output to the input. This precaution is not necessary if a Pulsecom SFP-OC3-1310-19 transceiver is installed.*
5. *Use a 15 dB optical attenuator in the OC3 path when connecting to OC3 test equipment.*

The O3D3-MO complies with Part 15 of the Federal Communications Commission (FCC) rules when used in the recommended mountings and installed as described in this manual. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.

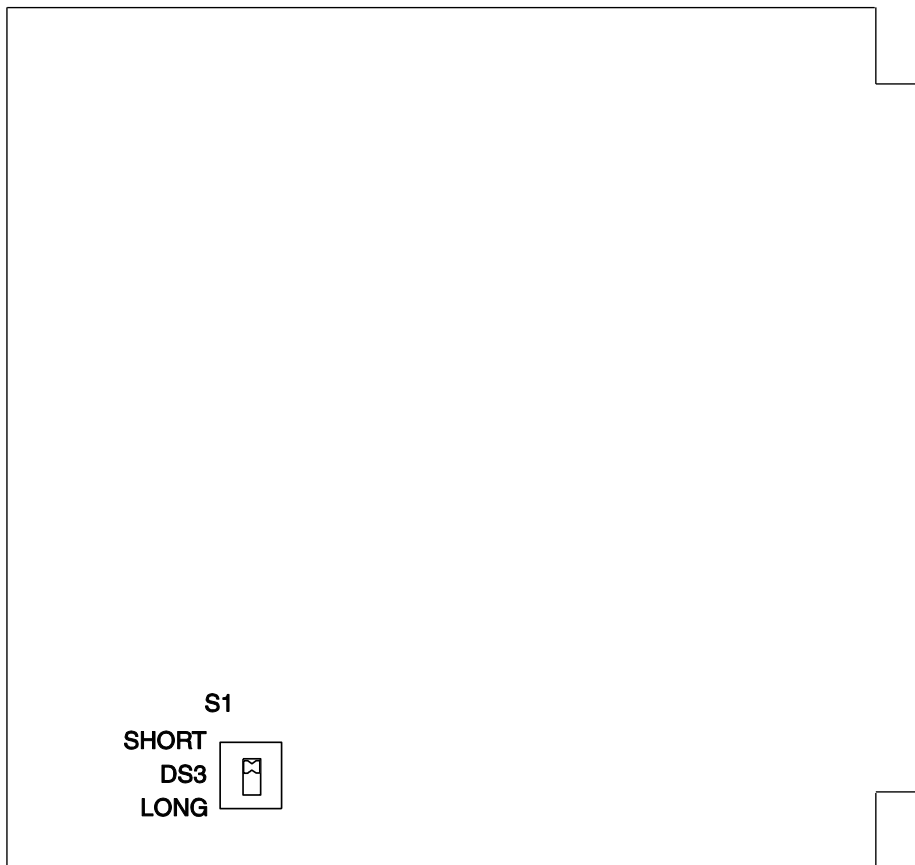
Per GR-1089-CORE June 2006, Section 9.8, the battery return (BR) of this unit does not have any internal connection to the unit's frame and, therefore, may be used in either DC-C (common bonding and grounding systems) or DC-I (isolated bonding and grounding systems). The chassis ground wire must be at least as large as the wire used for the BR.

Following ESD procedures, carefully plug the desired SFP optical transceiver into the O3D3-MO front-panel connector until it snaps into place. The connectors and indicators will then appear as shown in Figure 1 and described in Table 4.

Switch S1 on the printed circuit board selects the DS3 loop length, as shown in Figure 7. Use the SHORT position for 0 to 100 feet of coax cable or the LONG position for 100 to 450 feet of coax cable. It is recommended that small-diameter coax cable, such as 734 or 735, be used to construct the DS3 cables that attach to the front-panel BNC connectors. Type 734 and 735 coaxes, which are designed for DS3 transmission, allow for a smaller cable bend radius when installing the unit in tight quarters.

**Table 4. O3D3-MO Front-Panel Indicators and Connectors**

Indicator	Function	
OC3	Lights green to show normal OC3 link operation Lights red to show OC3 link failure	
DS3	Lights green to show normal DS3 link operation Lights red to show DS3 link failure	
UNIT	Lights green to show normal unit operation Lights red to show unit failure	
Connector	Function	Type
DS3 IN	DS3 (T3) input	75-ohm male BNC
DS3 OUT	DS3 (T3) output	
OC3 OUT	Fiber output	Female LC
OC3 IN	Fiber input	



**Figure 7. Location of Switch on O3D3-MO Printed Circuit Board**

After setting switch S1, plug the O3D3-MO into the desired mounting shelf, such as the Pulsecom 3O3D3-23L2A. Observe the power supply polarity information provided in Figure 8.

