MICROSENS

User Manual

MSP1000 Platform - Module X2G

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Warning: Only trained and qualified service personnel should install, replace, or service the equipment.

Warnung: Das Installieren, Ersetzen oder Bedienen dieser Geräte sollte nur von geschultem, qualifiziertem Personal ausgeführt werden.

Attention: Il est vivement recommandé de confier l'installation, le remplacement et la maintenance de ces équipements à des personnels qualifiés et expérimentés.

Before you install, operate or service the system, read the

„MSP1000 Safety & Certification Handbook"

This guide contains important safety information you should know before working with the system.

1 Overview

1.1 Supported Products

This document describes the following product:

Art-No.	Description
MS425601M	2 Channel Crossbar 2,7G Transponder X2G

1.2 Introduction

The 2 channel Crossbar 2,7G Transponder X2G module is an extremely flexible optical channel card with four pluggable interfaces interconnected by a fully non-blocking cross-connect matrix ('X-point Switch').

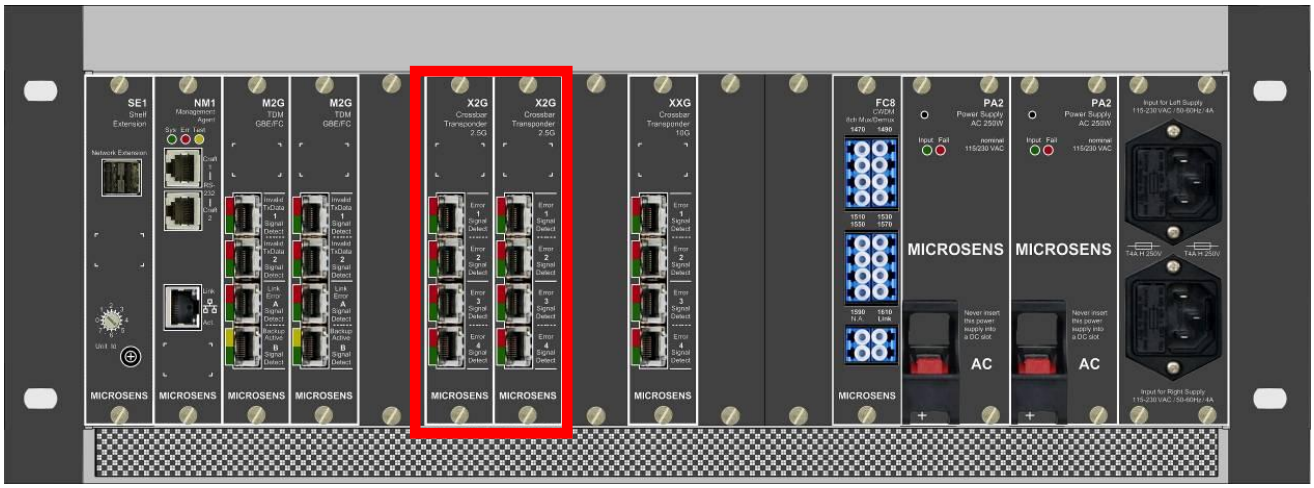
In principle any port to any other port connectivity is possible.

When used in conjunction with CWDM transceivers, plugged into the card, the same type of module can be used for 'Add/Drop', 'Express Bypass', 'Multidrop', 'Backup' and 'Dual Channel' functions.

The X2G can be connected directly to a dark fiber or may be used to feed into a DWDM or CWDM passive filter module. Linear, meshed and ring topologies are supported.

Typical applications include but are not limited to FibreChannel, Gigabit Ethernet, ATM, Fast Ethernet, SDH or SONET.

The X2G may be used with any MICROSENS MSP1000 shelf (e.g. MSP1100 or MSP1400).



Two X2G mounted in a MSP1400 4HU shelf

1.3 Typical Applications

The flexibility of the X2G permits a multitude of applications:

1.3.1 Double Converter / WDM Channel

The four optical interfaces permit use of the X2G as dual channel single mode to multimode converter. Two independent multimode applications are converted to any wavelength individually.

Depending on the plugged-in laser modules, short reach, long reach, CWDM or even DWDM wavelength' can be specified.

The 3R function allows to maximize distances and to optimize the optical signals prior to forwarding them to the application.

1.3.2 Backup Function

The X2G functions as full automatic backup system when equipped with three interfaces. The application data are internally duplicated and transmitted onto two geographically dispersed dark fibers. In the event of a link failure (even if caused by a laser failure) the other fiber is selected by the far end.

The X2G may be used in point-to-point applications or within a ring environment for utmost flexibility.

