OPTICAL SYSTEMS DESIGN

OPERATOR MANUAL

OSD2251A SERIES

4-PORT REDUNDANT RING

GIGABIT ETHERNET SWITCH

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1 TECHNICAL SUMMARY

1.1 BRIEF DESCRIPTION

1.1.1 OVERVIEW

The OSD2251A is a 4-port industrial switch with redundant ring Gigabit Ethernet providing simple network management with real-time monitoring. It has two 10/100/1000Base-T RJ45 copper ports and two SFP ports for the ring.

The OSD2251A incorporates redundant ring technology providing maximum reliability on critical networks. In the event of device or fiber failure the data path will automatically switch to a secondary path in less than 2ms per hop to maintain ring network integrity.

The unit will operate on either singlemode or multimode fiber. Operation over a network of hundreds of kilometers is possible by use of the appropriate optical devices. It normally requires two fibers but is optionally available for one fiber operation.

A major benefit of the OSD2251A is its reliable and consistent performance over the -20°C to +75°C temperature range that allows it to be used in uncontrolled environments such as roadside cabinets, mine sites and factories.

1.1.2 APPLICATIONS

- Any network utilising a mix of copper and fiber
- Industrial IP communications
- Self-healing Gigabit Ethernet backbone networks
- Networks using Ethernet devices such as cameras, intercoms, access control, telephones, etc.

1.1.3 FEATURES AND BENEFITS

- Complies with IEEE802.3i/802.3u/ 802.3ab 10/100/1000Base-T, IEEE802.3u 100Base-Fx, IEEE802.3z 1000Base-Lx/Sx standards
- Has a total of four ports: two fixed copper ports for 10/100/1000Base-T and two SFP ports for the fiber ring (100Base-Fx or 1000Base-X)
- A network diameter of hundreds of kilometers is practical
- Ring reconfiguration in the case of cable or switch failures takes less than two milliseconds per hop
- OSDview Lite Network Management System for ring version only
- MDI/MDIX Crossover: no need for crossover cables
- Can be used with either singlemode or multimode fiber over a variety of link budgets
- Available for operation over 1 or 2 fibers
- Auto-Negotiation for half or full duplex operation
- Dual power supply inputs
- Operates over the temperature range of -20°C to +75°C
- Powered by non-critical 10 to $36V_{DC}$ or $24V_{AC}$ supplies
- Compatible with the OSD2244 and OSD2254 Gigabit Ethernet switchs
- DIN rail Mounting
- Available for operation in ring or point to point configuration
- SFP module sold separately
- Supports 10KB jumbo frames

1.2 TYPICAL CONFIGURATION

Figure 1 below indicates a possible set-up for an OSD2251A system.

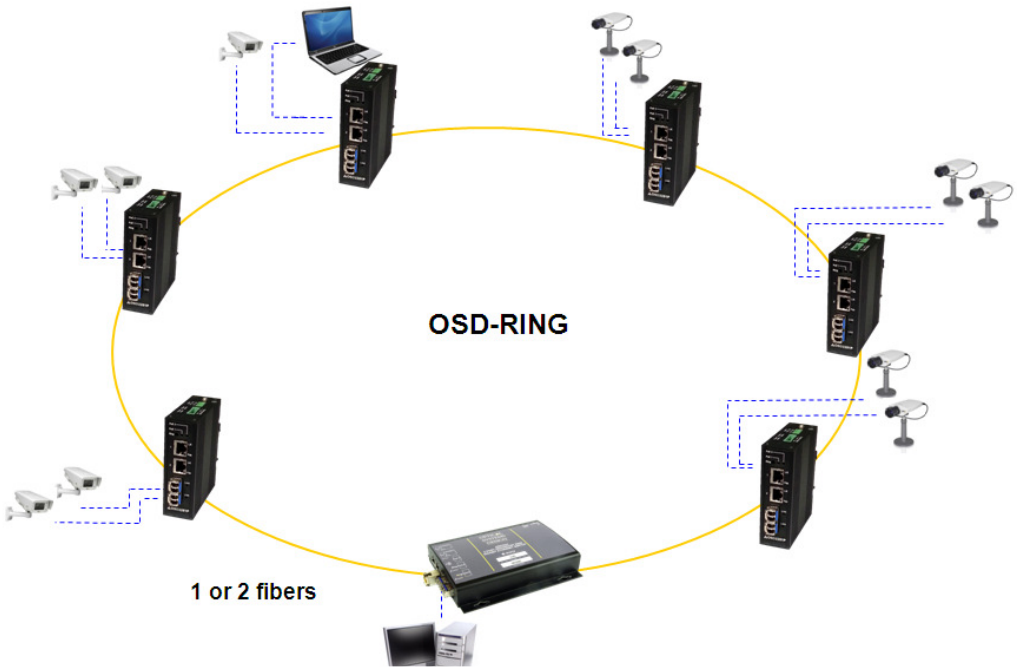


FIGURE 1: OSD2251A TYPICAL RING CONFIGURATION

1.3 TECHNICAL SPECIFICATIONS

TABLE 1: TECHNICAL SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Electrical Data Interface	IEEE802.3i/802.3u/802.3ab, 10/100/1000Base-T Ethernet
Electrical Data Rate	10, 100, 1000Mbps with energy detect, auto negotiate, auto MDIX
Jumbo Frame Support	10KB
Optical Data Interface	IEEE802.3z 1000Base-Lx/Sx, IEEE802.3u 100Base-Fx
Optical Data Rate	100Mbps or 1000Mbps user selectable
Operating Mode	Ring or non-ring user selectable Half or full duplex for 10/100 Full duplex for 1000 Flow control
Electrical Data Connectors	RJ45
Alarms	Ring to Bus High Temperature
Alarm Interface	Optoisolated MOSFET rated at 100mA @ 46V maximum
Optical Port Connectors	SFP
SFP Options	Short haul, long haul, single fiber operation, etc. Please consult OSD DATASHEET #10021000X or contact OSD
Indicators	2x Copper Link 2x Copper Activity 2x SFP Speed/Activity/Link 1x Initialise/Ring/Bus 1x Power
Dimensions (mm)	43W x 91D x 110H
Weight	0.48kg
Power Requirements	+10V to +36V_{DC} or 22 to 28VAC @ 8VA
Power Connector	4 way 5.08mm terminal block
Alarm Connector	4 way 3.5mm terminal block
Operating Temperature	-20°C to +75°C
Relative Humidity	0 to 95% non-condensing

102225106

1.4 OSD2251A PORT ALLOCATION

Front Panel: There are two fixed copper ports for 10/100/1000Base-T and two SFP ports.

Top Panel: The top panel consists of a 4-way 5.08mm terminal block power connector and a 4way 3.5mm terminal block alarm connector.

Bottom Panel: 4-Way DIP switch, Type-A USB connector and a Type-B USB connector.

Each section will be described further throughout this manual.

