
OPTICAL

SYSTEMS

DESIGN

OSD2140 SERIES

FOUR TO ONE (OR THREE TO TWO)

ETHERNET MULTIPLEXER

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1 TECHNICAL SUMMARY

1.1 BRIEF DESCRIPTION

1.1.1 OVERVIEW

The OSD2140 is a hard wired Ethernet multiplexer which has 4 ports all multiplexed onto 1 trunk port **or** 3 ports multiplexed onto 2 trunk ports which provides both increased throughput **and** redundant trunk operation. Each port is totally isolated from the other ports so that you have effectively 4 totally independent Ethernet channels being sent over the one transmission path. In the simplest case each of the 4 ports can be 10 or 100Mbps and the fiber trunk can operate at 1000BaseLx. However, it is also possible to have the 4 ports operating at 1000BaseT and the unit operates like a statistical multiplexer.

It is possible to set the priority level of each of these 4 ports for optimized operation for different networks. The system can also provide redundant trunks by using another port as a trunk so that 3 ports can be multiplexed over redundant fiber runs. Furthermore, the trunk port(s) can be set to operate at 100BaseFx so that long runs are possible over multimode fiber.

The unit will operate on either singlemode or multimode fiber. Operation over at least 50km of singlemode fiber 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 OSD2140 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

▲ Ethernet Security Applications

▲ Industrial IP communications

▲ Gigabit backbone networks

▲ Any network utilizing a mix of copper and fiber

1.1.3 FEATURES AND BENEFITS

▲ Complies with IEEE802.3

10/100/1000Base-T, 1000Base-X, 100Base-FX standards.

▲ Has a total of five ports: two fixed copper ports for 10/100/1000Base-T and three SFP ports which may be either copper or fiber.

▲ Two optional usage cases:

-- One Trunk Port + Four Multiplexer Ports

-- Two Trunk Ports + Three Multiplexer Ports.

▲ Ethernet packets are isolated between multiplexer ports, including broadcast packets.

▲ Using two trunk ports can increase trunk bandwidth to two Gigabits and provide redundant fiber operation over the trunk. Load balancing between two trunks is based on frame's DA/SA.

▲ Command Line Interface for configurations.

▲ Less than 2ms recovery time for Dual Trunks Mode if one trunk link is broken

▲ Optional four-level priorities can be assigned to each multiplexer port. Priority mode is optional between Weighted Mode (8:4:2:1) and Fixed Mode.

▲ Can be used with either singlemode or multimode fiber over a variety of link budgets.

▲ Available for operation over 1 or 2 fibers.

▲ Auto MDI/MDIX function, no need for crossover cables.

▲ Powered by non-critical 12VDC supplies.

▲ Temperature range of -20 to +75°C

▲ SFP module sold separately

▲ Dual Power Supply Inputs

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1.2 TYPICAL CONFIGURATION

Figure 1 below indicates a possible set-up for an OSD2140 system.

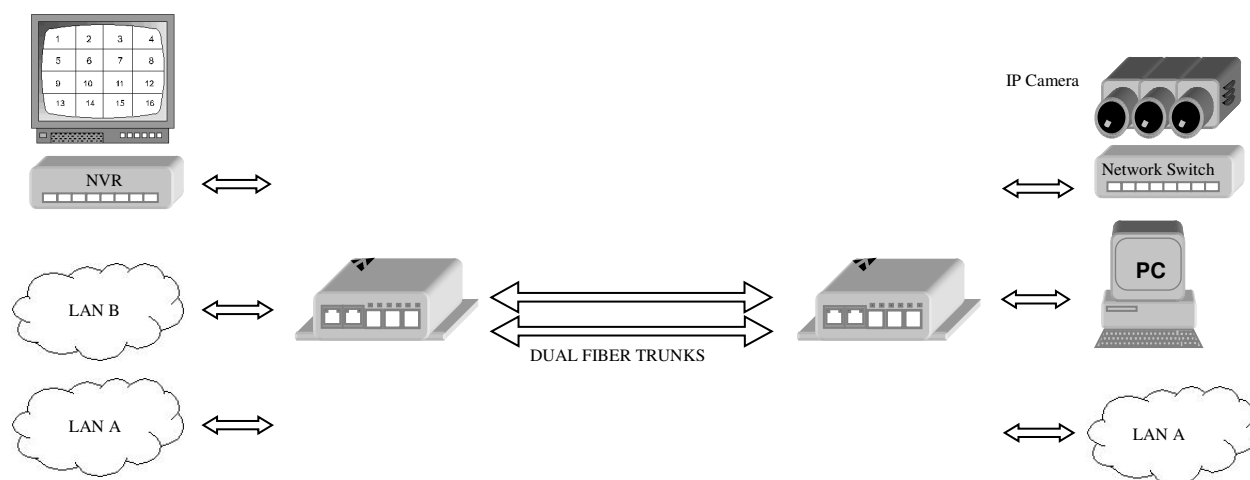


FIGURE 1: TYPICAL CONFIGURATION

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1.3 TECHNICAL SPECIFICATIONS

TABLE 1: TECHNICAL SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Electrical Data Interface	10Base-T (IEEE802.3), 100Base-T(IEEE802.3u), 1000Base-T(IEEE802.3ab)
Electrical Data Connector	RJ45 for fixed copper ports (Ports 1 and 2) and three SFP ports
Ports 1 and 2 data rates	10, 100, 1000Mbps with energy detect, auto negotiate, auto MDI/MDIX crossover
Optical Data Interface	1000Base-X (IEEE802.3z), 100Base-Fx(IEEE802.3u)
Optical connector	LC or SC
SFP Port 3, 4 and 5 Options	1000Base-x, 100Base-Fx, 10/100/1000Base-T
Operating Mode	Half or full duplex for 10/100 Full duplex for 1000 Flow control: Pause frames for full-duplex, Back pressure for half-duplex
Transmitter Wavelength	1310nm $\pm$ 30nm
Transmit Optical Power	>-10dBm to -4dBm (-5dBm and +2dBm @ 1310nm and 1550nm are optional)
Receiver Sensitivity	<-21dBm
Standard Optical Link Budget	>11dB: >800m on multimode fiber @ 1310nm (Fiber bandwidth limited) >20km on singlemode fiber @ 1310nm >40km on singlemode fiber @ 1550nm
Optional Optical Link Budget	>23dB: >100km on singlemode fiber with optional 1550nm devices
Indicators	1x Power 2x Copper Speed/Activity/Link on 2 x RJ45 3 x SFP Speed/Activity/Link for copper or fiber
Dimensions (mm)	114W x 173D x 31H (module) 25W x 208D x 100H (card)
Weight	0.5kg (module), 0.3kg (card)
Power Requirements	+8V to +35V _{DC} or 22 to 28V _{AC} @ 10VA (with 3x SFPs loaded)
Operating Temperature	-20°C to +75°C
Relative Humidity	0 to 95% non-condensing

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1.4 OSD2140 FRONT AND REAR PANELS

There are two fixed copper ports for 10/100/1000Base-T and three optional SFP ports which can be either copper or fiber on the front panel. The rear panel consists of a 6-way terminal block power connector, 8-way and 4-Way DIP switches, micro USB connector and an RJ11 connector. Each section will be described further throughout this manual.