Switching is autonomously controlled by each X2G resulting in lowest latency and increased reliability. No central manager is responsible for backup control, even in multi-wavelength ring and mesh systems. All switching is reported to the network management and numerous statistics are gathered to allow for quality of service reporting.

Backup may be combined with WDM and ring configurations. One path would be routed eastbound while the other port would be connected westbound. Both directions can use the same or a different WDM wavelength.

1.3.3 Add/Drop Function

The Add/Drop feature is suitable in ring networks. Data incoming from the westbound link are 'dropped' locally to one application port. The data from the other data port are converted to a CWDM (Course Wavelength Division Multiplexer) wavelength and send eastbound. The bidirectional nature of the X2G performs the same function likewise with data incoming eastbound. All received data are fully 3R recovered prior to being forwarded to the local application.

1.3.4 Repeater Mode

Each X2G can be switched from 'Add/Drop' to 'Express' mode on the fly. In Express mode eastbound data are fully 3R recovered and forwarded westbound to create a transit node on the ring. Due to the full signal regeneration very long ring circumferences are made possible.

Both, 'Add/Drop' and 'Repeater' setup can be selected from a remote management station, which permits adding a customer on the fly and total flexibility in ring configuration.

A repeater can use different wavelength on each side. While this is normally not recommended to avoid confusion, it can be useful if a given wavelength is already used in a certain ring segment. This might be the case when channels are added in a network upgrade.

1.3.5 Drop and Continue

This mode is suitable when unidirectional data need to be multicast to many receivers.

The network is setup as a linear open ring. Application data that enters the network are made available (dropped) at every intermediate node and are also fully 3R reshaped and forwarded to the next node.

A typical application for this mode is video broadcasting, whereby many base stations are fed with the same video signal.

1.3.6 WDM Operation

The X2G excels in CWDM & DWDM applications. Using transceivers with well-defined wavelength separation permit direct use with passive multiplexer WDM modules.

A CWDM setup permits increased fiber density by a factor of 4/8/16, a DWDM setup permits increased fiber density by a factor of 32/40.

Using duplicate transceiver and filter modules, full redundancy can be achieved without the need of an optical switch, although a common optical backup switch module, the LP1, is also available for high channel count systems.

Due to the very high density of the X2G and the passive WDM modules, a complete 8 channel CWDM system can be specified with as little as 5 modules, or half a MSP1400 shelf. (19”, 4U). The passive filter module may be located within the same shelf as the X2G or in a passive filter rack.

The X2G may be mixed and matched with other transponder modules such as the T4G 4G SAN Transponder or the CXG for 10Gbit.

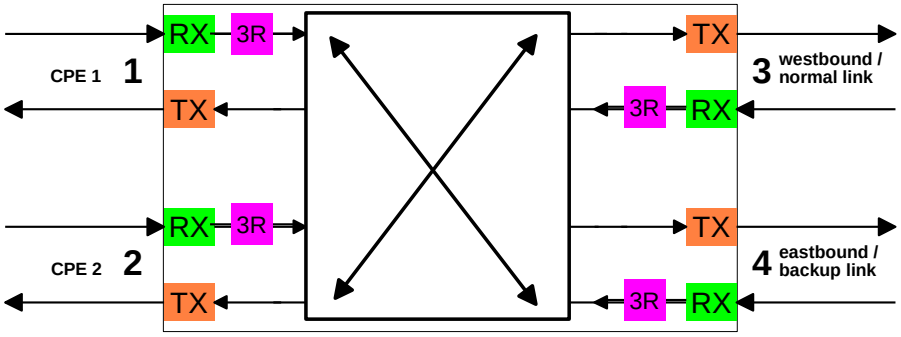
1.4 Principle of Operation

The X2G is constructed as fully self-contained module. Its highly integrated microcontroller and flash memory system hold all operating software (remote update possible) and configuration. The X2G does not rely on another entity for operation, even after power-up. This greatly increases overall system reliability.

The optical data received by any of the four ports is connected to the non-blocking cross-connect matrix switch, the heard of the module. Likewise all lasers are attached to that matrix, so that any to any connectivity is achieved. The pre-defined operating modes of the X2G use only a subset of the theoretical possibilities.

In conjunction with PLL based clock recovery circuits, the X2G performs full 3R regeneration (re-shaping, re-amplification and re-timing) on every port, which permits to refresh the application signal at every ring transit node.

