
OPTICAL

SYSTEMS

DESIGN

OPERATOR MANUAL

OSD1250

SELF HEALING RING

DUPLEX DATA TRANSCEIVER

OPTICAL SYSTEMS DESIGN

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1 TECHNICAL SUMMARY

1.1 BRIEF DESCRIPTION

1.1.1 OVERVIEW

The OSD1250 is a small, self-contained optical modem designed to interconnect Bus Master/Slave Data Terminal Equipment either in bus or ring topologies using dedicated optical fibers. Data link networks of hundreds of kilometres can be achieved when using singlemode fiber, with a maximum spacing between optical modems of 30km. Polled Data protocols are normally used to determine data traffic flow and will only be limited by the propagation timing throughout the network.

The OSD1250 has data interfaces for RS232, RS422, RS485 (2 wire), and RS485 (4 wire). Anti-streaming logic, which is set to 300ms detection time, prevents a faulty data transmission from hogging the network. The anti-streaming logic can be turned off for RS232 and RS422 thus allowing very low data rate or DC level to be transmitted.

This system operates by sampling the incoming data from one of the data interface at a high rate, encoding it and transmitting over the fiber. Each subsequent modem simply regenerates this encoded signal so that pulse distortion does not depend on the number of units in series. Consequently, an OSD1250 based system can have as many modems in series as required to cover all likely situations.

Each OSD1250 within a network monitors the status of adjacent units to determine the 'health' of the network. This information is used to determine the default data traffic direction. The direction will automatically be changed if necessary in a redundant ring when a network fault occurs.

The OSD1250 is available in two physical configurations: card or module. The card versions are designed to fit the 3RU-high 19" OSD370N chassis (or OSD350N chassis) which allows multiple OSD card products to be conveniently powered from and located in the one chassis. The module case versions are intended for isolated use which is mounted on a flat surface and require an external power source. The OSD1250 operates from an unregulated DC supply of +9 to 30V_{DC} @ 6VA.

1.1.2 APPLICATIONS

- ▲ Industrial networks using RS422 or RS485 based programmable logic controllers
- ▲ Transportation communications
- ▲ Access control systems
- ▲ Fire and alarm systems
- ▲ Building automation

1.1.3 FEATURES AND BENEFITS

- ▲ 2 and 4-wire RS485, RS422 or RS232 operation
- ▲ Extends module separation to several kilometers of multimode fiber and to over a hundred kilometers of singlemode fiber
- ▲ Compatible with all common fiber sizes
- ▲ Available in redundant Ring and Bus configurations
- ▲ Complete end-to-end isolation with up to 40 units in series
- ▲ DIN rail or surface mounting
- ▲ Built-in test features
- ▲ Safe transmission in hazardous environments
- ▲ Immune to electrical interference
- ▲ Extremely robust electronics and packaging designed for severe industrial environments
- ▲ Full duplex, asynchronous, DC to 2Mbps
- ▲ Powered by non-critical 9 to 30VDC supplies

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1.2 TYPICAL DESIGN APPLICATION

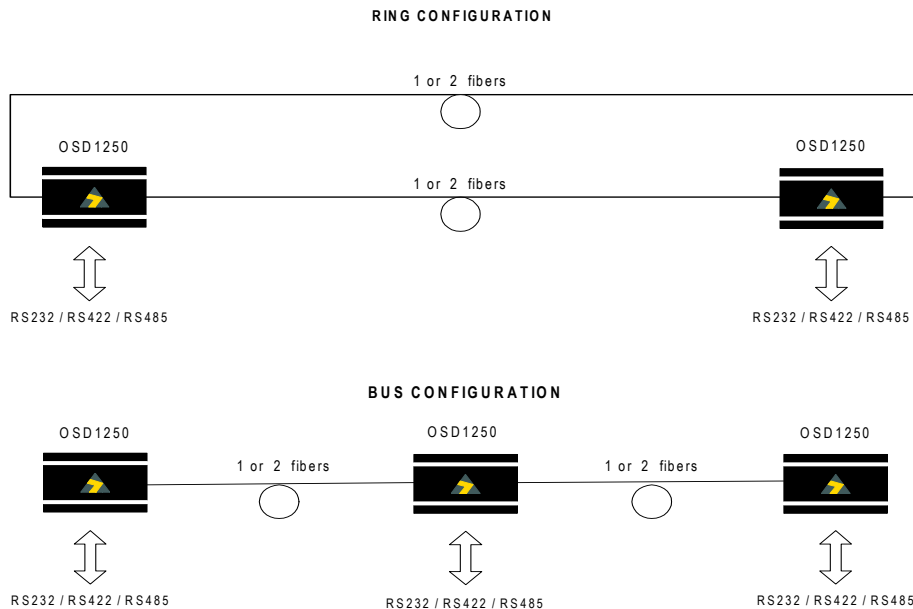


FIGURE 1: OSD1250 TYPICAL DESIGN APPLICATION

1.3 THEORY OF OPERATION

A simplified block diagram of the OSD1250 is shown in Figure 2.