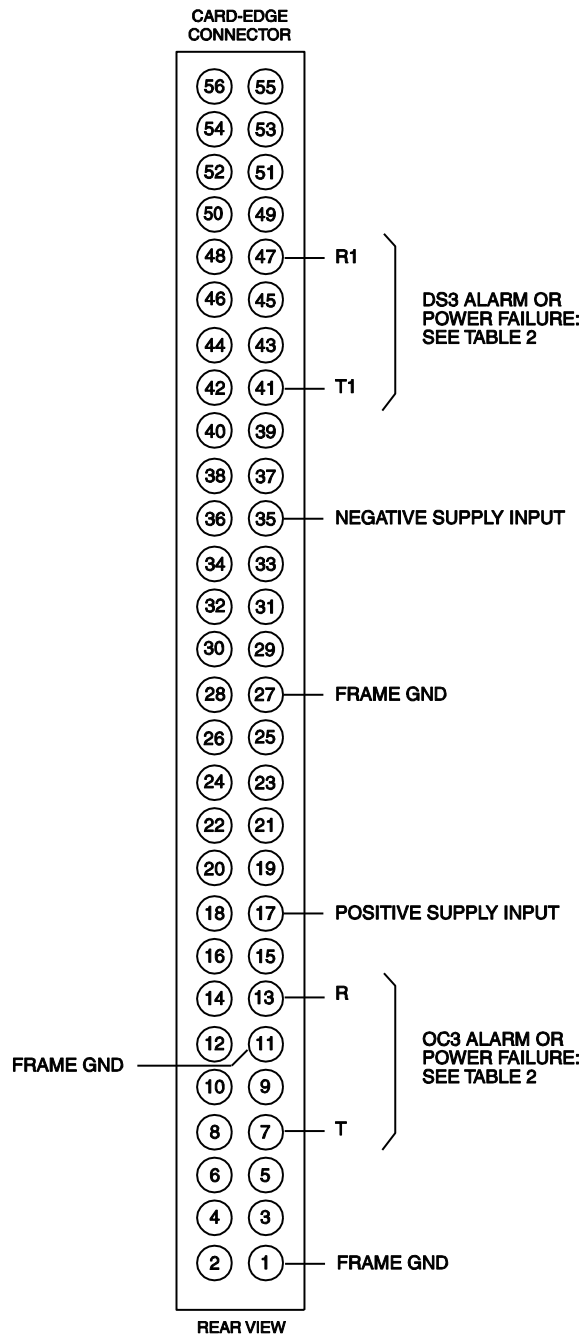


Figure 8. O3D3-MO Backplane Connector Pin Assignments

## 6. SPECIFICATIONS

Table 5 lists the electrical and physical characteristics of the unit.

**Table 5. O3D3-MO Specifications**

Description	Specification
<b>A. DS3 Interface</b>	
Impedance	75 ohms
Connector Type	BNC, male
DS3 Cable Lengths for Coaxial Cable Types	
a) 728	450 feet maximum
b) 734 and 734A	450 feet maximum
c) 735 and 735A (0.13" outside diameter)	235 feet maximum
d) 9231	450 feet maximum
e) RG59 B/U (0.24" outside diameter)	335 feet maximum
f) RG59 with messenger wire	Not recommended
g) Universal Triax (0.16" outside diameter)	Not recommended
<b>B. Optical Interface</b>	
Optical Bit Rate	155.52 MHz, $\pm 20$ ppm
Nominal Optical Wavelength (Depending Upon Installed SFP Module)	1310, 1550, 1471, 1491, 1511, 1531, 1551, 1571, 1591, or 1611 nm
Optical Receiver Sensitivity	-34 dBm, minimum
Maximum Optical Input and Output Levels	See Table 1
Optical Link Loss Budget	See Table 1
Optical Receive Monitoring	Loss Of Signal (LOS), Loss Of Frame (LOF), Alarm Indication Signal (AIS), Remote Defect Indication (RDI)
Isolation Between Fibers	25 dB, minimum
FDA Laser Classification	Class 1
Optical Connectors	LC, female
<b>C. Power Requirement</b>	
Maximum Current	
a) At -48V	80 mA
b) At +24V or -24V	160 mA
Voltage Range, Absolute	21.0 VDC to 56.7 VDC
Power Dissipation, Nominal	3.5 watts
<b>D. Environmental</b>	
Temperature Range, Operating and Storage	-40° to +70°C
Relative Humidity, No Condensation	10% minimum to 95% maximum
Size (height $\times$ width $\times$ depth)	5.59 $\times$ 0.675 $\times$ 5.977 inches
Weight	5.5 ounces (157 grams)

## 7. MAINTENANCE

In case of equipment malfunction, check the front-panel indicators. Reference Table 4.

If an optical connector exhibits transmission loss, clean it carefully using approved fiber-cleaning methods and materials.

Figure 8 shows backplane connector pin assignments.

## 8. CUSTOMER SERVICE

Direct questions concerning the operation of the unit to Technical Support. If the unit is defective, limit field repair to replacement of the plug-in module or SFP transceiver. Obtain repair services by returning the defective unit to the Engenuity/Pulsecom Repair Department, 3545 Stern Avenue, St. Charles, IL 60174; email [sales@engenuitycom.com](mailto:sales@engenuitycom.com).

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