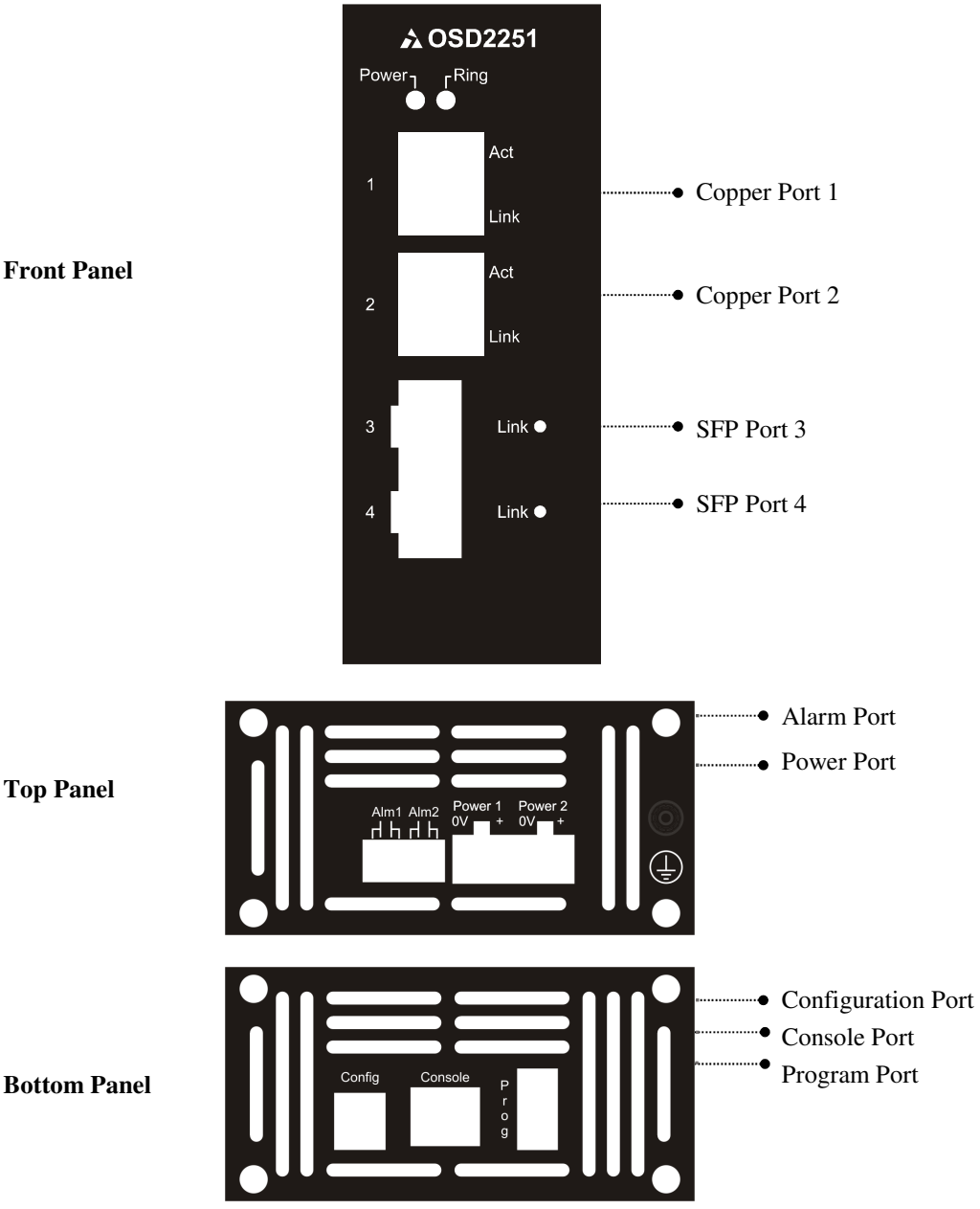


FIGURE 2: OSD2251A PORT ALLOCATION

2 INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section outlines the methods required to install and operate the OSD2251A 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 evident, return the unit with the packaging to your 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 OSD2251A is a **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 OSD2251A DRAWINGS AND DIMENSIONS

The OSD2251A is designed to be wall mounted onto a DIN-Rail (35mm top hat) fixture. The unit dimensions (excluding connectors, SFPs, etc) is shown in Figure 3 below

FIGURE 3: OSD2251A MOUNTING DIMENSIONS

2.2.3 LOCATION

As with any electric device, the OSD2251A should be placed where the switch will not be subjected to extreme temperatures, humidity, or electromagnetic interference. Specifically, the site selected should meet the following requirements:

- The ambient temperature should be between -40°C to 75℃ (-40℉ to 167℉).
- The relative humidity should be less than 95 percent, non-condensing.
- Surrounding electrical devices should not exceed the electromagnetic field (RFC) standards.
- Make sure that the switch receives adequate ventilation. Do not block the ventilation holes on any side of the switch.

2.2.4 POWER SUPPLY CONNECTIONS

The OSD2251A requires external power to the Redundant DC Terminal Block Power Connector located at the top of the unit. Always ensure that the power is off before any installation.

Redundant DC Terminal Block Power Inputs

There are two pairs of power inputs for use with redundant power sources. Only one power input is required to be connected to run the switch.

Step 1: Connect the DC or AC power to the appropriate power source, connect the plug-able terminal block on the OSD2251A switch and then turn power on.
Step 2: Disconnect the power if you want to shut down the switch.

TABLE 2: DC OR AC POWER CONNECTION

External Power Pin	Specification
Power 1 +	+10 to 36V_{DC} or 22 to 28 V_{AC} @ 8VA
Power 1 0V	Ground – 0V
Power 2 +	+10 to 36V_{DC} or 22 to 28 V_{AC} @ 8VA
Power 2 0V	Ground – 0V
⏚	Earth Ground Connection

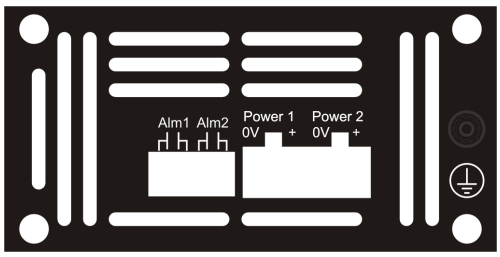


FIGURE 4: OSD2251A POWER SUPPLY CONNECTIONS

2.2.5 OSD2251A ALARM CONNECTION

The OSD2251A has two monitoring alarm outputs: 1) Ring to Bus Alarm and 2) Temperature Alarm. The alarm connections and conditions for alarm outputs are as set out in Table 3. There are four pins on the 3.5mm terminal block used alarm output. Maximum ratings the OSD2251A relay can drive is 100mA @ $46V_{(max)}$. Note: Alarm output has no polarity.

TABLE 3: ALARM CONNECTIONS

Alarm Output	Alarm1 Ring /Bus Status	Alarm CH2 Temperature
N/O	Ring	Less than 90°C
N/C	Bus*	Higher than 90°C

*Note: Bus alarm is only triggered *after* a ring connection is established.

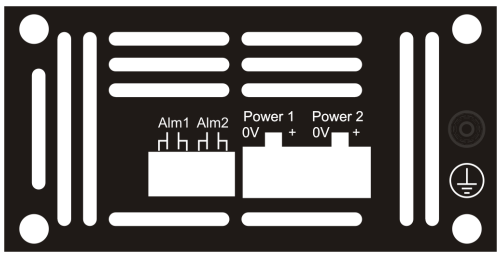


FIGURE 5: ALARM OUTPUTS

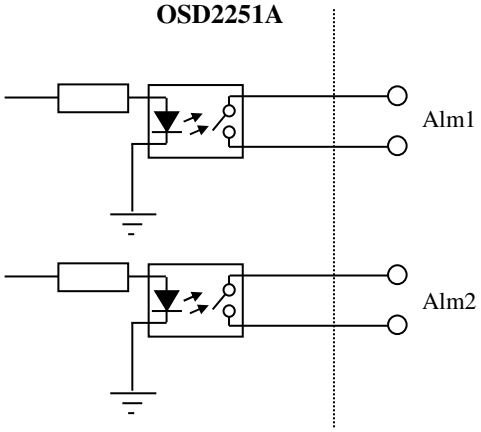


FIGURE 6: CONTACT CLOSURE OUTPUT

2.2.6 USB CONNECTOR

The OSD2251A has a USB – Type B connector located on the bottom of the unit that is used for Command Line Interface (CLI) from the PC to the OSD2251A via the PC's USB connector. See section 2.5 for further CLI information.