1.5 Block Diagram



2 Hardware

2.1 X2G Front Panel

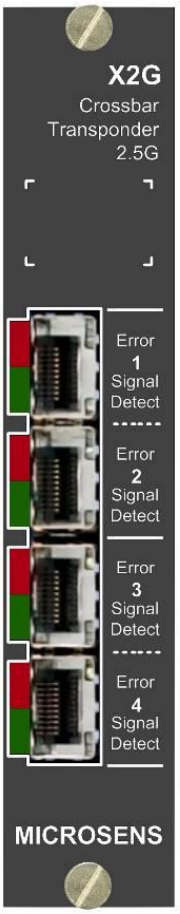
The X2G is designed for maximum channel density. Therefore, spaces saving LC connectors are used for all ports.

In most configurations the upper two ports (1&2) connect to the applications. If only one application is used (such as backup), the application connects to port 1.

The lower two ports connect to the data link and the optional backup link or the passive filter modules.

All ports are field exchangeable for utmost flexibility. SFP modules as well as the complete X2G itself are hot-swappable under power.

The LEDs, located adjacent to the optical ports, indicate port operation, 'Signal Detect' (green LED) and 'Error' condition (red LED), for details see table below.



2.1.1 Indicator LEDs

SD	ERR	Indication
Off	Off	Port disabled or unused due to configuration.
Off	On	Optical Input signal missing.
On	Off	Normal Operation. Input signal present, no error indicated.
On	On	Input signal present, but some error condition exists. PLL unlocked, data rate mismatch.
Off	Blink	SFP removed or failed.

2.1.2 Optical Cable Handling

The X2G requires LC cables. The other cable end may adapt to any other type such as an SC connector. Optical cables are not shipped with the unit unless specifically ordered. Do not reverse input and output fibers (always the upper connector of a pair is the transmitter output).

All optical interconnections are extremely sensitive to dust particles that can block the light stream. A single mode fiber has an extremely small active diameter of only 9µm that must be protected from dust and scratches.

- **Never look into any optical cable or connector. Invisible laser light may be present**.
- Never touch the tip of any optical connector
- Always fit protection sleeves on unplugged cables.
- The ferrules and end-face surfaces of optical components must be kept clean and free of all contaminants.
- Clean each connector before mating
- Never kink an optical cable.
- Tight bend radius of less than 5cm/2” will increase attenuation. Do not force the cables this way for a better looking installation.

See this document for additional safety information:
“MSP1000 Safety & Certification Handbook”.

2.1.3 Module & SFP Handling

Ensure that the installed SFP type matches the wavelength of the attached unit otherwise data transmission will not work. Usually the application ports require 850nm or 1300nm multimode interfaces. When in doubt use NMP to read out the values of the currently inserted SFP or remove the SFP interface and read its order code.

- **Always wear an ESD wrist strap as a safeguard when operating the hardware or removing an SFP.**
- Handle modules by the faceplates and edges only. Do not touch the printed circuit board and connector pins.
- Place any removed module on an antistatic surface or in a static shielding bag.
- Handle SFP with great care. Avoid contact with the electrical contacts and always fit protective rubber cap.

2.1.4 Technical Data

Data Rates	10Mbit/s - 2,7Gbit/s (depending of SFP used) Clock Recovery (3R) available for: • Transparent (No clock recovery) • 100 Mbit/s (LastMile Quad E1 Module) • 125 Mbit/s (FDDI, Fast Ethernet) • 155 Mbit/s (STM-1, OC-3) • 200 Mbit/s (ESCON) • 270 Mbit/s (SDI) • 622 Mbit/s (STM-4, OC-12) • 1.0Gbit/s (FICON, Fibre Channel) • 1.25Gbit/s (Gigabit Ethernet) • 1,45Gbit/s (HDTV) • 2.1Gbit/s (Double Speed Fibre Channel) • 2.488Gbit/s (STM-16, OC-48) • 2,55Gbit/s (MICROSENS M2G compatible) • 2,67Gbit/s (STM-16, OC48 with FEC)
Front Panel	Loss of Signal indication for all optical ports. Port error for all ports.
Temperature	Operating: 0 – 40°C, non-condensing Storage: 0 – 70°C Fan cooling required.
Dimensions, Weight	129mm x 25mm x 190 mm (H x W x D) 1 system slot wide, ~ 250g including four SFPs
Safety & Certifications	See the following document for detailed information: ***"MSP1000 Safety & Certification Handbook"***

3 Installation

3.1 Module Installation

3.1.1 Inserting a module

The X2G may be inserted in any active system slot of any MICROSENS MSP1000 shelf.

The slot position is not relevant. The management system will automatically detect the presence and locate the newly inserted module.