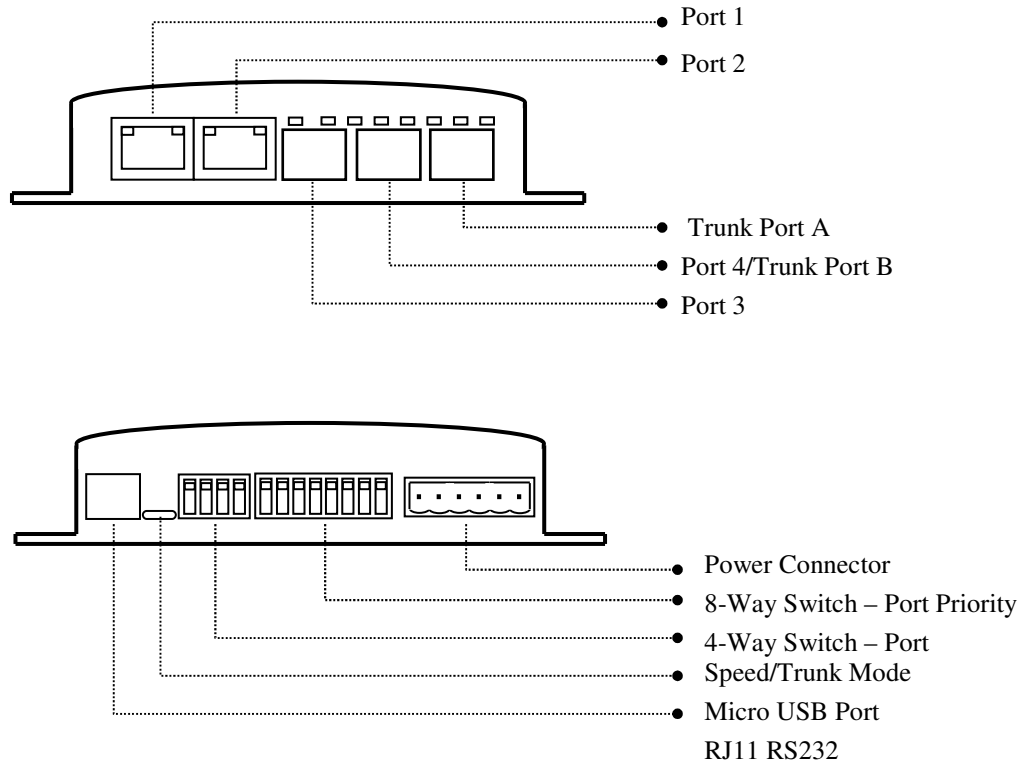


FIGURE 2: OSD2140 CONNECTORS

2 INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section outlines the methods required to install and operate the OSD2140 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

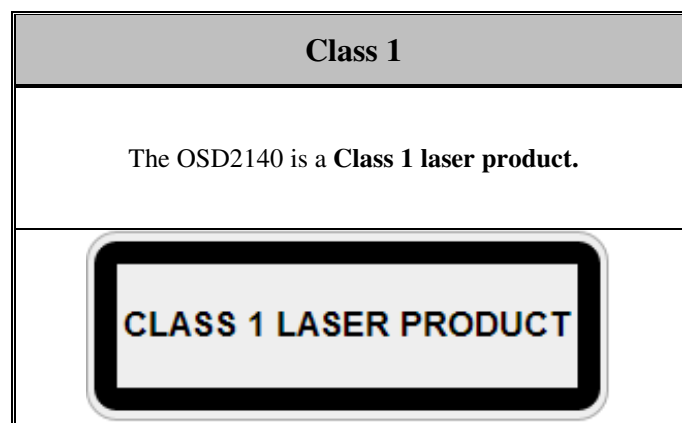
2.2.1 WARNING AND PRECAUTIONS

▲ 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.



