OPTIC▲L
SYSTEMS
DESIGN

OPERATOR MANUAL

OSD138

UNIVERSAL FIBER OPTIC DATA

MODEM

OPTICAL SYSTEMS DESIGN

INDEX

1   TECHNICAL SUMMARY

1.1   PRODUCT DESCRIPTION

1.1.1   OVERVIEW

The OSD138 is a high performance universal fiber optic modem capable of transmitting and receiving RS422, RS232 or RS485 full duplex, asynchronous data over distances of several kilometres at the speeds from DC to 1Mbps. The 6-way switch is used to configure the Data Mode and RS485 turnaround times.

The OSD138 is available in two physical configurations: card or module. The card versions are designed to fit the 3RU-high 19" OSD370 chassis (or OSD350 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 and require an external power source.

The OSD138 operates over up to 5km of standard low cost multimode fiber optic cable and over up to at least 50km of singlemode fiber.

The OSD138 can be used with any standard multimode optical fiber, and is available optionally for singlemode fiber use. Wavelength Division Multiplexing (WDM) is available to allow the use of a single fiber for transmission and reception. For 2-wire RS485 transmission, the OSD138 is also available with Single Fiber Single Wavelength operation (SFSW) which will interoperate with the OSD155 RS485 modem.

1.1.2   APPLICATIONS

▲   Long distance RS422, RS232 or RS485 links

▲   Links requiring a module at one end and a card at the other

▲   Secure, noise immune government and industrial communications

1.1.3   FEATURES AND BENEFITS

▲   Multi-protocol operation

▲   2 and 4-wire RS485, TTL, RS422, Manchester, Biphase or RS232 operation

▲   Extends link lengths to 5km on multimode and over 50km on singlemode fiber

▲   Full duplex, asynchronous, DC to 1Mbps

▲   Plugs directly into the OSD370 or OSD350 standard chassis (card version)

▲   ST optical connectors standard

▲   Safe transmission in hazardous environments

▲   More secure than copper cables

▲   Robust and reliable

1.2 TYPICAL CONFIGURATION
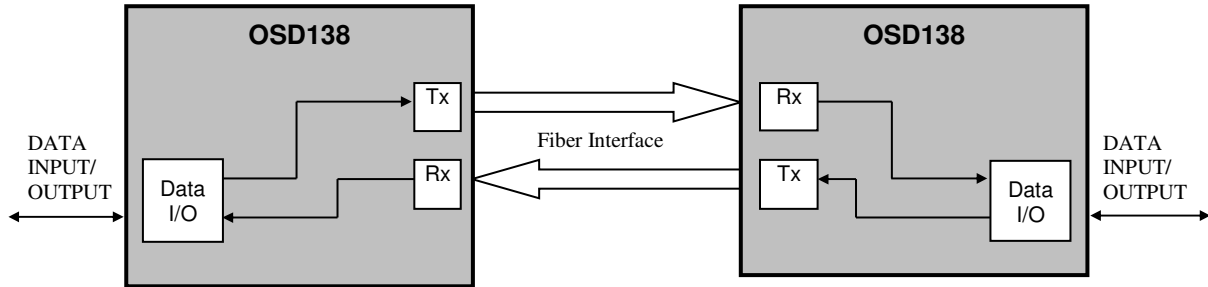
FIGURE 1: OSD138 TWO FIBER SYSTEM
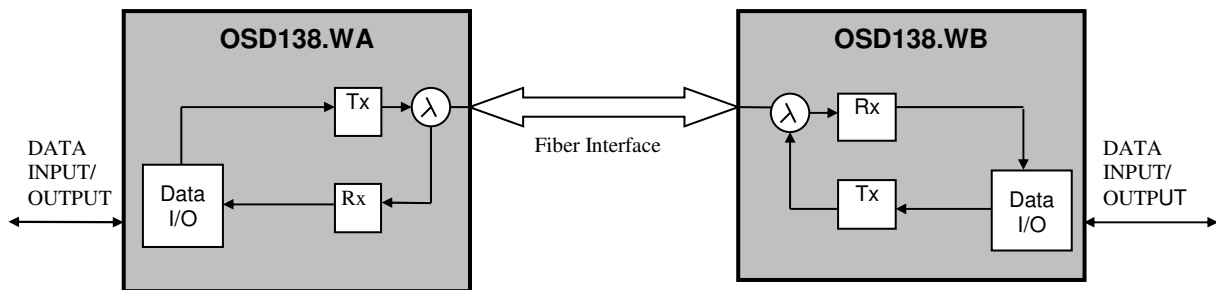
FIGURE 2: OSD138 SINGLE FIBER WDM OPERATION

1.3 PRODUCTS AND OPTIONS

The standard configuration options available for the OSD138 are described in Table 1.