The unit is designed to operate either in bus or ring topologies (see Figure 9 & Figure 10).

In all cases only one unit in the network is designated the Bus Master and acts as both the start and end of the bus/ring, i.e. signals do not pass through from Channel 1 to Channel 2 (and vice versa) as they do at the slaves.

In the case of a bus topology, the unit(s) located at the extremities of the system require only one Channel: the unused Channel is fitted with protective caps. Note that the Bus Master unit does not have to be at the extremity of the bus.

A further consideration is the need to ensure that faults don't cause the bus to be monopolised. This could be due to a software fault in a remote unit causing transmission or it may be a fault within the optical modem forcing a logical "1" to be continuously transmitted. The unit therefore has three anti-streaming (or anti-jabber) circuits, which inhibit transmission if the preset time limit of 300ms is exceeded and then enable transmission after the streaming signal is removed. The OSD1250 removes a streaming signal for a minimum of 1 second. This ensures that a faulty unit cannot monopolise the bus for more than 30% of the time. The OSD1250 does not require any special settings for user data rates from 300bps to 2Mbps (25% distortion max). The OSD1250 is best suited to polled data protocols.

A concern with systems like this which continuously regenerate the signals is that system timing can be lost or degraded if an intermediate unit fails. The OSD1250 overcomes this by having a fixed crystal oscillator at each node. When the incoming data exhibits either a very high bit error rate (this rate is around 1×10^{-2}), or the incoming optical signal is lost, the associated transmitter's timing is switched over to the fixed oscillator and the receiver recovered clock is also stabilised with the fixed oscillator.

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The primary method of managing data traffic is the use of RTS/DCD. In RS232 and RS422, the RTS signal envelopes the user data. In RS485, a voltage 'window' comparator is used to detect when the copper pair is driven out of the idle state. The output of window comparator is used to provide a pseudo RTS signal. The RTS signal is used to enable data buffers at the remote end as DCD.

The OSD1250 data interface is via a high density DB26 female connector. Essential modem control signals are available as RS232 or RS422 signals. Translation between RS232 and RS422 is possible. The OSD1250 generates Data Set Ready only when it detects the adjacent units are in their correct operating state. The OSD1250 does use Data Terminal Ready as true input to determine if DTE is operational. If user hardware does not use DSR/DTR then a wire link should be used between these 2 signals on the interface connector.

Data received from the fiber is sent to the receiver outputs and tri-stated or continuously driven depending on each mode. Output signals from the interface like DSR are only 'true' if the OSD1250 links are operational,

The Net Error signal has been included to indicate a Link failure. It can be used to energise a relay for normal operation. A network or power failure will cause a relay to be de-energised. The maximum rating for relay is 30V at 100mA.

The receivers will deliver the correct idle logic state output without any signals connected at inputs. MOV and diode protection is included on all outputs.

1.4 FRAME STRUCTURE

The simplest and most robust way of transmitting the data over the fiber is to encode it using methods like Bi-phase or Manchester coding. This enables simple and effective timing recovery and bit error monitoring over the link.

The OSD1250 uses a 32MHz primary clock. The data is transmitted as manchester encoded data at 16Mbps. The high speed sampling of user data is at 8Mbps. The remaining 8Mbps is further divided into a 4Mbps channel for sampling RTS and 8 channels each at 0.5Mbps. The 0.5Mbps channels are used for synchronisation, network status bits, and three low speed data channels.

The frame is multiplexed such that user data is sampled every second bit. Every second alternate bit is RTS/DCD. The remaining bits reflect the 8 channels at 0.5Mbps.

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1.5 PRODUCTS AND OPTIONS

There are various options available for the OSD1250 as identified in Table 1 below:

OSD1250 L C W * (example only)

1 2 3 4

TABLE 1: PRODUCTS AND OPTIONS

1	ITEM	DESCRIPTION
	-	Multimode operation
	L	Singlemode operation

2	ITEM	DESCRIPTION
	-	Card version (3RU high chassis mount for OSD370 or OSD350)
	C	Stand-alone module version

3	ITEM	DESCRIPTION
	-	Standard (2 fiber per channel)
	W	WDM version (1 fiber per channel)
	R	Special Contact Closure Version

4	ITEM	DESCRIPTION
	*	Ground Isolated
	*	Special Railway Application

* Notes: Both Ground Isolated and Special Railway Application versions are identical products which needed customer specific naming requirements. The 0V power input and the data ground (from the DB26 connector) are connected to the internal ground but isolated from the optical connectors and chassis/case ground.