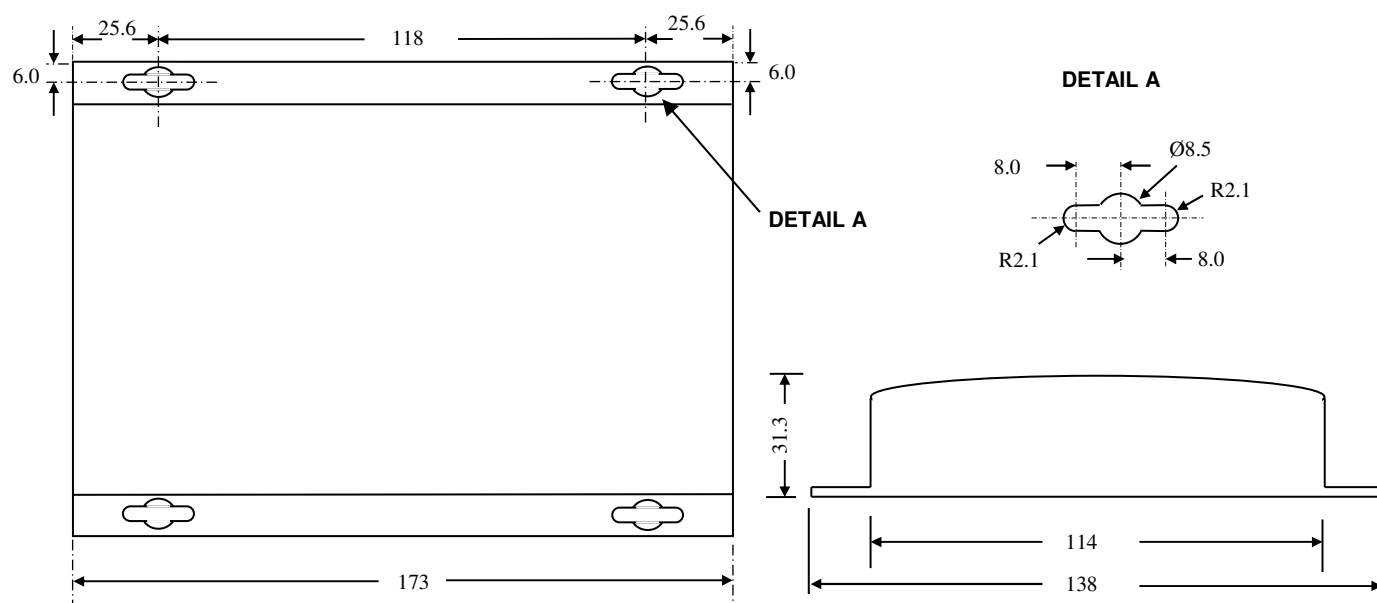
PRECAUTIONS

- ▲ 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.

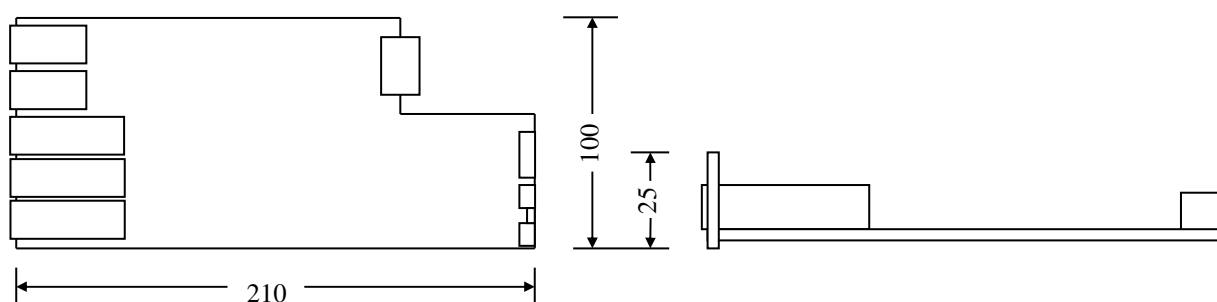
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2.2.2 OSD2140 DRAWINGS AND DIMENSIONS

The OSD2140 standalone module is designed to be mounted on an even surface and to be secured by means of M4 or smaller screws. The OSD2140 card version is designed to be inserted into a chassis and secured by means of captivated screws.



(a) Module Version



(b) Card Version

FIGURE 3: OSD2140 MOUNTING DIMENSIONS

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2.2.3 POWER SUPPLY CONNECTIONS

The OSD2140 card version is powered from the OSD370 or OSD350 chassis. DC power on the OSD2140 card version is connected via the DB9 connector. The card version of the OSD2140 should be fixed into the OSD370 (or OSD350) chassis using the captivated screws. The card can be plugged in or out of the OSD370 (or OSD350) chassis with power on or off.

The OSD2140 module requires external 8 to 35V_{DC} or 22 to 28V_{AC} @ 10VA. The OSD2140 features a second input voltage channel for redundant power operation. Power should be connected to the power socket located at the back of the case as indicated in Table 2

WARNING: Because Pin2 and Pin5 are connected together internally, make sure that two external power supplies, if redundant power supplies are applied, can not be shorted through Pin2 and Pin5, especially for AC power supply usage.

TABLE 2: DC OR AC POWER CONNECTION

External Power Pin	Specification
Pin 1 and/or 5	+8V _{DC} to +35V _{DC} or 22 to 28V _{AC} @ 10VA
Pin 2 and/or 6	Ground – 0V
Pin 3 & 4	Not Used

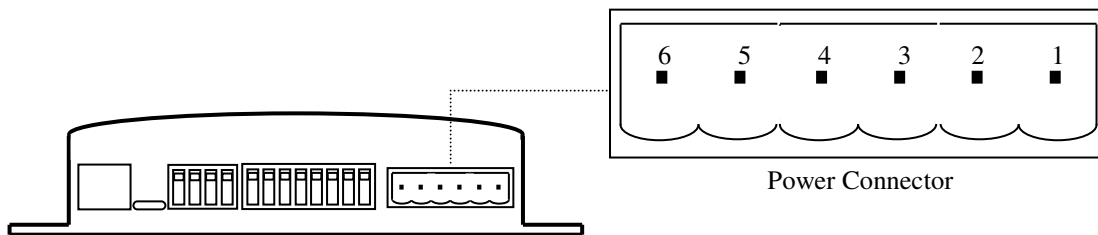


FIGURE 4: 2140 POWER SUPPLY CONNECTIONS

2.2.4 RJ45 COPPER PIN ASSIGNMENTS

Figure below shows the pin configuration for both the fixed copper ports or the optional SFP ports fitted with RJ45 copper port

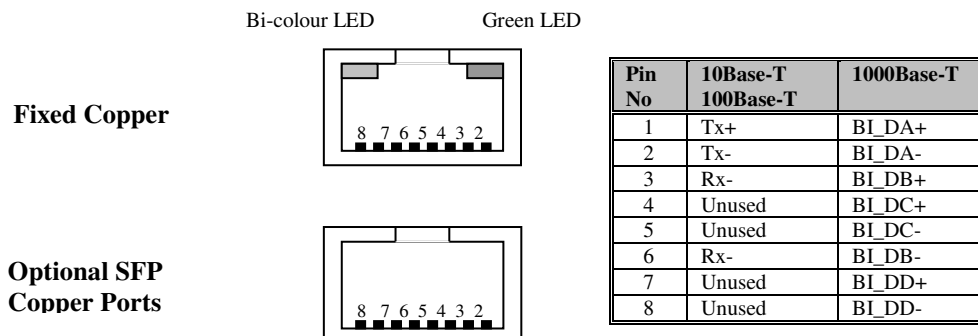


FIGURE 5: FIXED 10/100/1000BASE-T ETHERNET RJ45 CONNECTORS

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2.2.5 RS232 CONNECTOR

The OSD2140 has an RJ11 connector located on the rear of the unit that is used for Command Line Interface (CLI) from the PC to the OSD2140 via the PC's RS232 connector. See section 2.4 for further CLI information.