TABLE 1: PRODUCT OPTIONS

OPTION	DESCRIPTION
C	Stand-alone Modem Case
L	Single mode operation
WA or C.WA	1-fiber Wavelength Division Multiplexed (WDM) multimode operation with Tx:850nm & Rx:1310nm, works in pair with WB or C.WB
WB or C.WB	1-fiber Wavelength Division Multiplexed (WDM) multimode operation with Tx:1310nm & Rx:850nm, works in pair with WA or C.WA
L.WA or LC.WA	1-fiber Wavelength Division Multiplexed (WDM) singlemode operation with Tx:1310nm & Rx:1550nm, works in pair with L.WB or LC.WB
L.WB or LC.WB	1-fiber Wavelength Division Multiplexed operation (WDM) singlemode operation with Tx:1550nm & Rx:1310nm, works in pair with L.WA or LC.WA

OSD138 | SFM | | L | | C | | WA | (example only)
❶ ❷ ❸ ❹

❶

ITEM	DESCRIPTION
-	Two Fiber version
SFL	Single Fiber Singlemode version
SFM	Single Fiber Multimode version

❷

ITEM	DESCRIPTION
-	Multimode for two-fiber version
L	Singlemode for two-fiber version

❸

ITEM	DESCRIPTION
-	Card version (3RU high chassis mount for OSD370or OSD350)
C	Stand-alone case version (extrusion case)

❹

ITEM	DESCRIPTION
-	Two optical fiber operation or SFL version or SFM version
WA	Wavelength Division Multiplexed (WDM) single fiber operation with Tx @ 1310nm and Rx @ 1550nm.

1.4   TECHNICAL SPECIFICATIONS

Table 2 below provides the technical specifications for the OSD138

TABLE 2: TECHNICAL SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Data rate	DC to 1Mbps NRZ
Pulse Distortion and Jitter	$<\pm0.3\mu sec$ over full dynamic range
Wavelength	850nm nominal (1300nm for the OSD138L)
Coupled Transmit Power	>-15 to -12dBm peak into 62.5/125 multimode fiber >-15 to -12dBm peak into 10/125 singlemode fiber (OSD138L only)
Receiver Sensitivity	<-37dBm peak for 1×10^{-9} BER
Optical Link Budget	>22dB at 850nm (>5km of multimode fiber for OSD138) >22dB at 1300nm (>50km of singlemode fiber for OSD138L)
Receiver Saturation	>-12dBm peak
Input	User selectable between RS422/485 levels, TTL on the + input with - input floating or RS232 levels
User Controls	A 6-way user settable lever switch controls: RS422/RS232 or RS485 RS232 polarity 2-wire or 4-wire RS485 RS485 bias on/off RS485 turnaround times
Electrical Connectors	9-pin male subminiature D connector for power on card 2-way terminal block with screw clamps for power on module 8-way terminal block with screw clamps for data
Optical Connector	ST standard
Operating Temperature	-20 to 75°C
Relative Humidity	0 to 95% non-condensing
Power Requirements	$+11_{DC}$ to $+35V_{DC}$ or 22 to $28V_{AC}$ at less than 1.8VA
Weight	150g (card) 280g (module)
Dimensions(mm)	210D x 25W x 100H (card) 114D x 105W x 31H (module)

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NOTE:
>   Many combinations of laser types and optical levels, receiver types and sensitivity levels are possible. Contact OSD for details.