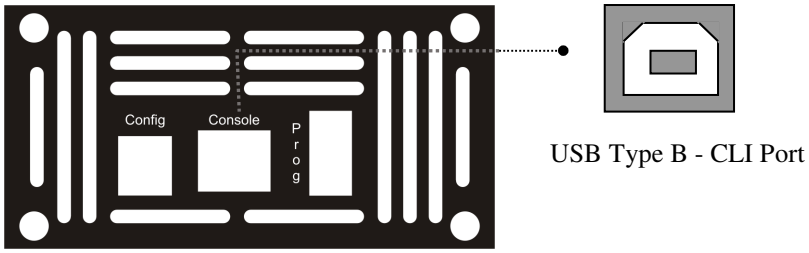
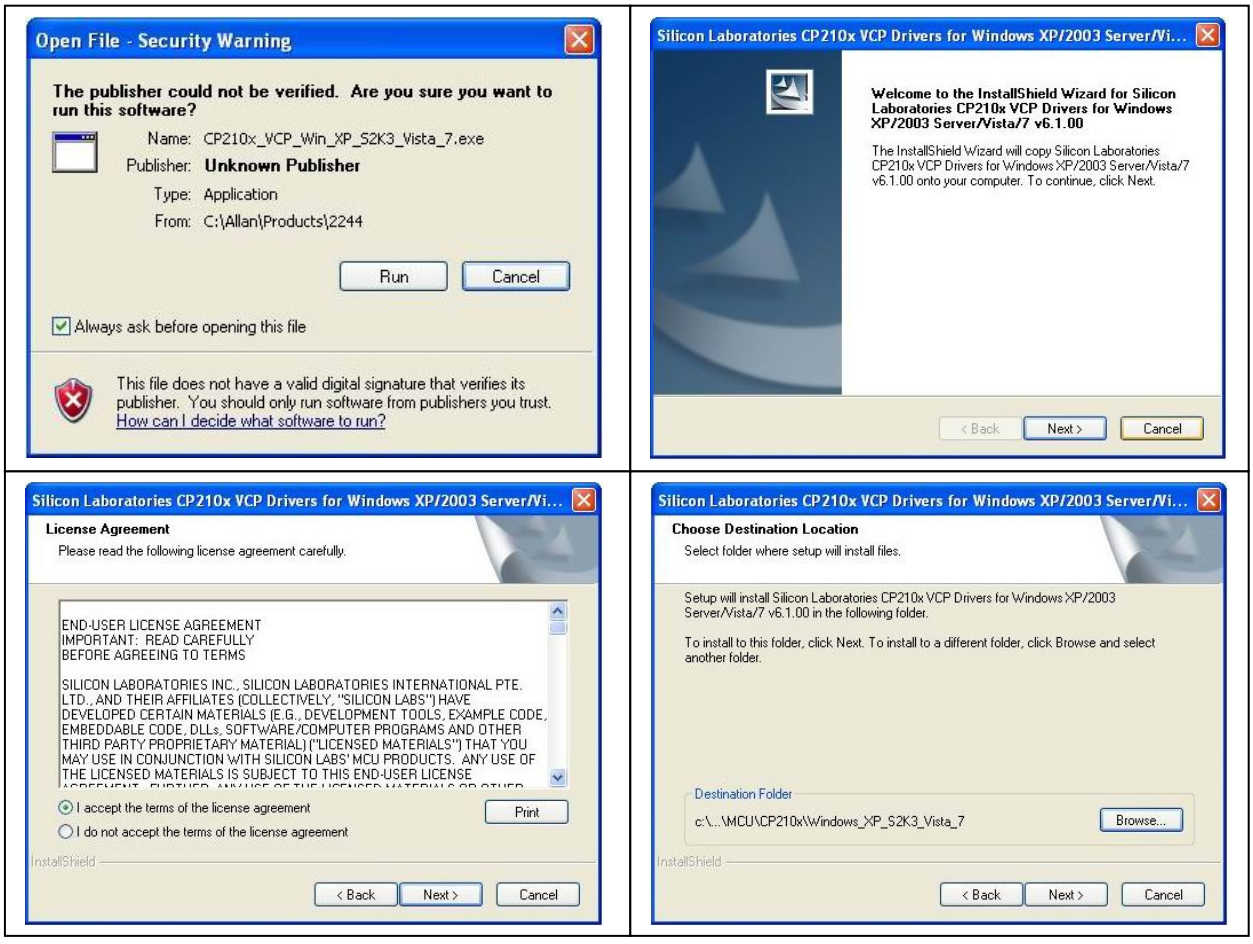


FIGURE 7: USB TYPE B CLI PORT

To operate and control the OSD2251A using the CLI an OSD2251A driver will be required to be installed onto the PC being used. The driver can be found on the included CD or on the OSD website. Please contact OSD sales if the driver cannot be found or installed. For Windows XP, Vista and Windows 7: CP210x_VCP_Win_XP_S2K3_Vista_7.exe. For Windows 2000: CP210x_VCP_Win2K.exe



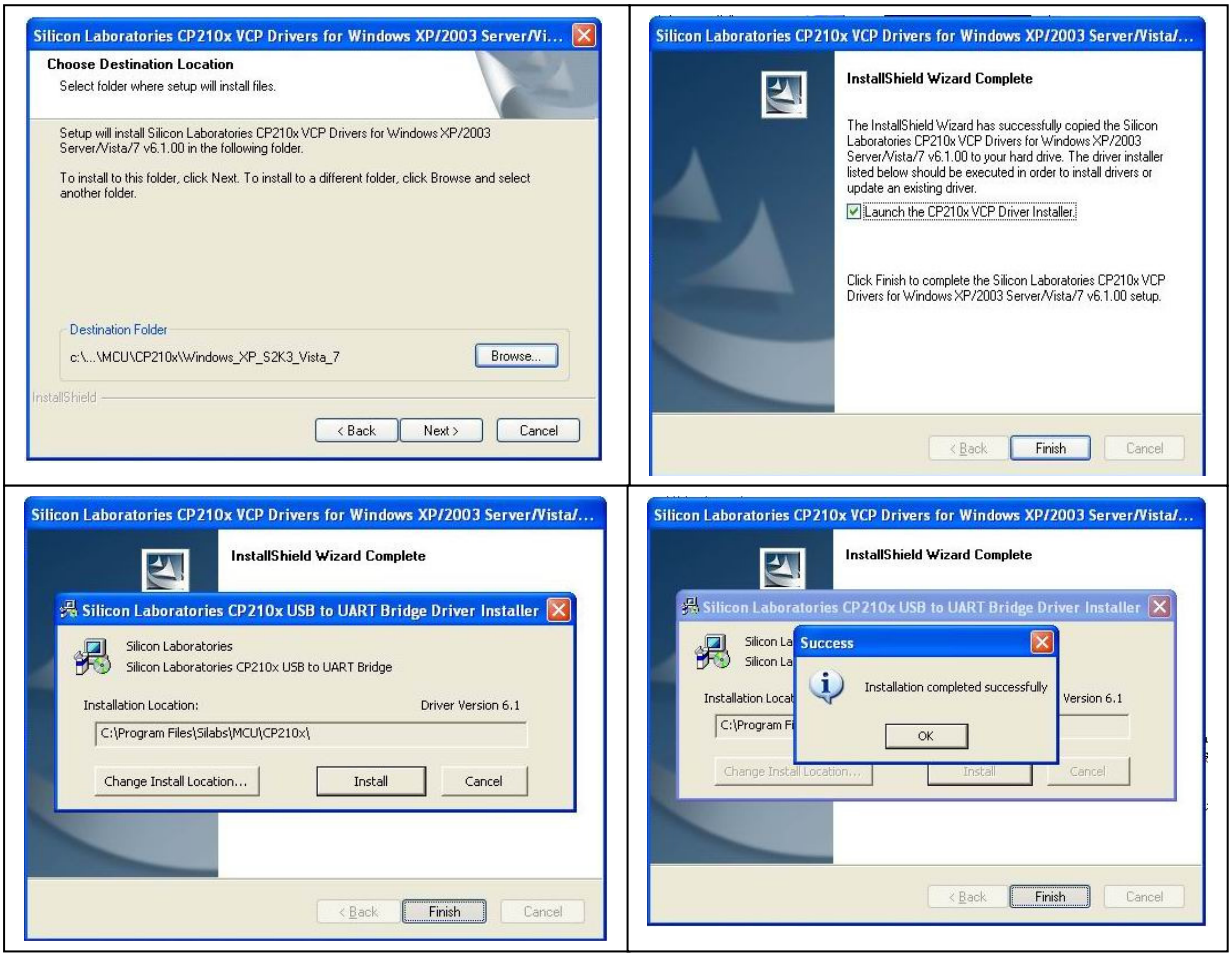


FIGURE 8: WIN XP INSTALLATION

2.2.7 LED INDICATORS

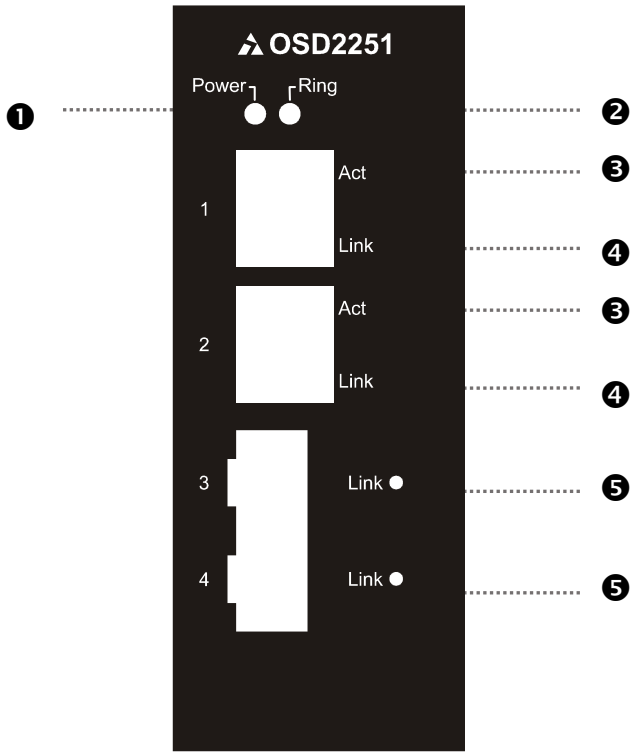


FIGURE 9: PORT/LED

TABLE 4: LED FUNCTION

No	Function			LED Colour Function		
	On	**Blink**	**Off**	**Green**	**Gr/Am**	**Amber**
❶	Power	-	No Power*	Power	-	-
❷	Ring/Bus	Initial	Non-Ring	Ring	Initializing	Bus
❸	No Activity	Activity	No Link	Active	-	-
❹	Link Present	-	No Link	-	-	On
❺	No Activity	Activity	No Link	1Gbps	-	100Mbps

*In Programming Mode this LED is OFF

2.2.8 CONTROLS

The OSD2251A has a 4-way DIP switch to control a number of functions. Table 5 outlines the function of each switch.