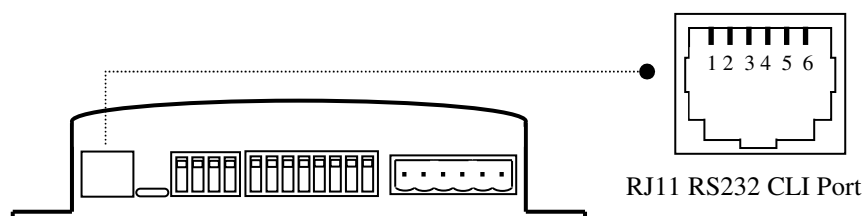


FIGURE 6: RJ11 RS232 CLI PORT

The connections to the PC is through the DB9 or DB25 connector. The RJ11 on the OSD2140 requires 6P6C (6 position 6 conductor) connector. The following table outlines the pin configuration.

TABLE 3: RS232 PIN CONNECTIONS

PC		OSD2140	OSD2140 Function
DB9F	DB25F	RJ11	
2	3	1	Tx
3	2	2	Rx
5	7	4	Gnd

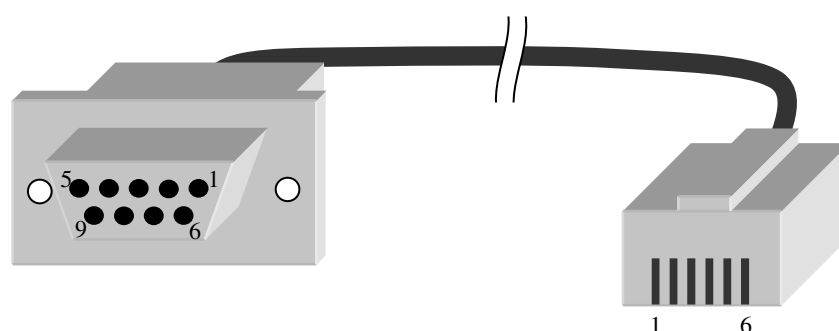


FIGURE 7: DB9 TO RJ11 RS232 CABLE

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2.2.6 PORT ALLOCATION AND LED INDICATORS

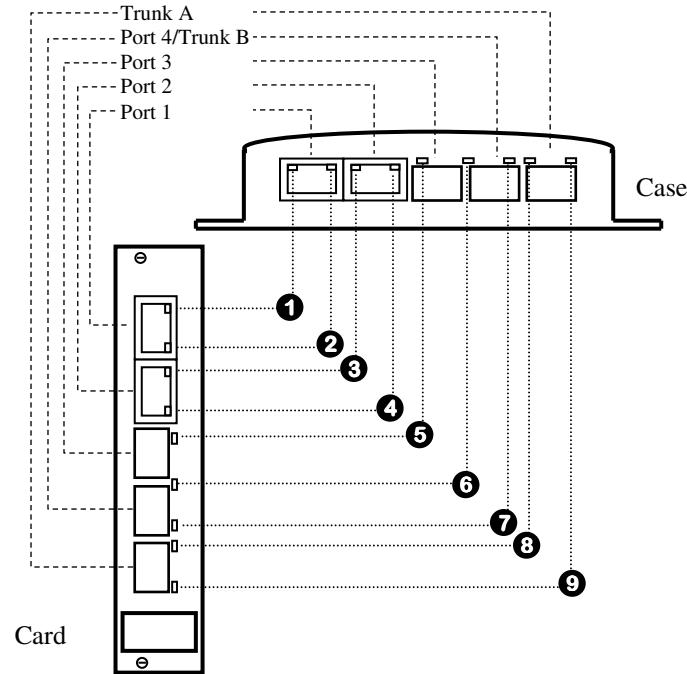


FIGURE 8: LED AND PORT ALLOCATION

TABLE 4: LED ALLOCATION

* Note On LED could be either Green or Amber

No	Function			LED Colour Function		
	On	Blink	Off	Green	Gr/Am	Amber
❶	No Activity	Activity	No Link	1Gbps	100Mbps	10Mbps
❷	Full Duplex	-	Half Duplex	On*	-	On*
❸	No Activity	Activity	No Link	1Gbps	100Mbps	10Mbps
❹	Full Duplex	-	Half Duplex	On*	-	On*
❺	Power On	-	Power Off	On	-	-
❻	No Activity	Activity	No Link	1Gbps	100Mbps	10Mbps
❼	No Activity	Activity	No Link	1Gbps	100Mbps	10Mbps
❽	Trunk Link OK	Trunk Link Error	-	Single Trunk Mode	Trunk Link Error	Dual Trunk Mode
❾	No Activity	Activity	No Link	1Gbps	100Mbps	10Mbps

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2.2.7 CONTROLS

The OSD2140 has a 4-way and 8-way DIP switch to control a number of functions. Table 5 and Table 6 outline the function of each switch.

All switch settings should be down before powering on OSD2140.

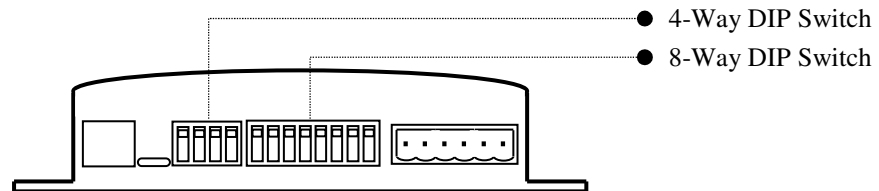


FIGURE 9: OSD2140 CONTROLS

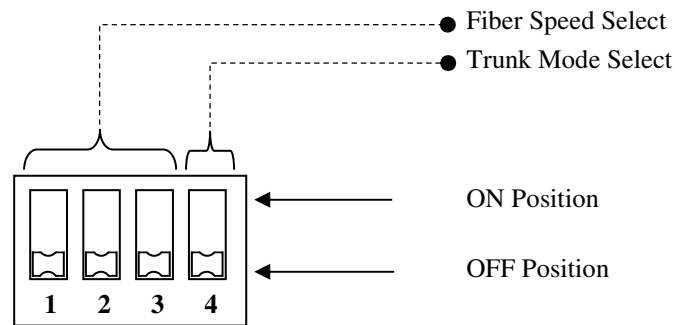


FIGURE 10: OSD2140 4-WAY DIP SWITCH

TABLE 5: OSD2140 4-WAY DIP SWITCH SETTINGS

SWITCH NUMBER	DESCRIPTION	FUNCTION	SWITCH POSITION	COMMENTS
1	Trunk Port A Fiber Speed	1000Mbps 100Mbps	OFF* ON	Trunk Ports must have the same setting.
2	Port 4/Trunk Port B Fiber Speed	1000Mbps 100Mbps	OFF* ON	
3	Port 3 Fiber Speed	1000Mbps 100Mbps	OFF* ON	
4	Trunk Mode	Single Trunk Dual Trunk	OFF* ON	

*Default settings.