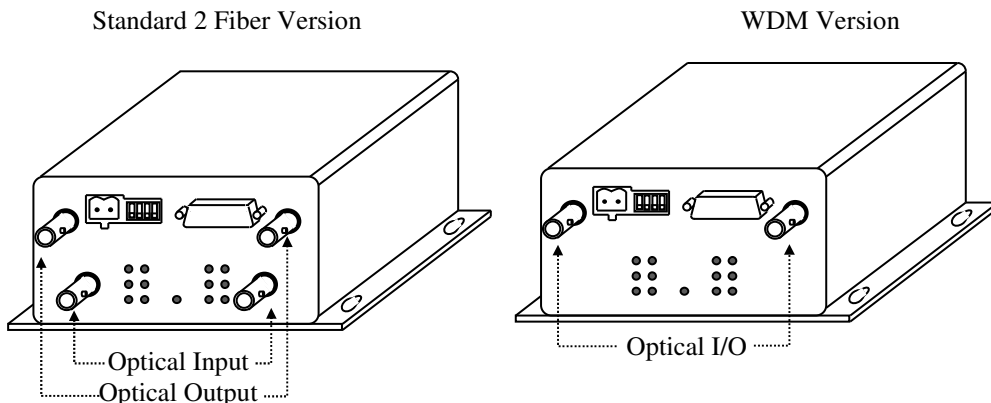


FIGURE 3: OSD1250 VERSIONS

OPTICAL SYSTEMS DESIGN

1.6 TECHNICAL SPECIFICATIONS

TABLE 2: TECHNICAL SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Electrical	
Data Interface	RS232,RS422,RS485 2 WIRE, RS485 4 WIRE
Electrical Connector	HDB26
Data Rate	DC to 2Mbps
Bit Error Rate	$< 1 \times 10^{-9}$
Alarms	Network Failure
Alarm Interface	Open drain MOSFET rates at 200mA @ 50V max
Optical	
Optical Wavelength	1300nm (850nm and 1550nm are optional)
Optical Connectors	ST Standard
Transmit Power	-12 to -6dBm
Receive Sensitivity	$< -35\text{dBm}$
Receive Saturation	$> -5\text{dBm}$
Receiver Fail Indication	$< -39\text{dBm}$ to -41dBm
Indicators	
Copper Transmit Data Present	Amber (1 Only)
Receiver Optical Signal Ok	Green/Red (2, 1 per port)
Receiver Sync Ok	Green/Red (2, 1 per port)
Laser Ok	Green/Red (2, 1 per port)
Receiver Data Present	Amber (2, 1 per port)
Receiver Bit Error	Red (2, 1 per port)
Transmitter Switched to Local Crystal	Red (2, 1 per port)
Packaging and Environmental	
Dimensions (mm) excluding flanges and connectors	104W x 144D x 40H (Module) 128W x 142D x 50H (Card)
Weight	350g (card), 500g (module)
Operating Temperature	-20°C to 70°C
Relative Humidity	0 to 95% non-condensing
Power Requirements	+9 to 30V _{DC} @ 6VA

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2 INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section briefly outlines the steps required to install and operate the OSD1250 successfully. It should be studied carefully to avoid undue damage to the equipment and poor operation.

This equipment has been fully tested before dispatch and is ready for immediate operation. However, it is advisable to check for external transportation damage before operation. If damage is present, return the unit and packing to the supplier immediately.

2.2 INSTALLATION

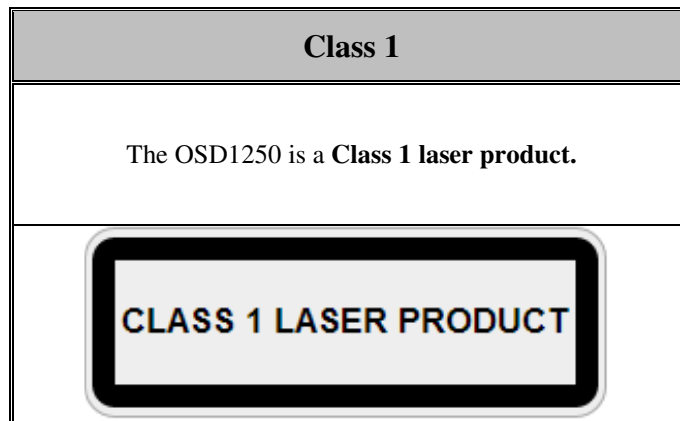
2.2.1 WARNING AND PRECAUTIONS

▲ ELECTROMAGNETIC COMPATIBILITY

WARNING: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

▲ OPTICAL OUTPUT OPERATION

WARNING: Laser Safety: Class 1 Laser Product per IEC/EN 60825-1:2014 standard.