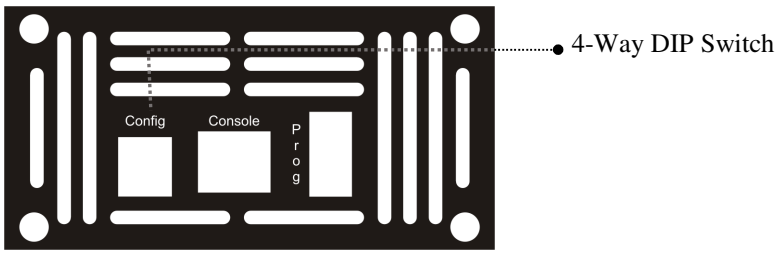


FIGURE 10: OSD2251A CONTROLS

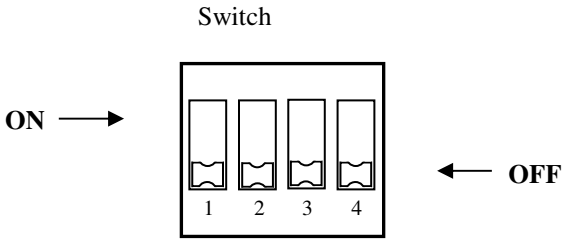


FIGURE 11: OSD2251A 4-WAY DIP SWITCH

TABLE 5: OSD2251A 4-WAY DIP SWITCH SETTINGS

SWITCH NUMBER	DESCRIPTION	FUNCTION	SWITCH POSITION
1	Port 4 Fiber Speed	100Mbps 1000Mbps	ON OFF*
2	Port 3 Fiber Speed	100Mbps 1000Mbps	ON OFF*
3	Ring/Non-Ring	Non-Ring Mode Ring Mode	ON OFF*
4	Reserved	Programming Mode User Mode	ON OFF*

* Default settings. SW4 switch should remain in OFF position at all times.

2.2.9 FITTING SFP CONNECTORS

Care should be taken when inserting/removing the SFP connectors from SFP port 3 and 4as SFP modules are Electrostatic (ES) sensitive and Electrostatic Discharge (ESD) precautions should be taken when installing. Ensure that the SFP is fully engaged and latched into position.

Inserting SFP – Ensure that the SFP lever is in the locked position and insert into appropriate SFP port. Gently push the SFP until it locks into place. Remove plastic/rubber dust cap and fit fiber cable or RJ45 plug.

Removing SFP – Remove fiber connector or RJ45 plug. Pull the SFP lever down to unlock SFP from housing. Using the lever, gently pull the SFP out.

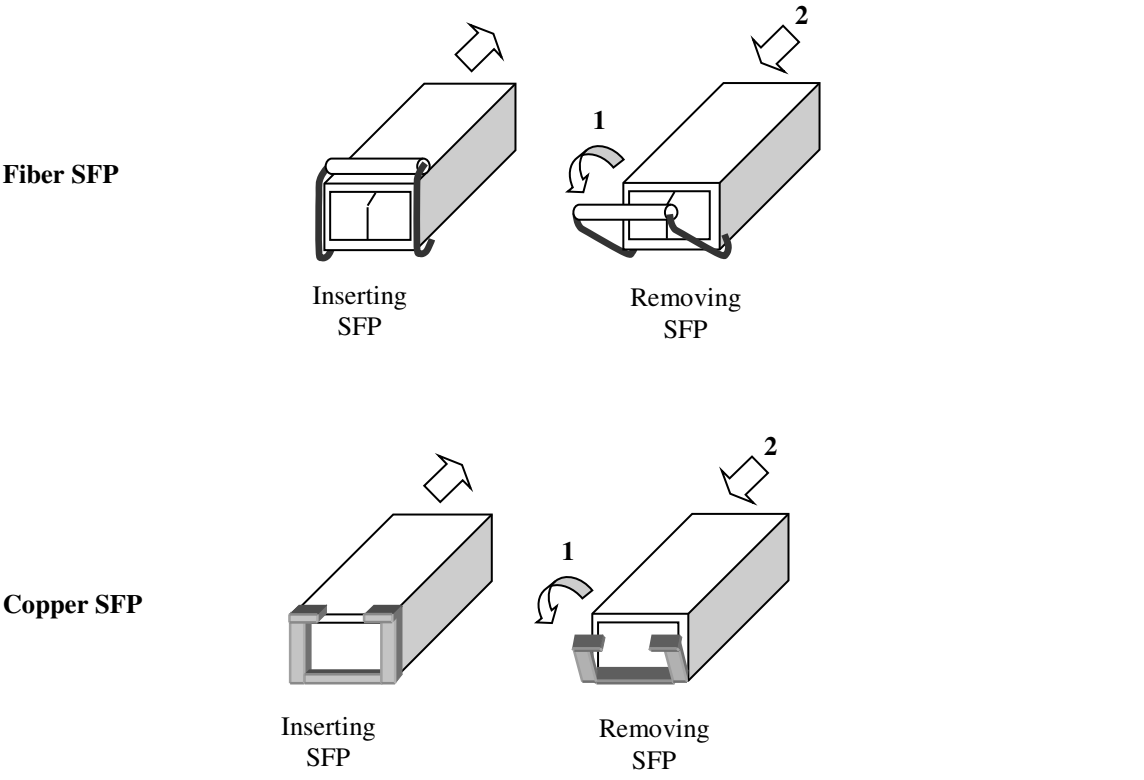


FIGURE 12: FITTING/REMOVING SFP CONNECTORS

2.3 OSD2251A OPERATION

When using the OSD2251A for the first time, check that the unit is in good condition with no visible damage.

Upon power up check that the indicators illuminate accordingly on power up (see Table 4).

2.3.1 CONNECTIONS

For RJ45 connection use Category 5 (CAT5) or higher. Length should be no more than 100 meters.

For singlemode fiber connections, fiber used must be 9/125µm singlemode fiber.

For multimode fiber connections, fiber used must be 50/125µm or 62/125µm multimode fiber.

Plug in the appropriate connectors for system configuration;

- RJ45 cable to fixed copper ports (port 1 and 2) and copper SFP modules
- LC or SC fiber cable to fiber SFP modules.

Redundant Ring Operation

The OSD2251A connected in a redundant ring topology providing maximum reliability on critical networks. In the event of device or fiber failure the data path will automatically switch to a secondary path in less than 2ms per node to maintain ring network integrity.

FIGURE 13: REDUNDANT RING CONFIGURATION

To connect the OSD2251A in a redundant ring configuration ports 3 and 4 must be used together with fiber SFPs. The non-ring ports (ports 1 & 2) should be used to connect to your Ethernet devices (eg. Cameras, PLCs, computers, etc.)

Figure 14 shows the connection method. Typically the SFP used would be a fiber SFP with duplex LC connectors. The dashed line indicates the closed loop, but more OSD2251A units can be connected to the ring as required using this topology. Ensure that the switch settings for port 4 and 5 are set to 1000Mbps (1Gbps) – see Table 5.