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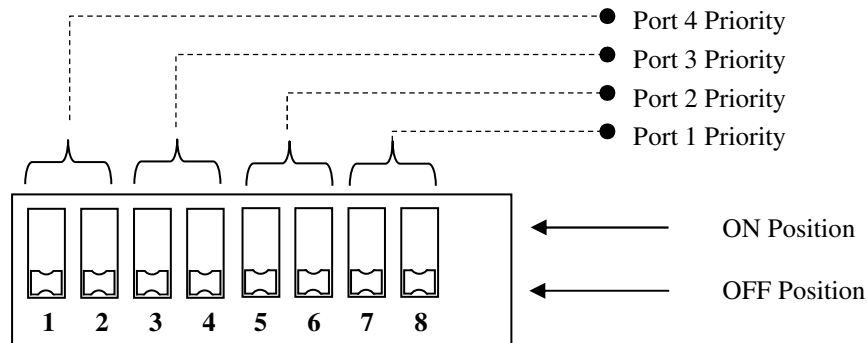


FIGURE 11: OSD2140 8-WAY DIP SWITCH

TABLE 6: OSD2140 8-WAY DIP SWITCH SETTINGS

SWITCH NUMBER	DESCRIPTION	FUNCTION	SWITCH POSITION	COMMENTS
1-2	Set priority level for Port 4	0b00 → priority level 0	OFF* ON	SW No.2 – High Bit SW No.1 – Low Bit
3-4	Set priority level for Port 3	0b01 → priority level 1	OFF* ON	SW No.4 – High Bit SW No.3 – Low Bit
5-6	Set priority level for Port 2	0b10 → priority level 2	OFF* ON	SW No.6 – High Bit SW No.5 – Low Bit
7-8	Set priority level for Port 1	0b11 → priority level 3	OFF* ON	SW No.8 – High Bit SW No.7 – Low Bit

* Default settings.

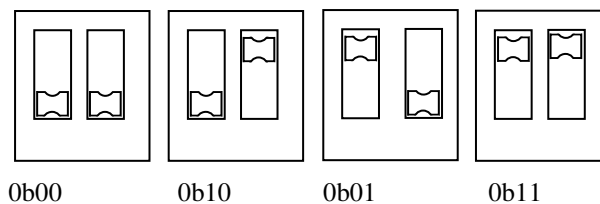


FIGURE 12: OSD2140 PORT PRIORITY DIP SWITCH VALUES

If Port 4 is used as one trunk port in Dual Trunk Mode, priority setting for Port 4 has no use.

If 8-way DIP switch setting is 11111111 or 00000000, port priority function is disabled, including the setting of Port 4 even if OSD2140 is in 3-2 mode. In this case, all normal ports have the same priority level and share the trunking bandwidth equally on average.

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2.2.8 FITTING SFP CONNECTORS

Care should be taken when inserting/removing the SFP connectors from SFP port 3,4 and 5 as 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.

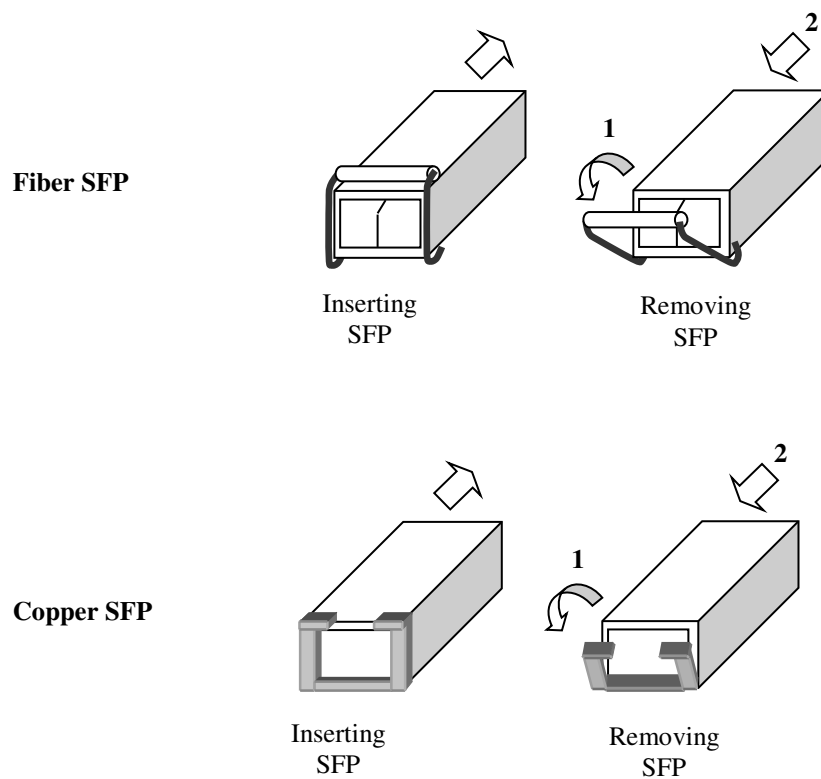


FIGURE 13: FITTING/REMOVING SFP CONNECTORS

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2.3 OSD2140 OPERATION

When using the OSD2140 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 OSD370 or OSD350 chassis and check that the indicators illuminate accordingly on power up (see Table 4). If a module version (OSD2140M) is used, connect the unit to an appropriate power source and 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 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 fiber cable to fiber SFP modules.

Four to One Operation

To connect the OSD2140 with a single trunk only, Trunk Port A must be used together with fiber or copper SFPs. The non-trunk ports (ports 1,2, 3&4) should be used to connect to your Ethernet devices (eg. Cameras, LANs, computers, etc.)