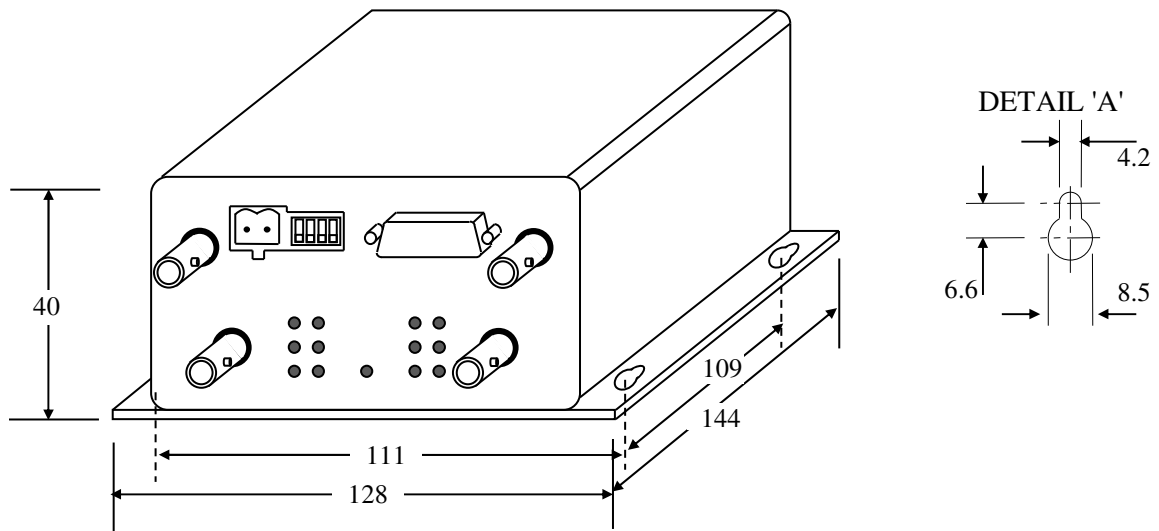
PRECAUTIONS

- ▲ All service personnel should be provided training as to the hazards of direct viewing of laser radiation and of the precautionary measures during servicing of equipment
- ▲ Areas where laser products are installed should be restricted in access to trained service personnel only and appropriate warning signs posted in the work area.
- ▲ All laser apertures should be covered by protective covers when not connected to optical fibers. Never leave outputs uncovered.
- ▲ Laser equipment should be positioned above or below eye level where possible. Apertures should be positioned away from personnel.
- ▲ Protective eyewear should be worn in the vicinity of laser equipment.

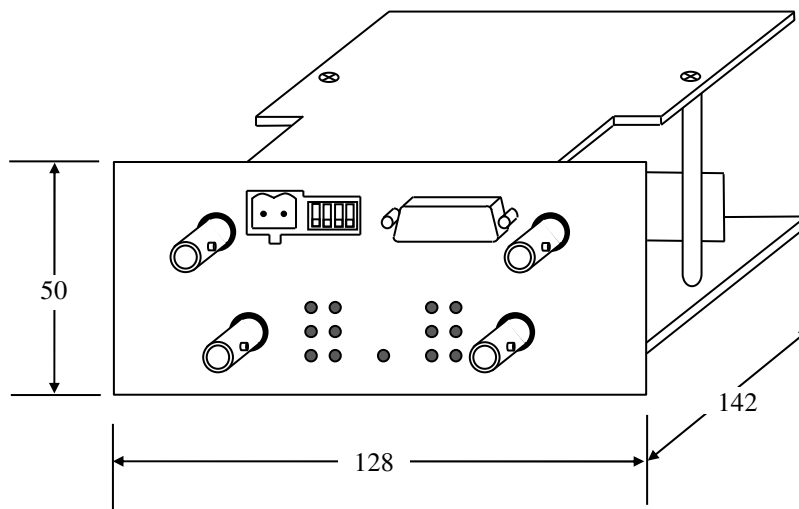
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2.2.2 DRAWINGS AND DIMENSIONS

The unit is designed to rest on a flat surface such as a modem tray or bench top or, via the optional mounting bracket onto a TS32 DIN rail. The card versions are designed to be inserted into an OSD370 or OSD350 chassis and secured by means of captivated screws.