1.5 DATA I/O CONNECTOR PIN ASSIGNMENTS

TABLE 3: DATA CONNECTOR PIN ASSIGNMENTS

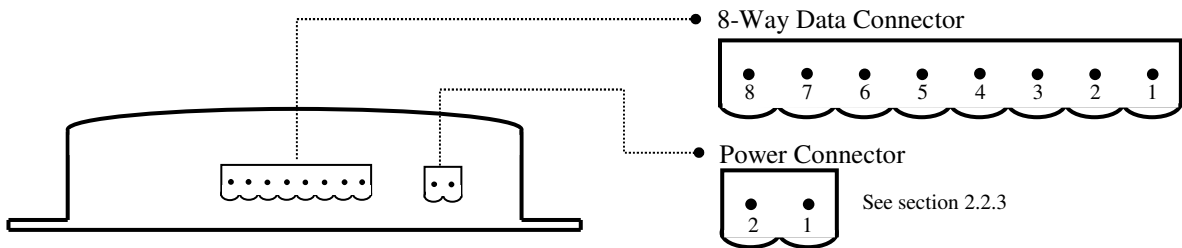| 8 WAY DATA TERMINAL BLOCK	FUNCTION
1	RS422 INPUT + / RS485 (2W I/O, 4W INPUT +)
2	RS422 INPUT - / RS485 (2W I/O, 4W INPUT -)
3	GROUND
4	RS422 OUTPUT + / RS485 (4W OUTPUT +)
5	RS422 OUTPUT - / RS485 (4W OUTPUT -)
6	RS232 TRANSMIT
7	RS232 RECEIVE
8	GROUND

FIGURE 3: DATA 8 -WAY TERMINAL BLOCK CONNECTOR

CAUTION:
The modem case is floating and should be connected to ground. Failure to do so may result in interference on the data lines.

When connecting data cables between the OSD138 and the host equipment please ensure that both equipment are grounded together otherwise unreliable data may occur.

RS485 2-Wire half duplex is used to connect several devices to the same bus when only one unit transmits data at a time. All units are normally in high impedance receive mode waiting for data. When transmission of data is requested, the device waits for a protocol specific turn-around time delay before transmitting after which it returns to receive mode.

RS485 4-Wire full duplex is used for master/slave arrangement. Devices are polled and respond faster with no turn-around time delay required between request/response. The receiver is always enabled allowing the devices to receive data even while responding to a request.

Note: If a link doesn't seem to be working correctly (no communication or just one way communication), try swapping the polarity of the data lines on both ends.   Some devices are marked opposite the RS485 standard.

2 INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section outlines the methods required to install and operate the OSD138 modem successfully. It should be studied carefully if damage to the equipment or poor results are to be avoided.

This equipment has been fully tested prior to 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 in its original packaging 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 60825-1:20011 standard.

| Class 1 |
| :---: |
| The OSD138 is a **Class 1 laser product.** |
| **CLASS 1 LASER PRODUCT** |
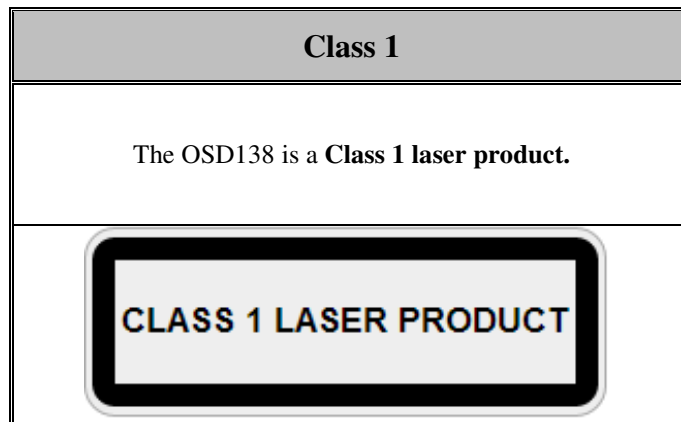
PRECAUTIONS

- ▲ 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.
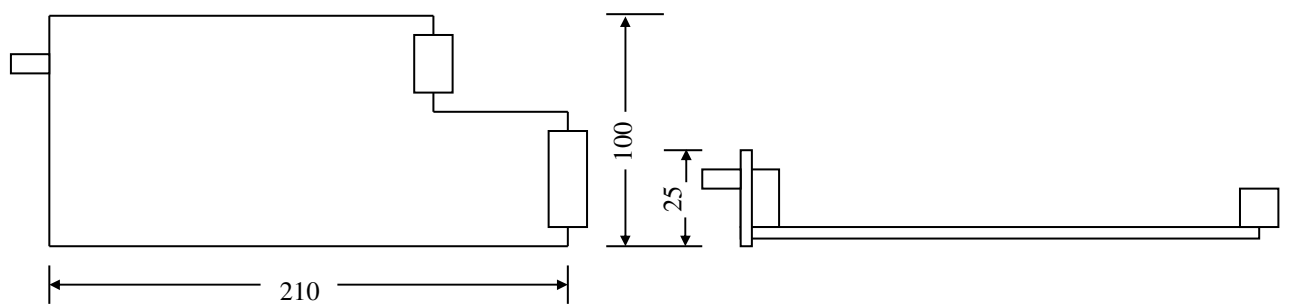
2.2.2   OSD138 DRAWINGS AND DIMENSIONS