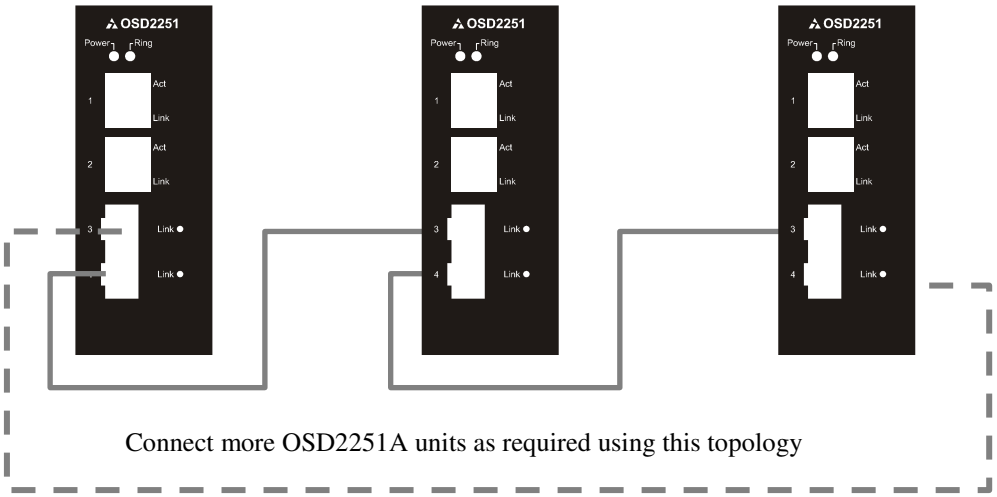
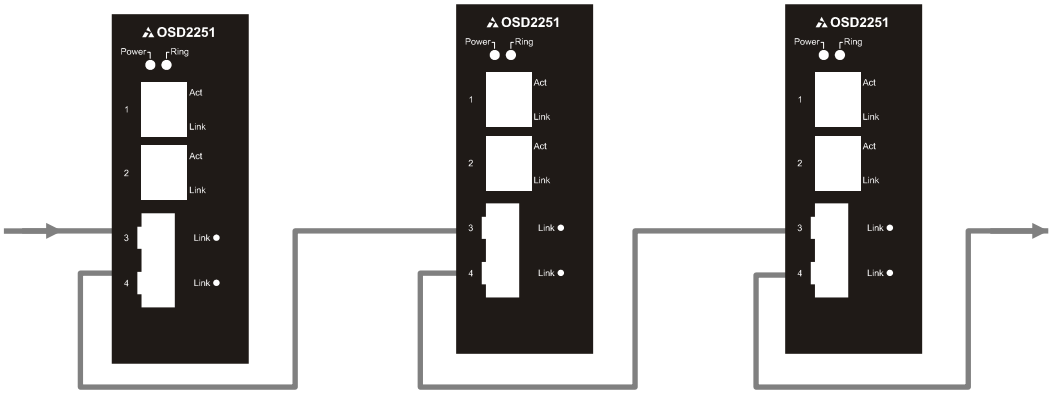


FIGURE 14: REDUNDANT RING CONNECTION

Bus Operation

To connect the OSD2251A in a bus configuration ports 3 and 4 must be used together with fiber SFPs. The remaining ports (ports 1 & 2) should be used to connect to your Ethernet devices (eg. Cameras, PLCs, computers, etc.)



Connect more OSD2251A units as required using this topology

FIGURE 15: BUS CONNECTION

2.4 TYPE-A USB PORT

The Type-A USB Port is used for uploading firmware updates. All OSD2251A units will be shipped with the latest firmware already installed. This port has no function for end user.

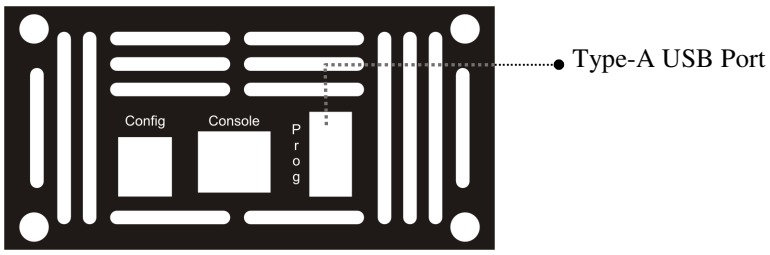


FIGURE 16: OSD2251A USB CONNECTOR

2.5 COMMAND LINE INTERFACE

The Command Line Interface (CLI) is a useful tool for checking link status and debugging link connections. To enable the use of CLI the OSD2251A must be connected to a PC with a serial port and an appropriate cable as specified in section 2.2.6. Using a terminal emulation program such as Hyperterminal, a number of command lines specific to the OSD2251A can be implemented to check link/node status, ring/bus topology and enable/diable float backup.

2.5.1 TERMINAL EMULATION SETUP

Using a terminal emulation program such as hyperterminal the following parameters should be set up for correct command line operation. Select the appropriate "COM port" set up for the serial port.

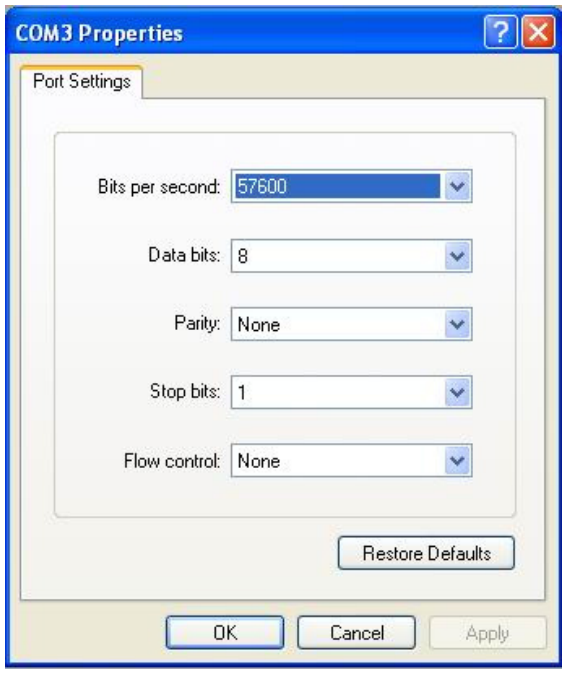


FIGURE 17: SERIAL PORT SETTINGS

2.5.2 COMMAND LINE FUNCTIONS

There are a number of command line functions that enables the user to obtain running information of a single OSD2251A unit or the complete topology of the ring/bus network. This section explains the command lines and its functions.

When the terminal emulation program is operating, connect the USB cable to any one of the OSD2251A units on the ring/bus network – or alternatively, the OSD2251A unit which the user wishes to interrogate. Note: A message will be displayed on the terminal emulation program when the unit is powered after USB connection. This message will not open when the unit is switched on while plugging in the USB cable, however the command lines are functional.

The following table outlines the user available command line commands and their functions

TABLE 6: TERMINAL COMMAND LINES

TERMINAL COMMAND LINE	SPECIFICATION	FUNCTION	FIGURE
help	help	Displays all user available CLI commands	-
tc	Topology Check	Displays the topology status of the established ring/bus	Figure 18
nc	Node Check	Displays the running status of the node with given MAC address	Figure 20
lnc	Local Node Check	Gets running status of the local node	Figure 21
fbe	Float Backup Enable	Enables float backup function for all nodes on the ring/bus	Figure 22
fbd	Float Backup Disable	Disables float backup function for all nodes on the ring/bus	Figure 26
vc	Version Check	Displays the current software version and revision installed on the unit	Figure 29

TOPOLOGY CHECK - <tc> Command Line

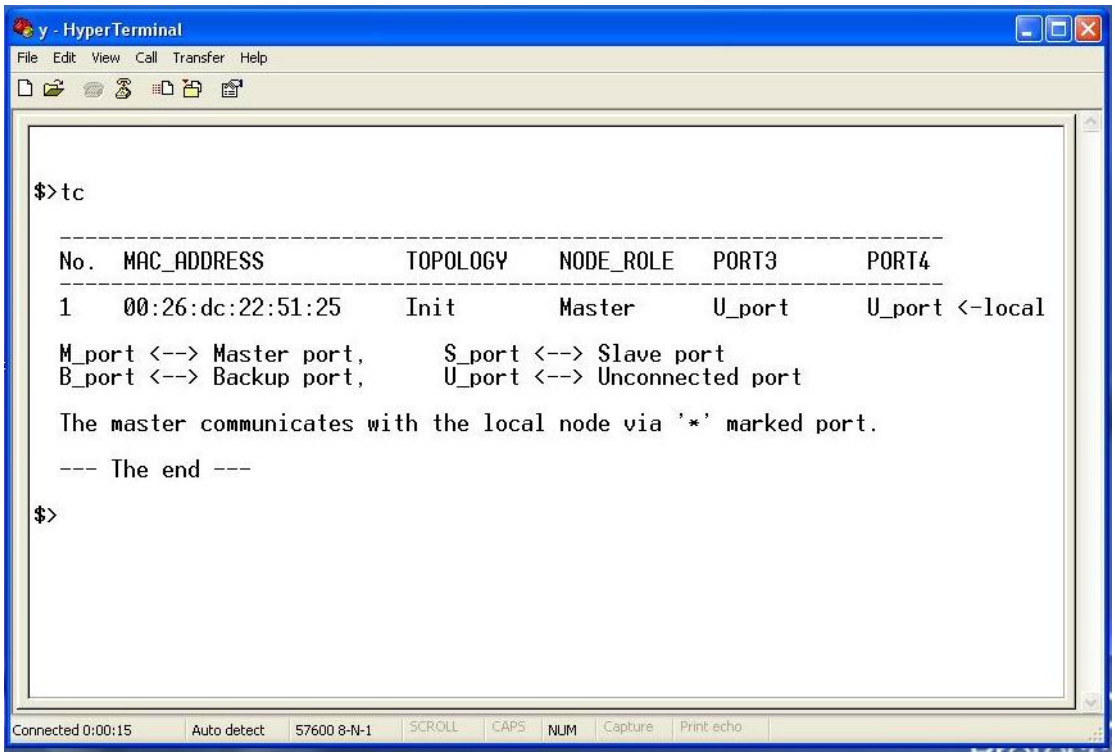


FIGURE 18: TOPOLOGY CHECK

In this case, only one OSD2251A is connected to the USB cable. The display indicates the following;