Figure 14 shows the connection method. Typically the SFP used would be a fiber SFP with duplex LC connectors

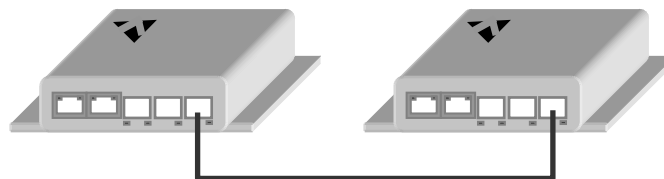


FIGURE 14: FOUR TO ONE CONNECTION

The trunk mode will be shown by the LED indicator (see Table 4 and Figure 8).

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Three to Two Operation

To connect the OSD2140 with Dual Trunk Ports Trunk Port A and B must be used together with fiber or copper SFPs. The remaining ports (ports 1,2, &3) should be used to connect to your Ethernet devices (eg. Cameras, LANs, computers, etc.)

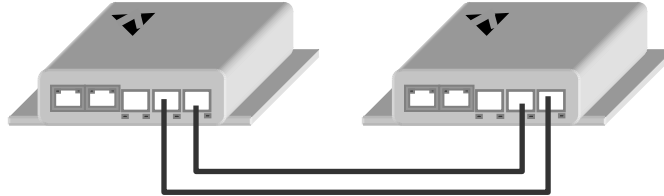


FIGURE 15: THREE TO TWO (DUAL REDUNDANT TRUNK) CONNECTION

This configuration allows greater bandwidth transmission over the Trunk Ports, as well as offering redundancy should one of the Trunk Ports lose connection.

WARNING: For Three to Two Mode, Fiber Speed Setting for Trunk Port A and B should be the same.

2.4 COMMAND LINE INTERFACE

The Command Line Interface (CLI) is a useful tool setting Priority Mode and Enabling/Disabling Flow Control. To enable the use of CLI the OSD2140 must be connected to a PC with a serial port and an appropriate cable as specified in section 2.2.5.

2.4.1 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 16: SERIAL PORT SETTINGS

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2.4.2 COMMAND LINE FUNCTIONS

There are three command line functions that enable the user to configure the OSD2140 to suit the users application. This section explains the command lines and its functions.

When the terminal emulation program is operating, connect the RS232 cable to the OSD2140 unit that the user wishes to configure/interrogate. Note: A message will be displayed on the terminal emulation program when the unit is powered after RS232 connection. This message will not open when the unit is switched on while plugging in the RS232 cable, however the command lines are functional.