The OSD138 is designed to be mounted on an even surface and to be secured by means of M4 or smaller screws. The OSD138 card versions is designed to be inserted into a chassis and secured by means of captivated screws.
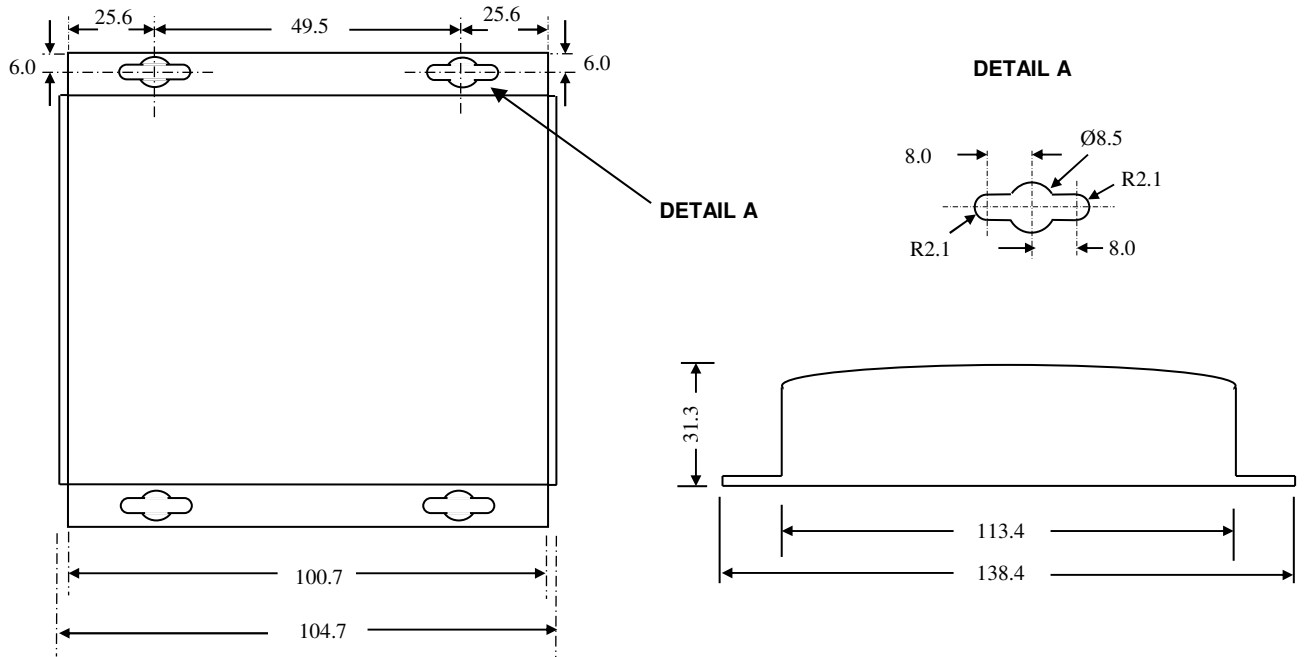
(a) Module Version

(b) Card Version

FIGURE 4: OSD138 MODULE AND CARD MOUNTING DIMENSIONS

2.2.3   POWER SUPPLY CONNECTIONS

The OSD138 card version is powered from the OSD370 or OSD350 chassis. DC power on the OSD138 card version is connected via the DB9 connector. The card version of the OSD138 should be fixed into the chassis using the captivated screws and can be plugged in or out of the chassis with power on or off.

The OSD138 module requires external DC or AC power. The voltage range of the OSD138 is $+11V_{DC}$ to $+35V_{DC}$ or 22 to $28V_{AC}$ with maximum current requirement of 1.8VA. Power should be connected to the power connector located at the back of the case (see Figure 5), and as indicated in Table 4.