(a) Module Version



(b) Card Version

FIGURE 4: MOUNTING DIMENSIONS

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2.2.3 POWER SUPPLY CONNECTIONS

The OSD1250 units are powered by +9V_{DC} to 30V_{DC} @ 6VA.

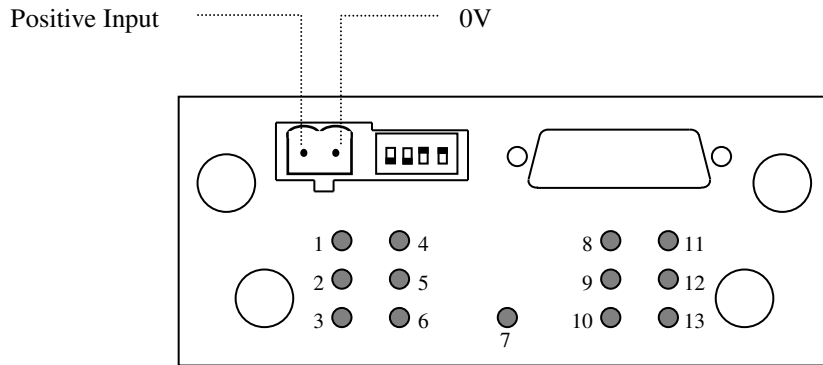


FIGURE 5: POWER SUPPLY CONNECTION

WARNING - Ensure that you are using the correct voltage!

The unit employs an internal resettable solid state fuse to protect both it and the power source in the event of a fault in the modem's internal power supply.

The OSD1250 card version requires DC power which is connected via a DB9 connector and supplied by the OSD370N or OSD350N chassis. The card should be fixed into the chassis using the captivated screws. The cards can be plugged in or out of the chassis with power on or off.

2.2.4 SWITCH SETTINGS

In the context of the following switch settings for the module version the ON position is UP and the OFF position is down.

The term AS refers to Anti-Streaming.

The BIAS switch SW2 is dual function and only generates BIAS in RS485 modes.

MODE	SW1	SW2	SW3	SW4
		RS485 BIAS		
MASTER	ON			
SLAVE	OFF			
RS232 WITH AS		OFF	OFF	OFF
RS422 WITH AS		OFF	OFF	OFF
RS232/422 NO AS		ON	ON	OFF
RS485 2 WIRE		AS REQUIRED	ON	ON
RS485 4 WIRE		AS REQUIRED	OFF	ON

TABLE 3: SWITCH SETTINGS

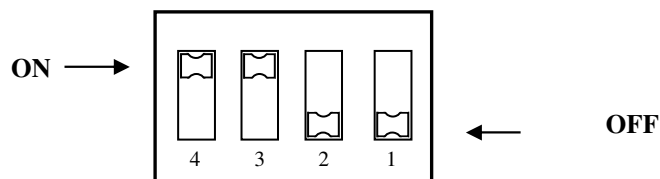


FIGURE 6: SWITCH SETTINGS

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2.2.5 DATA I/O CONNECTION

The OSD1250 Interface Card uses HDB26 connector. The data formats supported are RS232, RS422, RS485, and RS485 4-wire.

Signal	RS232 Pin	RS422 Pin*	RS485 Pin*	RS485 4W Pin*
GND PIN 1	1	1	1	1
TXD2	2			
RXD2	3			
RTS2	4			
CTS2	5			
DSR2	6			
GND PIN 7	7	7	7	7
DCD2	8			
DSR+		9		
485_4WR+				
DTR-		11		
DTR+		12		
485_2W+		13 TX+	13	13 TX+
RXD+		14 RX+		14 RX+
RTS+		15		
CTS+		16		
DCD+		17		
DSR-		18		
485_4WR-				
DTR2	20			
485_2W-		21 TX-	21	21 TX-
RXD-		22 RX-		22 RX-
RTS-		23		
CTS-		24		
DCD-		25		
NET ERROR	26	26	26	26

TABLE 4: DATA I/O CONNECTION

For RS232 without anti-streaming five connections are required being TXD2, RXD2, GND.

DSR2 needs to be connected to DTR2 if the user equipment does not generate DTR.

All modes support NET ERROR as an open drain output.

* Not available on contact closure versions

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2.3 ALARMS

The OSD1250 has an open drain MOSFET rated at 200mA @ 50V max on pin 26 of the DB26 connector. Output at pin26 is 0Ω when unit is powered and ring/bus fiber link present. The output at pin26 becomes high impedance on all units on ring/bus when any fiber link is broken or the unit is off along the ring/bus. The output can be connected to a relay coil as shown.