No: 1 – Number of units connected on the ring/bus (in this case only one unit)

MAC_ADDRESS: 00:26:dc:22:51:25 – Displays all the MAC addresses of the units connected on the ring/bus

TOPOLOGY: Init – Displaying type of connection (in this case "Init" as there is only one unit)

NODE_ROLE: MASTER – Displays whether the unit is either the Master or Slave on the ring/bus (in this case only one unit is connected thus displaying master). The Master unit is determined by the unit with the lowest MAC address

PORT3: U_port. Indicates the function of port 3 and its relation to the ring/bus. There are four possibilities;

1. M_port – Master Port (port facing the master)
2. S_port – Slave Port (port back to the master)
3. B_Port – Backup Port
4. U_Port – Unconnected Port

PORT4: U_port. Indicates the function of port 4 and its relation to the ring/bus. There are four possibilities;

1. M_port – Master Port
2. S_port – Slave Port
3. B_Port – Backup Port
4. U_Port – Unconnected Port

<-local: This points to the unit that the USB cable is plugged into on the ring/bus.

In the example below there are four OSD2251A connected in a ring configuration.

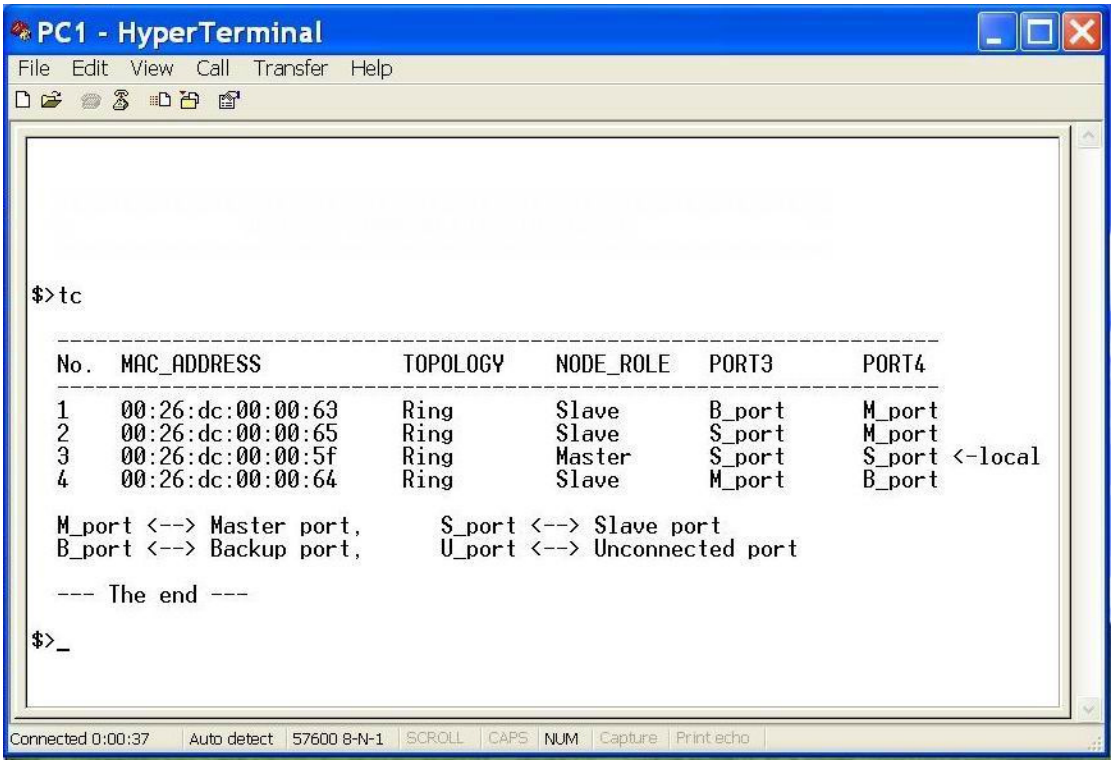


FIGURE 19: TOPOLOGY CHECK

No: 4 – Four units connected

MAC_ADDRESS:– Displaying all the MAC addresses of the units connected on the ring/bus

TOPOLOGY: Ring – Displaying type of connection.

NODE_ROLE: MASTER – Displays if the unit is either the Master or Slave on the ring/bus. Master is determined by the lowest MAC address

PORT3: U_port. Indicates the function of port 3 and its relation to the ring/bus. There are four possibilities;

1. M_port – Master Port
2. S_port – Slave Port
3. B_Port – Backup Port
4. U_Port – Unconnected Port

PORT4: U_port. Indicates the function of port 4 and its relation to the ring/bus. There are four possibilities;

1. M_port – Master Port
2. S_port – Slave Port
3. B_Port – Backup Port
4. U_Port – Unconnected Port

<-local: This points to the unit that the USB cable is plugged into on the ring/bus.

NODE CHECK - <nc> Command Line

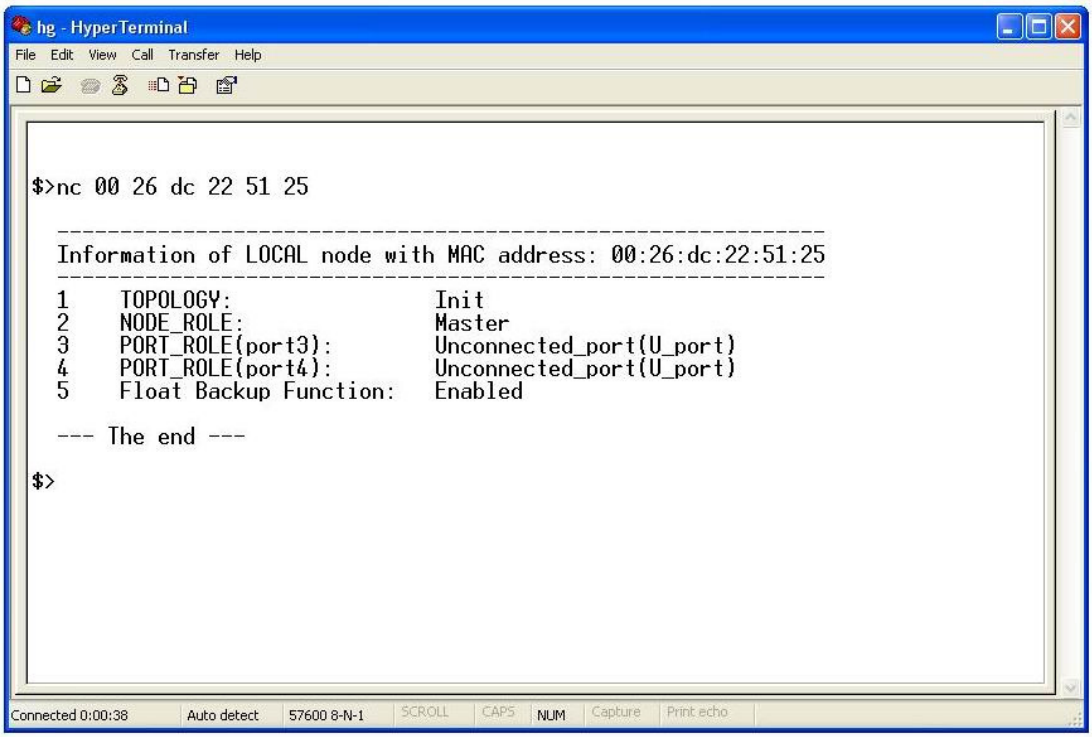


FIGURE 20: NODE CHECK

The Node Check command line is a useful command for checking the running status of any remote node connected to the ring/bus topology from any particular node that the USB cable is plugged into. This enables the user to perform a node check on any OSD2251A unit from one location on the ring/bus network.

The Node Check command requires the MAC address number for the node being interrogated. The command line format is as follows;

nc 00 26 dc xx xx xx

Notes: When entering the MAC address, leave one space between every two hex digits as shown in the example in Figure 20.

The information displayed is the remote MAC address, Topology, Node Role, Port Role and Float Backup status.