TABLE 4: DC POWER CONNECTION

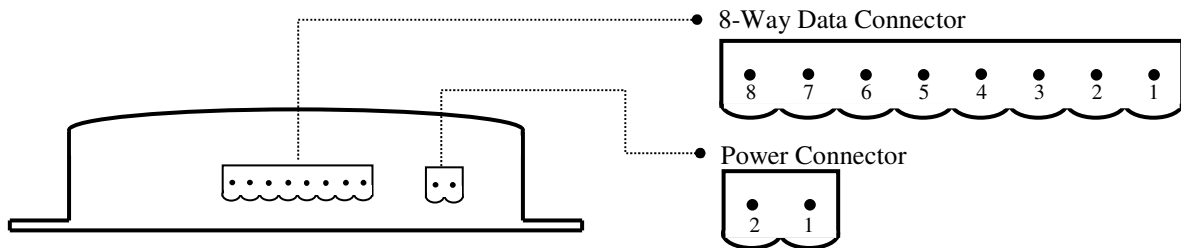| External Power Pin	Specification
Pin 1	+11V to +35V DC or 22 to 28V AC
Pin 2	Ground

FIGURE 5: OSD138C POWER SUPPLY CONNECTIONS

NOTE:
  1. The OSD138 card version should be fixed into the OSD370 or OSD350 chassis using the captivated screws
  2. The cards can be plugged in or out of the chassis with power on or off.

2.2.4   BASIC CONNECTIONS

Data signals are connected to the 8-way terminal block connector as set out in Table 3.

The optical fiber cable must be terminated with the appropriate optical connector. Before connection, inspect the ends of the connectors to ensure that no dust or dirt is present as it could contaminate the modem connector and result in poor performance.

If it is necessary to clean the cable connectors, use isopropyl alcohol and lint free tissue to remove contamination.

2.3   OSD138 OPERATION

When using the OSD138 for the first time, check that the unit is in good condition with no visible damage.

If a card version is used, insert it in an appropriate slot on the OSD chassis and check that the indicators illuminate as per Table 5 on power up. If a module version (OSD138C) is used, connect the unit to an appropriate power source and check that the indicators illuminate as per Table 5 on power up.

Plug the digital signal source. Check that the "Power" (see Figure 6) indicator is illuminated green. If it is not illuminating, there may be a problem with the unit and it should not be used. The "Tx Data" and "Rx Data" should not illuminate.

Setting of RS422, RS232 or RS485 data transfer is done by setting switches on the 6 Way Data Mode Switch according to Table 6. If RS485 is used Table 7 gives the settings for turnaround times.

Connect the Data cables to 8-way mating terminal connector according to Table 3 then plug it into the connector on the OSD138 unit.

The LED indicator "Tx Data" should illuminate amber when Data is being transmitted.

2W RS485 OPERATION WARNING:

It is essential that the external equipment's 2w RS485 data connection to the OSD138 be the correct polarity ie

Data + ↔ OSD138 I/O +
Data - ↔ OSD138 I/O –
or
Data + ↔ Pin 1
Data - ↔ Pin 2

If these connections are reversed it is likely that the will be no communications or just one way communications. Such a situation may be indicated by the Tx LED indicator on one unit permanently glowing (ie it is transmitting) and the Rx LED on the other unit permanently glowing (ie it is receiving).

Connect the optical cables to the receptacles located on the side of the case or on the front panel of the card version. When the remote OSD138 is connected and receiving Data the "Rx Data" indicator should illuminate amber. Please note that when using OSD138 1-fiber WDM option you must connect WA with WB; refer to page 3 in this manual for descriptions of part numbers.
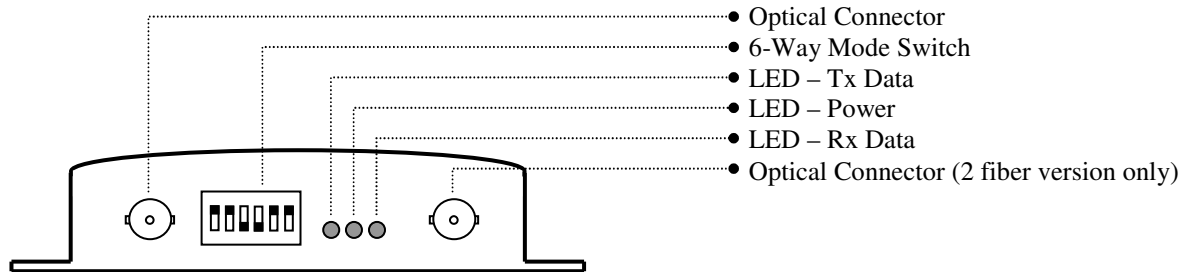
- Optical Connector
- 6-Way Mode Switch
- LED – Tx Data
- LED – Power
- LED – Rx Data
- Optical Connector (2 fiber version only)

FIGURE 6: OSD138C SIDE VIEW

2.3.1   INDICATOR FUNCTIONS

The indicator function of the OSD138 modem is summarised in Table 5 below.