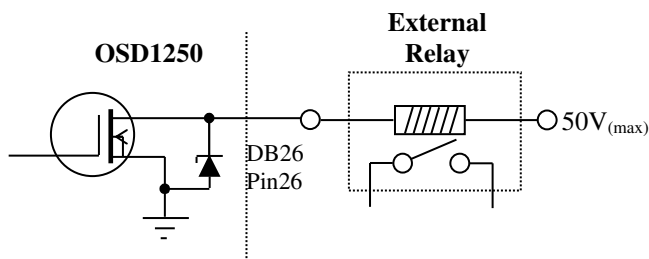


FIGURE 7: ALARM OUTPUT

2.4 FIBER OPTIC CABLE CONNECTION

The OSD1250 supports all commonly available multimode and singlemode optical fibers. Remove the protective caps from the optical output and optical input ports.

Before inserting the optical connectors ensure they are free from any contamination. If they need cleaning use alcohol and lint free tissues. Connect the already terminated cables to the output/input ports. Ensure that the optical output port of one OSD1250 connects to the optical input port of an OSD1250 at the other end.

Remember that the optical transmit channel of one modem connects to the optical receive channel of the next unit of the system and vice versa.

Figure 9 shows the set up for a typical bus configured system and Figure 10 shows a typical ring configured system.

TABLE 5: OPERATING WAVELENGTHS

Product Description	Channel 1		Channel 2	
	Optical Input	Optical Output	Optical Input	Optical Output
OSD1250L	1310nm	1310nm	1310nm	1310nm
OSD1250LC	1310nm	1310nm	1310nm	1310nm
OSD1250	850nm	850nm	850nm	850nm
OSD1250C	850nm	850nm	850nm	850nm
OSD1250L.W	1550nm	1310nm	1310nm	1550nm
OSD1250LC.W	1550nm	1310nm	1310nm	1550nm

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2.5 LED INDICATOR FUNCTIONS

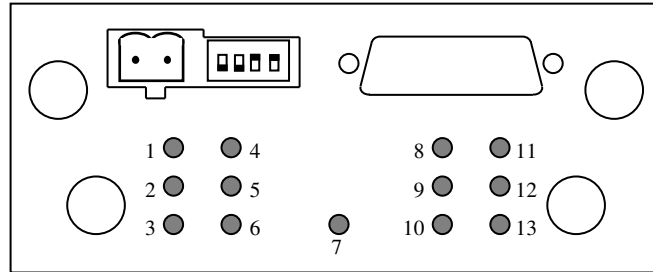
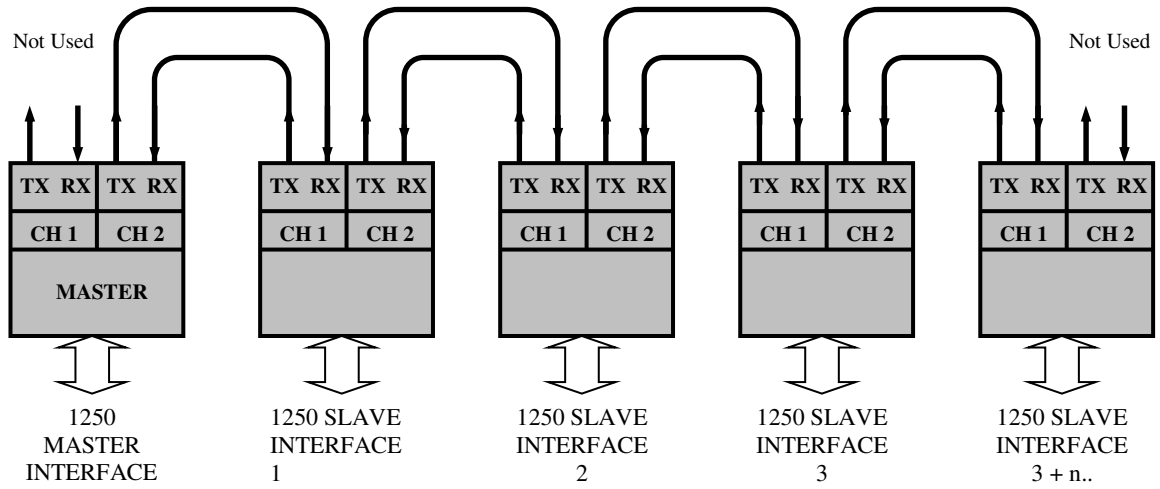