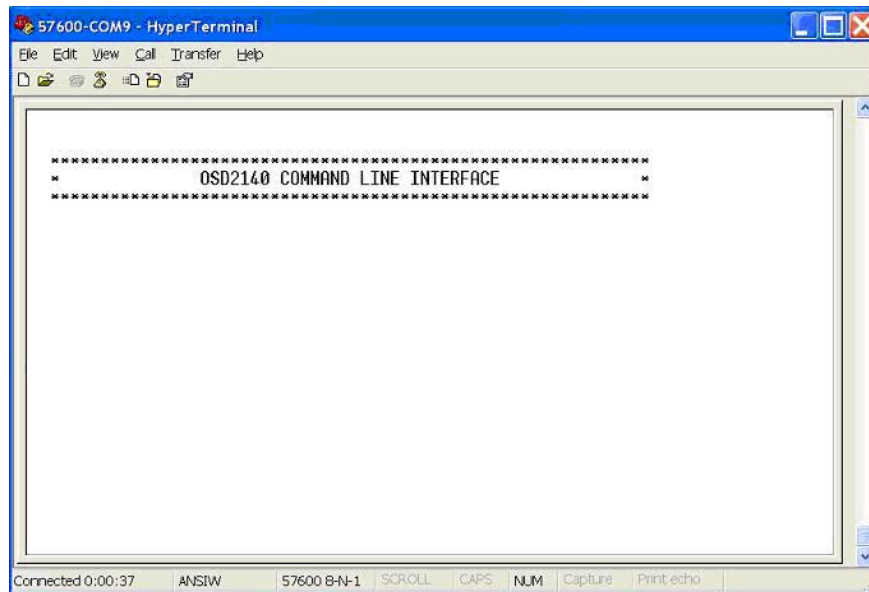


FIGURE 17: INITIAL COMMAND LINE SCREEN

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

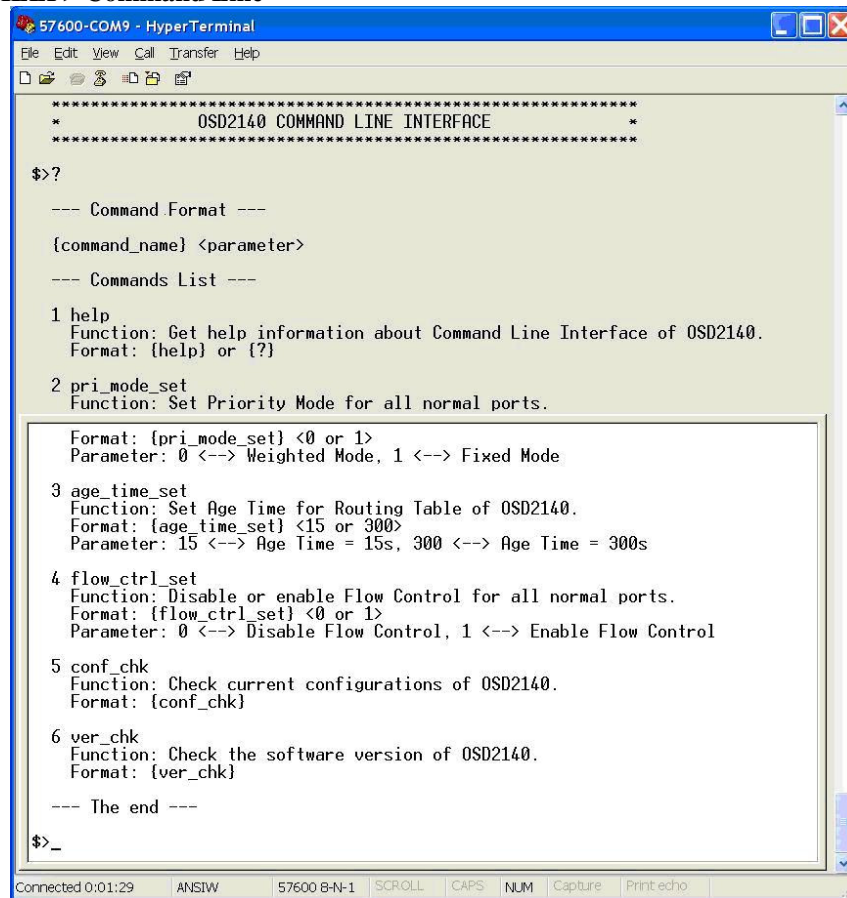
TABLE 7: TERMINAL COMMAND LINES

TERMINAL COMMAND LINE	SPECIFICATION	FUNCTION	FIGURE
help	help	Displays all user available CLI commands	18
conf_chk	Configuration Check	Displays the configuration status of the unit	19
ver_chk	Software Version Check	Displays the software version of the unit	20
pri_mode_set	Priority Mode Set	Sets the priority mode to weighted* or fixed	21
age_time_set	Age Time Set	Set the Age Time for the Routing Table of the OSD2140	22
flow_ctrl_set	Set Flow Control	Enable or Disable* Flow Control	23

* Default settings.

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HELP - <HELP> Command Line



```
57600-COM9 - HyperTerminal
File Edit View Call Transfer Help
*****
*          OSD2140 COMMAND LINE INTERFACE          *
*****

$>?

--- Command Format ---
{command_name} <parameter>

--- Commands List ---

1 help
Function: Get help information about Command Line Interface of OSD2140.
Format: {help} or {?}

2 pri_mode_set
Function: Set Priority Mode for all normal ports.
Format: {pri_mode_set} <0 or 1>
Parameter: 0 <--> Weighted Mode, 1 <--> Fixed Mode

3 age_time_set
Function: Set Age Time for Routing Table of OSD2140.
Format: {age_time_set} <15 or 300>
Parameter: 15 <--> Age Time = 15s, 300 <--> Age Time = 300s

4 flow_ctrl_set
Function: Disable or enable Flow Control for all normal ports.
Format: {flow_ctrl_set} <0 or 1>
Parameter: 0 <--> Disable Flow Control, 1 <--> Enable Flow Control

5 conf_chk
Function: Check current configurations of OSD2140.
Format: {conf_chk}

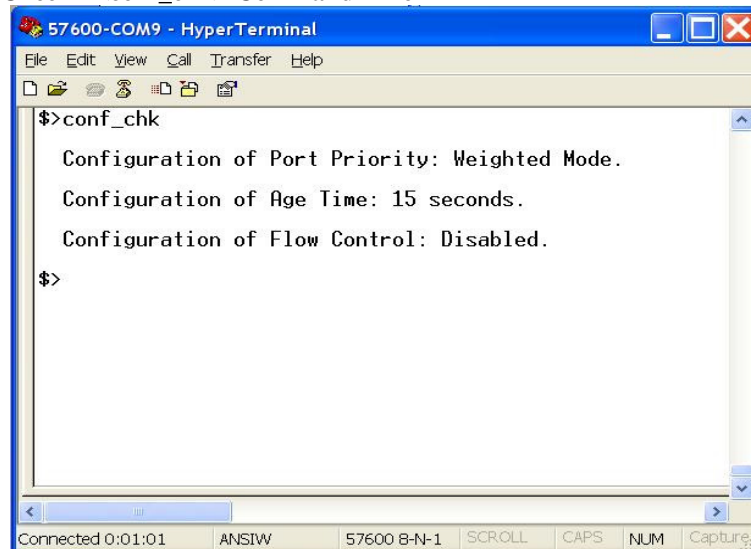
6 ver_chk
Function: Check the software version of OSD2140.
Format: {ver_chk}

--- The end ---

$>_
```

FIGURE 18: CLI COMMAND - HELP

Configuration Check - <conf_chk> Command Line



```
57600-COM9 - HyperTerminal
File Edit View Call Transfer Help

$>conf_chk

Configuration of Port Priority: Weighted Mode.
Configuration of Age Time: 15 seconds.
Configuration of Flow Control: Disabled.

$>
```

FIGURE 19: CLI COMMAND – CONFIGURATION CHECK

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Software Version Check - <ver_chk> Command Line

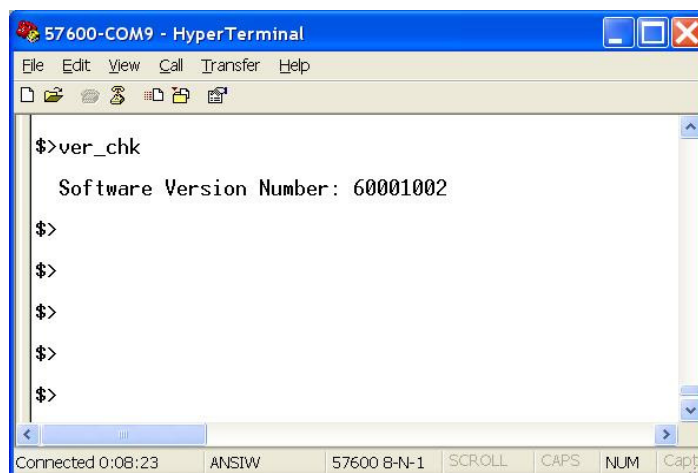


FIGURE 20: CLI COMMAND – VERSION CHECK

Priority Mode Set -<pri_mode_set> Command Line

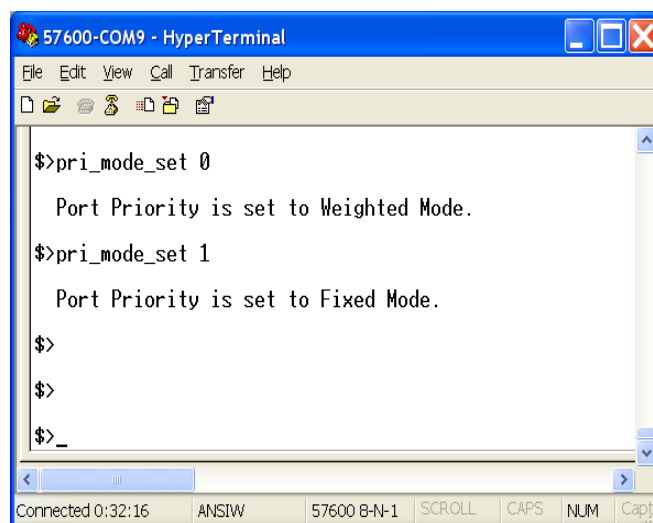


FIGURE 21: CLI COMMAND – PRIORITY MODE SET

There are two priority mode for multiplexer ports :

1) Weighted Mode

In this mode, a Priority Ratio – 8:4:2:1 is implemented for priority level 3, 2, 1,0 respectively. This Priority Ratio decides the scale value that a multiplexer occupies out of whole trunk bandwidth.