LOCAL NODE CHECK - <lnc> Command Line

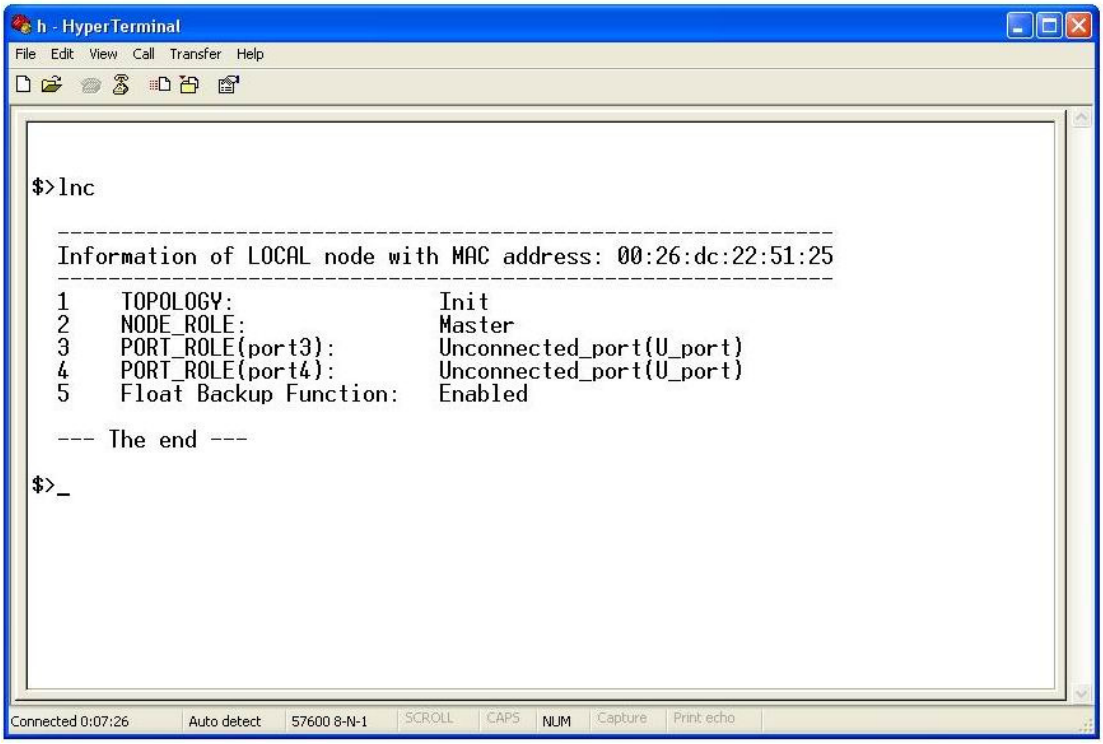


FIGURE 21: LOCAL NODE CHECK

This command line displays the running status of the local node that the USB cable is plugged into. The information provided is the MAC address, Topology, Node Role, Port Role and Float Backup status.

FLOAT BACKUP ENABLE <fbe> Command Line

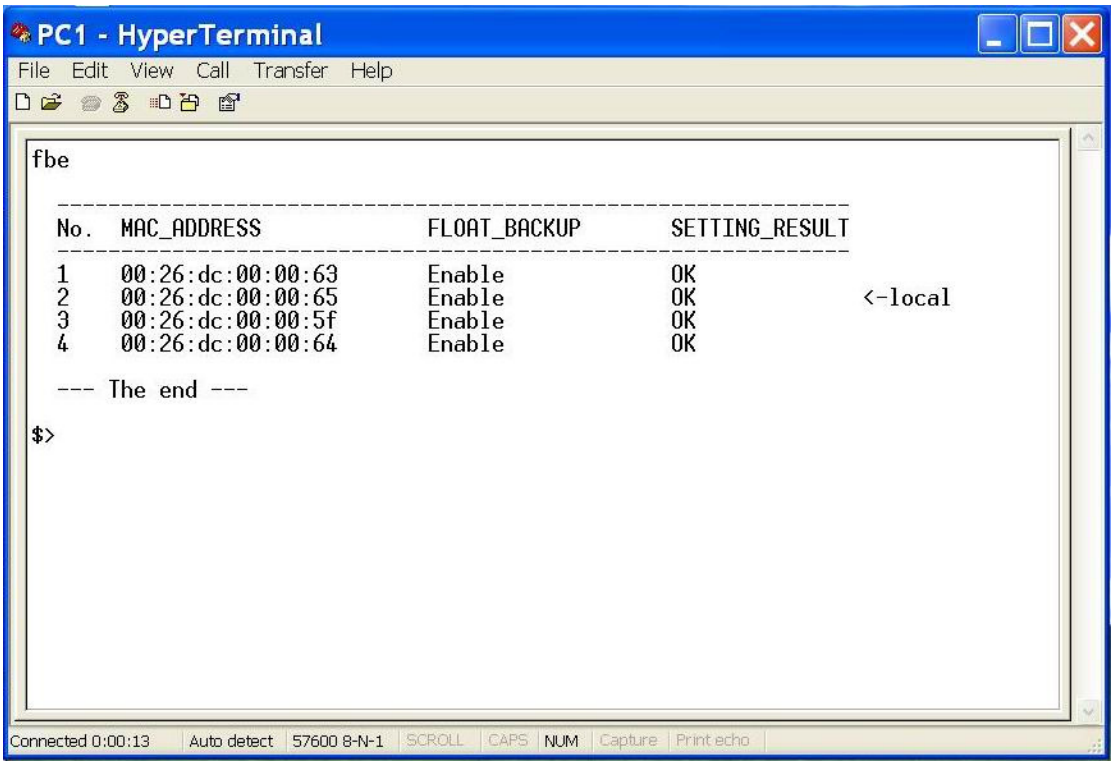


FIGURE 22: FLOAT BACKUP ENABLED 1

No: 4 – Lists number of units connected (in this case 1,2,3,4)

MAC_ADDRESS:– Displaying all the MAC addresses of the units connected on the ring/bus

FLOAT_BACKUP: Enable – Displays all the units connected to the ring/bus having Float Backup enabled.

SETTING_RESULT: OK – Displays the Float Backup enable has been successfully implemented.

<-local: This points to the unit that the USB cable is plugged into on the ring/bus.

The link furthest from the Master unit in a ring configuration is automatically selected as the backup branch. In the case of even units on a ring the fiber link on port 3 will always be the backup branch – indicated by a dashed line on a ring topology.

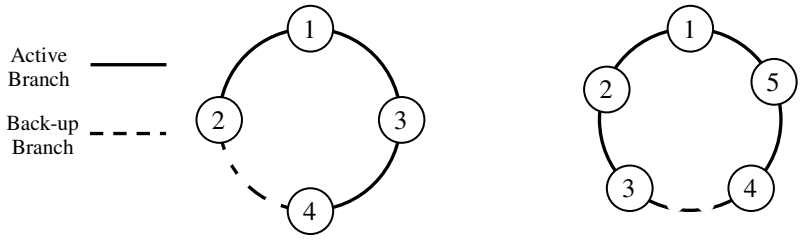


FIGURE 23: RING TOPOLOGY

In Figure 23, node 1 will communicate with node 2, node 3 and node 4 via node 3. Node 2 will communicate to node 4 only via node 1 and 3.

In the event of a fiber link being broken or disconnected (indicated by a cross) the backup branch will become the active branch. If the link between node 1 and 3 is broken (see Figure 24), node 1 will communicate with node 3 via node 2 and node 4.

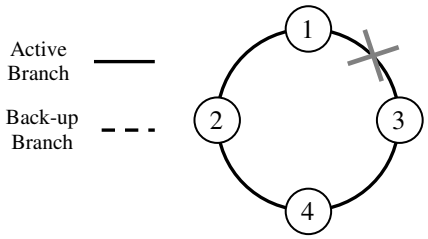


FIGURE 24: FLOAT BACKUP ENABLED 2

When the float backup is in enabled mode, if the broken or disconnected branch is re-established, the backup branch will now be the last broken/disconnected branch as shown in Figure 25.

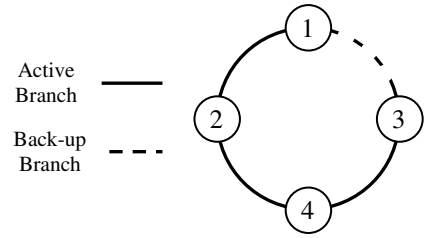


FIGURE 25: FLOAT BACKUP ENABLED 3

Note: When configuring the float backup function ***all*** units on the ring/bus network ***must*** have the same float backup configuration for correct operation. Differing backup configurations will cause segmented backup branches and may not function as intended.

All OSD2251A are set to **enabled** float backup upon shipment.