FIGURE 8: FRONT PANEL LED INDICATORS

TABLE 6: LED INDICATOR FUNCTION

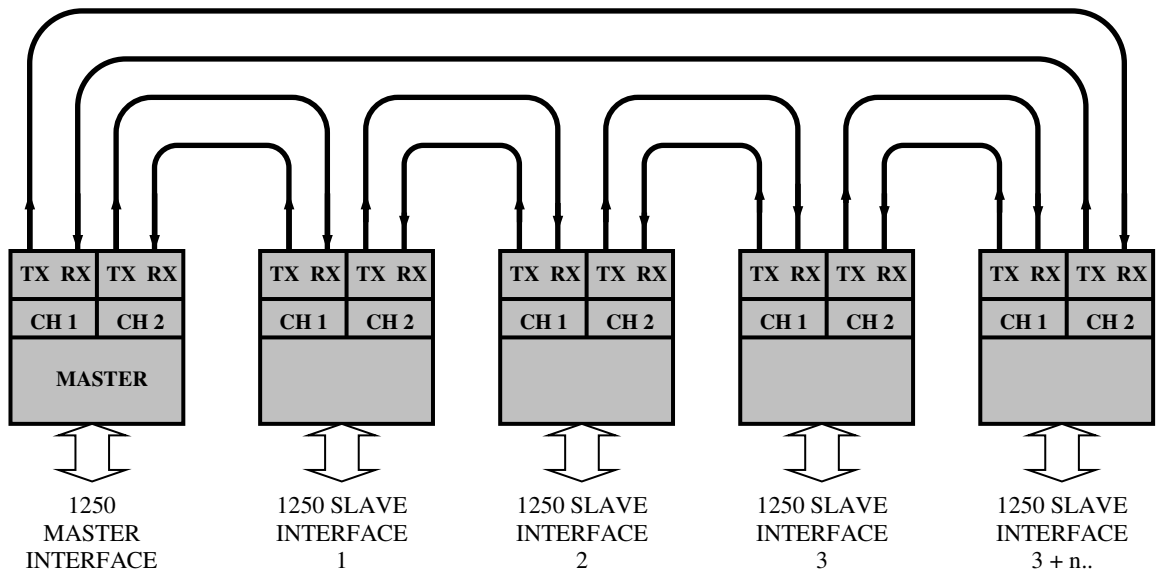
LED No		LABEL	LED COLOUR	FUNCTION
CH 1	CH 2			
1	11	Rx LOS	Green	Optical signal is received
			Red	Loss of Optical Signal
2	12	Link OK	Green	Receiver Data Link is locked onto data frame
			Flashing	Next slave does not detect master in network, bus or fault
			Red	Data Link frame not locked
3	13	Laser OK	Green	Laser function is OK
			Red	Laser function is not working correctly
4	8	RxD	Orange	Receiving from fiber channel and transmitting to copper
			Off	Not receiving User Data
5	9	Bit Error	Red	Receiver is detecting bit errors in Data Link frame
			Off	No bit errors are present.
6	10	Slave TxC	Red	Receiver Link OK is false or Loss of Optical Signal
			Off	When set as a Master or as Slave and repeating User Data
7		TxD	Orange	Optical data is transmitted to fiber from copper
			Off	No data is being transmitted to fiber

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In WDM systems only one fiber connects between adjacent units.

FIGURE 9: BUS CONFIGURED SYSTEM



In WDM systems only one fiber connects between adjacent units.

FIGURE 10: RING CONFIGURED SYSTEM

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2.6 SPECIAL CONTACT CLOSURE VERSION

The OSD1250LC.R versions (only available at time of order) has one contact closure channel which makes use of the RS422/RS485 data channel. Note: Only RS232 data is available for this version. THE CONTACT CLOSURE INPUT IS CONTROLLED AT THE MASTER UNIT (PIN 21 ON THE DB26 CONNECTOR). TO OPERATE THE CONTACT CLOSURE, THE INPUT SHOULD BE SWITCHED TO GROUND (SEE

Figure 11).

The contact closure common output is on Pin14 while the normally open contact is connected to Pin22 of the DB26 connector. Maximum ratings the OSD1250LC.R relay can drive is 120mA @ 350V_(max).