TABLE 5: OSD138 INDICATOR FUNCTION

INDICATOR	AMBER	GREEN	LIGHT OFF
POWER	-	POWER ON	POWER OFF
Tx DATA	DATA TRANSMITTED	-	NO DATA TRANSMITTED
Rx DATA	DATA RECEIVED	-	NO DATA RECEIVED

2.3.2   DATA MODE CONTROL SWITCH SETTINGS

SW5 can add a bias voltage to the RS485 link so that when the link is inactive it pulls the link weakly to the "Low" state. In normal operation the bias is desirable and the switch is left in the ON state. However, there may be occasions where external devices already provide this bias. In such cases the bias is disabled by setting this switch to the OFF state. The settings are given in Table 6 below.

2 wire RS485 operates by sending bursts of data onto a 2 wire bus. In order to determine the direction of transmission, the OSD138 accepts the first Logical High data signal coming from either copper or fiber as valid data and then inhibits any signals coming from the opposite direction. This inhibition lasts from 10μs to 30ms after the active signal returns to the Logical Low state. This time is called the RS485 Turnaround Delay and is user settable. The settings are given in Table 7 below.

OSD recommends that the unit be initially set to the minimum period of 10μS (ie SW2, SW3 and SW4 all in the ON position). Should there be communication errors change this delay one step at a time until the system is working correctly.

The 6-way data control switch is located at the front of OSD138 modem. Switches SW1 (T1), SW5 (T5) and SW6 (T6) are used for setting the data mode options.

TABLE 6: DATA MODE SWITCH SETTINGS

SWITCH	STATE	FUNCTION
SW1(T1)	OFF	RS232/RS422
	ON	2 WIRE AND 4 WIRE RS485
SW5(T5)	OFF	NO BIAS RS485
	ON	BIAS RS485
SW6(T6)	OFF	RS232/RS422 OR 4 WIRE RS485
	ON	INVERSE RS232 OR 2WIRE RS485

Switches SW2 (T2), SW3 (T3) and SW4 (T4) are used for setting RS485 turnaround time.

TABLE 7: RS485 TURNAROUND TIME SWITCH SETTINGS

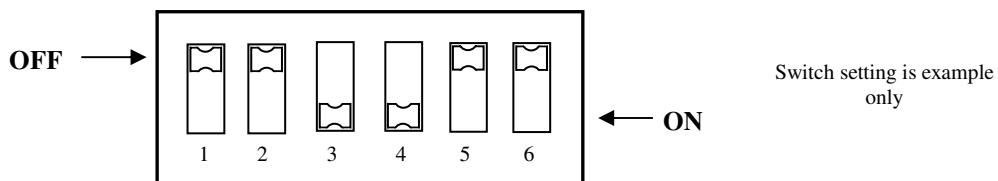| SW2 (T2)	SW3 (T3)	SW4 (T4)	RS485 TURNAROUND TIME
ON	ON	ON	10us
ON	ON	OFF	30us
ON	OFF	ON	100us
ON	OFF	OFF	300us
OFF	ON	ON	1ms
OFF	ON	OFF	3ms
OFF	OFF	ON	10ms
OFF	OFF	OFF	30ms

Switch setting is example only

FIGURE 7: FRONT VIEW OF DATA MODE SWITCH

3   MAINTENANCE

3.1   INTRODUCTION

The following section outlines the fault-finding procedure for the OSD138 modems. Please take note of the following:

σ   Personnel without appropriate training should not attempt any maintenance except that outlined below.

σ   If further maintenance is attempted you are warned that every care should be taken to ensure that internal measurements made while the equipment is operational are taken carefully as some components within the unit are expensive and may be damaged by failure of any portion of their support circuitry.

σ   Some components within the unit are electrostatic sensitive and ESD precautions should be taken when performing maintenance upon the unit.

3.2   EXTERNAL INSPECTION

Visually check for the following:

σ   Check that the correct power source is connected to the power socket.

σ   Check that the data signals are connected to the modem correctly and that the distant OSD138 modem has been terminated correctly to any external equipment.

σ   Inspect the optical connectors for any contamination and clean using isopropyl alcohol and a lint free tissue if any contamination is detected.

σ   Check that any external termination resistors are connected if the system configuration requires them.

3.3   ROUTINE MAINTENANCE

σ   There is no routine maintenance required with the OSD138.

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 repair labels is evident.

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