FLOAT BACKUP DISABLE - <fbd> Command Line

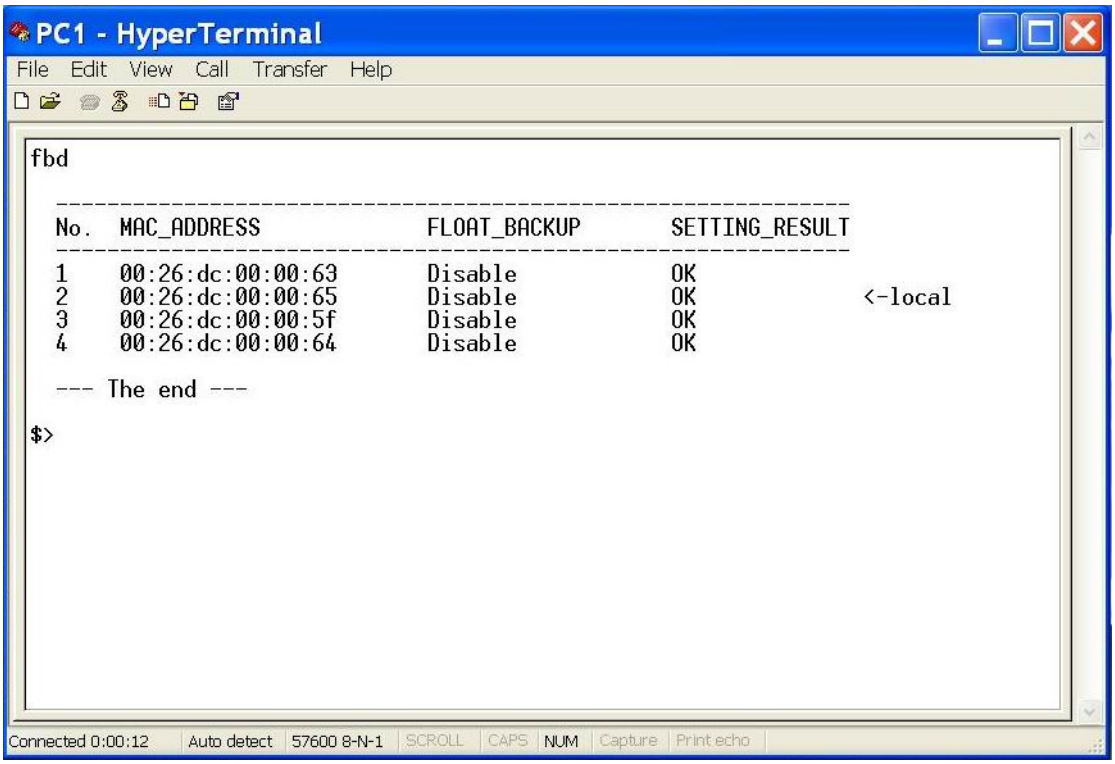


FIGURE 26: FLOAT BACKUP DISABLED 1

No: 4 – Lists number of units connected (in this case 1,2,3,4)

MAC_ADDRESS:– Displaying all the MAC addresses of the units connected on the ring/bus

FLOAT_BACKUP: Disable – Displays all the units connected to the ring/bus having Float Backup disabled.

SETTING_RESULT: OK – Displays the Float Backup disable has been successfully implemented.

<-local: This points to the unit that the USB cable is plugged into on the ring/bus.

The link furthest from the Master unit in a ring configuration is automatically selected as the backup branch. In the case of even units on a ring the fiber link on port 3 will always be the backup branch – indicated by a dashed line on a ring topology.

In the event of a fiber link being broken or disconnected (indicated by a cross) the backup branch will become the active branch.

If the link between node 1 and 3 is broken (see Figure 27) , node 1 will communicate with node 3 via node 2 and node 4.

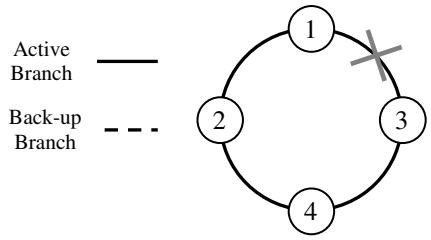


FIGURE 27: FLOAT BACKUP DISABLED 2

When the float backup is in disabled mode, if the broken or disconnected branch is re-established, the backup branch will again be the furthest link from the smallest MAC addressed unit as shown in Figure 28.

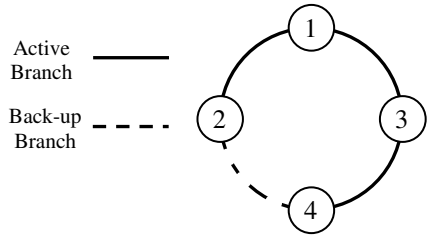


FIGURE 28: FLOAT BACKUP DISABLED 3

Note: When configuring the float backup function ***all*** units on the ring/bus network ***must*** have the same float backup configuration for correct operation. Differing backup configurations will cause segmented backup branches and may not function as intended.

All OSD2251A are set to **enabled** float backup upon shipment.

VERSION CHECK - <vc> Command Line

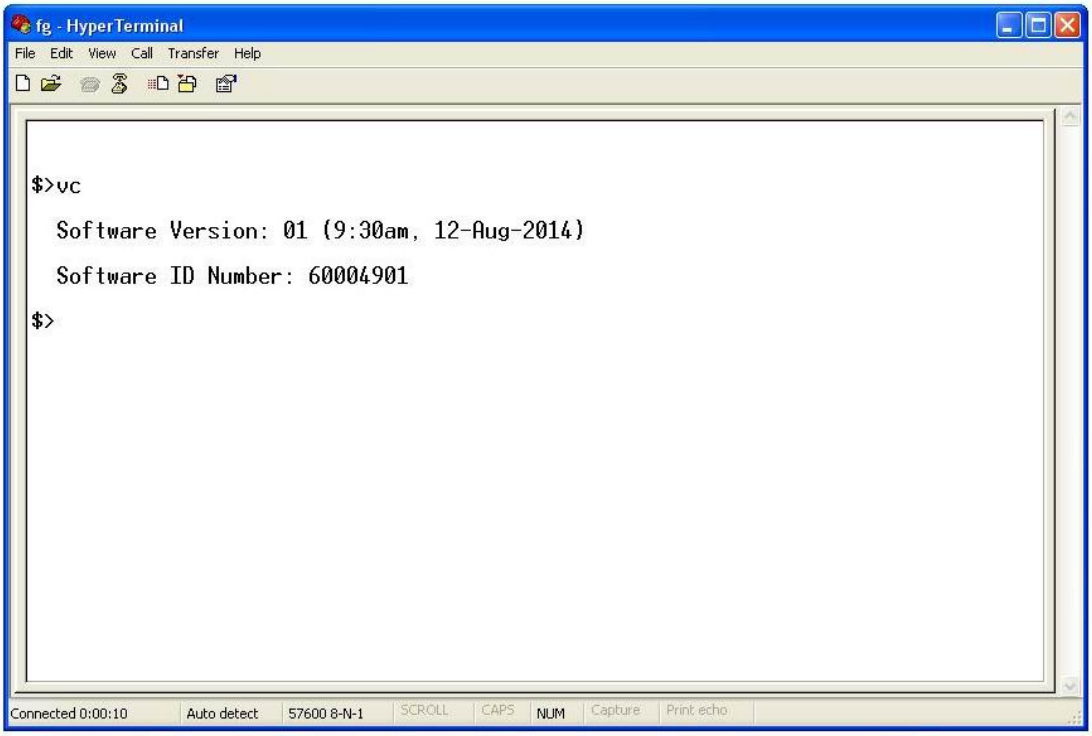


FIGURE 29: VERSION CHECK

Displays the Software Version Number and Software ID Number installed on the OSD2251A

3 MAINTENANCE

3.1 INTRODUCTION

The following section outlines the fault-finding procedure for the OSD2251A modems. Please take note of the following:

- Personnel without appropriate training should not attempt any maintenance except that outlined below.
- 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.
- Some components within the unit are Electrostatic (ES) sensitive and Electrostatic Discharge (ESD) precautions should be taken when performing maintenance upon the unit.

3.2 EXTERNAL INSPECTION

Visually check for the following:

- Check that the correct power source is connected to the power socket.
- Check that the Ethernet cables are connected to the modem correctly and that the distant OSD2251A modem has been connected correctly to any external equipment.
- Inspect the optical connectors (for fiber SFP option) for any contamination and clean using isopropyl alcohol and a lint free tissue if any contamination is detected.

3.3 ROUTINE MAINTENANCE

- There is no routine maintenance required with the OSD2251A.

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 contact 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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