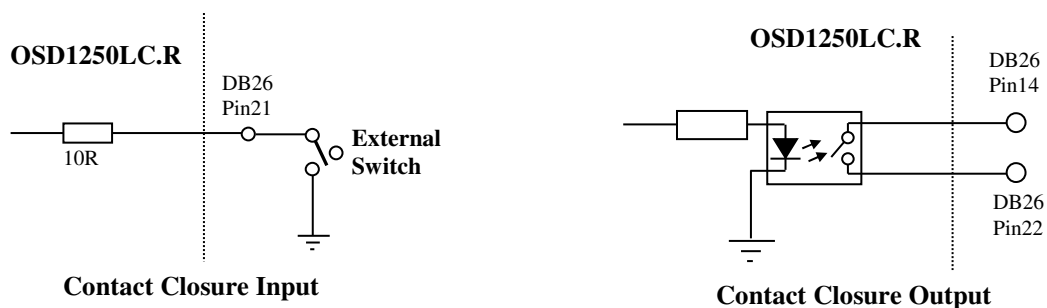
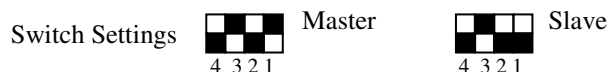


FIGURE 11: CONTACT CLOSURE INPUT/OUTPUT

2.6.1 CONTACT CLOSURE OPERATION

Dip-switch setting for the master and slave nodes:



When the Master unit input is open the default status of all the contact closure outputs on the ring (or bus) is also normally open.

When the Master unit input is closed (Pin21 is Ground), an activating signal is transmitted to all the outputs of the slave OSD1250LC.R on the ring (or bus) to close the contact closure.

Fail-safe mode

- In the event of the Master unit failing, all the contact closure outputs of the slave nodes on the ring (or bus) will be in normally open position.
 - Since the contact closure action is momentary and not latching, if the Master unit fails, regardless of the current status of the input (i.e. grounded [closed] or not grounded [open]), all the contact closure outputs of the slave nodes on the ring (or bus) will be in normally open position.
- If any slave node becomes isolated from the network due to power failure or fiber disconnection, regardless of the current status of the input (i.e. grounded [closed] or not grounded [open]), the contact closure output of only that slave node will be in normally open position without influencing the functionality of the other nodes.

When the input condition is changed back to open, all the contact closure outputs on the ring (or bus) is also normally open - i.e. Contact closure action is momentary and not latching.

3 MAINTENANCE

The following section briefly outlines the faultfinding procedures for the OSD1250 modem. Please take note of the following:

Personnel without considerable technical training should not attempt any maintenance other than that outlined below.

If further maintenance is attempted than which is outlined below, you are warned that every care should be taken to ensure that internal measurements made while the equipment is running are taken carefully. Some components are extremely expensive and can be damaged by failure of any part of their support circuitry.

3.1 EXTERNAL INSPECTION

Visually check the following:

- ▲ Inspect the optical connectors and give them a clean before reinsertion.
- ▲ Check that the power wiring has been correctly terminated and that the correct power source has been selected.
- ▲ Check that the data connector wiring has been correctly terminated, and the Master selection switch is set where required
- ▲ Check that the status LEDs illuminate as expected in accordance with Table 5.
- ▲ Check that the correct optical power levels are present at both receiver and transmitter ports.

3.2 ROUTINE MAINTENANCE

No routine maintenance is required for this equipment.

4 WARRANTY

Thank you for purchasing equipment designed, manufactured and serviced by Optical Systems Design (OSD). OSD warrants that at the time of shipment, its products are free from defects in material and workmanship and conforms to specifications. Our Warranty conditions are outlined below:

4.1 WARRANTY PERIOD

For warranty period, please call your local OSD distributor.

4.2 REPAIRS

Optical Systems Design reserves the right to repair or replace faulty modules/units. Please obtain a "Return Material Authorisation" (RMA) form and number before returning goods.

Goods must be returned in adequate packing material to Optical Systems Design, Warriewood or its nominated authorised representative, for all repairs.

4.2.1 WARRANTY REPAIRS

Return shipments to OSD shall be at customer's expense and freight back to the customer will be at OSD expense.

4.2.2 OUT-OF-WARRANTY REPAIRS

OSD reserves the right to repair or replace any faulty goods. Freight costs and insurance for both journeys are met by the user. All equipment repaired by OSD will have a 3-Month Warranty from the date of dispatch.

4.2.3 SITE REPAIRS

By agreement site repairs may be undertaken for which out of pocket, hotel and travel expenses will be charged.

4.2.4 EXCLUSIONS

This warranty does not apply to defects caused by unauthorized modifications, misuse, abuse or transport damage to the equipment. All modifications to OSD's standard product will need written authorization and will be charged at normal repair rates. All modifications are to be carried out by OSD Technicians. Warranty is void if unauthorized removal and/or tampering with serial number and/or labels is evident.

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