For example:

If priority setting for each multiplexer port in 4-1 mode is: Port1 – Level0, Port2 – Level1, Port3 – Level2, Port4 – Level3. All multiplexer port work at 1Gbps.

Trunk Bandwidth used by Port1 is: $1/(8+4+2+1) = 1/15 = 6.7\%$

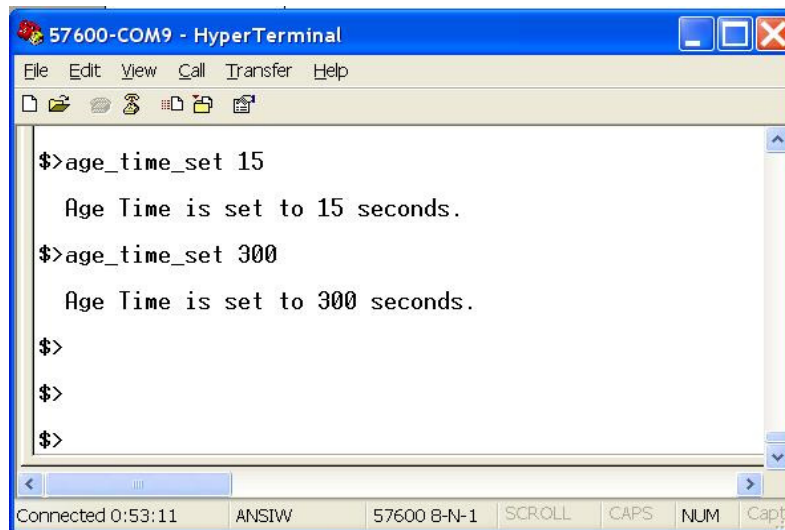
Trunk Bandwidth used by Port4 is: $8/(8+4+2+1) = 1/15 = 53.3\%$

2) Fixed Mode

In this mode, the multiplexer port with the highest Priority Level will use Trunk Bandwidth first and then the second highest. Low level port may not have opportunity to send frame out in this case.

OPTICAL SYSTEMS DESIGN

Age Time Set -<age_time_set> Command Line



A screenshot of a HyperTerminal window titled "57600-COM9 - HyperTerminal". The window shows a command-line interface with the following text:

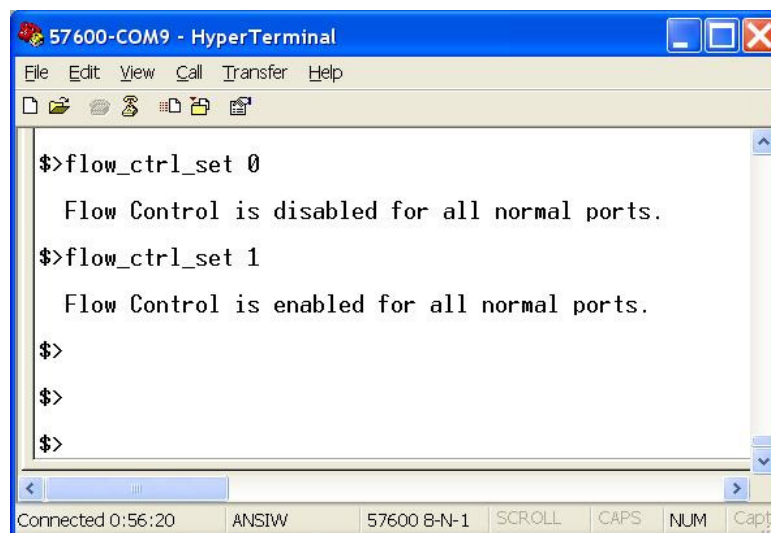
```
$>age_time_set 15
    Age Time is set to 15 seconds.
$>age_time_set 300
    Age Time is set to 300 seconds.
$>
$>
$>
```

The status bar at the bottom indicates "Connected 0:53:11", "ANSIW", "57600 8-N-1", "SCROLL", "CAPS", "NUM", and "Capt".

FIGURE 22: CLI COMMAND – AGE TIME SET

Two optional Age Time value: 15s(default) or 300s

Set Flow Control <flow_ctrl_set> Command Line



A screenshot of a HyperTerminal window titled "57600-COM9 - HyperTerminal". The window shows a command-line interface with the following text:

```
$>flow_ctrl_set 0
    Flow Control is disabled for all normal ports.
$>flow_ctrl_set 1
    Flow Control is enabled for all normal ports.
$>
$>
$>
```

The status bar at the bottom indicates "Connected 0:56:20", "ANSIW", "57600 8-N-1", "SCROLL", "CAPS", "NUM", and "Capt".

FIGURE 23: CLI COMMAND – FLOW CONTROL SET

If flow control is enabled, pause frame will be used for full-duplex mode and back-pressure will be used for half-duplex mode.

OPTICAL SYSTEMS DESIGN

2.5 OSD2140 DEFAULT SETTINGS

The detailed default settings of the OSD2140 upon shipment can be found in Table 5, Table 6 and Table 7. Below is a summary of the default settings;

TABLE 8: DEFAULT SETTINGS

	Switch Number	Position	Setting
4-Way Dip Switch	1	Off	Trunk Port A Speed – 1000Mbps
	2	Off	Trunk Port B Speed – 1000Mbps
	3	Off	Port 3 Speed – 1000Mbps
	4	Off	Single Trunk
8-Way Dip Switch	1-2	Off	Priority Level 0
	3-4	Off	Priority Level 0
	5-6	Off	Priority Level 0
	7-8	Off	Priority Level 0
Command Line Interface	-	Weighted	Priority Mode Set
	-	Disable	Flow Control

Note: If 8-way DIP switch setting is 00000000 or 11111111, port priority function is disabled.

3 MAINTENANCE

3.1 INTRODUCTION

The following section outlines the fault-finding procedure for the OSD2140 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 OSD2140 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 OSD2140.

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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