1. Remove the blind panel that covers the unused slot and keep the panel for later reuse.
2. Hold the logic module by the face plate and such a way that the component side is right or on top depending on the shelf orientation.
3. Insert the module into the card guides and gently push the module into the shelf. Ensure the module is parallel to the other modules.
4. Press the module into the socket with just a bit of force. If the module does not easily mate, remove the module check for proper alignment of the module.
5. Upon proper insertion the faceplate should be flush with the shelf front and other modules.
6. Tighten the two knurled screws on the outer edges of the faceplate by hand. Do not use a screwdriver! Do not overly tighten them.

- **Wear an ESD wrist strap as a safeguard when inserting or removing a module.**
- Handle modules by the faceplates and edges only.
  Do not touch the printed circuit board and connector pins.
- Place any removed module on an antistatic surface or in a static shielding bag.
- **In no case apply excessive force when inserting a module. A broken or bent connector pin can cause severe damage**

- The module can be inserted and extracted during system operation. Electronic circuits ensure a soft-start to avoid influences on neighboring modules.
- When the shelf is under power, some LED shall light up.

3.1.2 Extracting a module

Before extracting a module consider the possible application impact.

1. Disconnect all optical cables before extracting.
2. Loosen the knurled screws at the edges of the faceplate until they seem to be free moving. They are designed to be left in place and will not fall off.
3. Now pull the modules by the two undone screws. Be sure to pull evenly on both screws.
4. Once the module is removed place it in an ESD protected bag or similar container.
5. Unless a replacement module is to be inserted, place a blind face plate to cover the free slot position. This is to ensure continued protection against electromagnetic interference and to ensure the internal airflow continues as designed.

3.2 Optical transceiver Installation (SFP)

The SFP converts the electrical data signal to an optically modulated signal. The X2G accepts up to 4 SFP. For details on the port assignment refer to the table in the following paragraph.

SFP come in many variations with regard to optical wavelength, optical performance and ultimately price. The value of some SFP can be higher than that of the module itself. Therefore, treat the SFPs with good care.

- **Wear an ESD wrist strap as a safeguard when inserting or removing an SFP.**
- Place any removed SFP in a static shielding bag or box.
- In no case apply excessive force when inserting an SFP.
- Never touch the exposed golden electrical contacts of the SFP.

- Always keep the rubber dustcap on the SFP unless an optical cable is connected. Dirt is the number one source of errors in optical systems.
- An SFP may be inserted and removed under power. There will be a management alarm trap indicating insertion or removal of the SFP.

3.2.1 SFP Insertion

1. Observe the orientation of the SFP. The label must face to the right in vertically mounted modules and upwards in horizontally mounted modules.
2. Gently push the SFP until a click can be heard. When properly seated approximately 1cm (1/2") remains visible.
3. Optical SFP usually accepts LC type cables. The cables can only be inserted one way, with the extractor handle facing right or upwards.

3.2.2 SFP Extraction

Different SFP types use various extraction handles but the principle is always the same:

A lever is moved to provide a handle to grasp the SFP. At the same time a metal latch, that hold the SFP securely in place, is unlocked. The optical cable must be unplugged in order to move the handle in the unlock position.

1. Unplug the optical cables and immediately place suitable covers on the cable ends. Never allow the connector tip to touch anything.
2. Pry the lever out. Usually a colored item is located above the LC latches on top.
3. Lower the extraction handle until the locking mechanism unhooks and pull the SPF out. If it does not move, check if you moved the lever sufficiently to unlock.
4. Place the rubber dust cap on the SFP
5. Place the SFP in an ESD protected container or bag.

3.3 Connecting the optical interfaces

In general the local application interfaces (Appl.) connect to the local premises multimode cables (usually 850nm or 1300nm multimode) while the other ports use high power interfaces to drive single mode fiber connected to the far end. Refer to the table in following section for port assignment.

Check with the arrow symbols to determine in and output side. The lower half of the LC connector is the input. The adjacent green SD light should turn on, once connected (and light is present).

For more details on the LED behavior refer to the X2G front panel description. Mixing transmit and receive is a common error when setting up the cables.

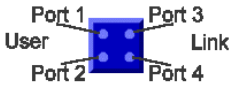
3.4 X2G Port Assignment

The proper cable assignment varies with the selected ‘Operational Mode’ of the X2G, which has to be defined via NMP configuration. The X2G may be used as general purpose optical converter or can form the basis of an optical multiplexer (CWDM) which may operate in point-to-point and ring networks.

‘Appl’ ports usually connect to the local application with multimode SFP transceivers. Other ports are usually connected to the dark fibers or the CWDM or DWDM passive filter, which in turn is connected to the dark fiber.

In principle, however, any SFP port can be equipped with any kind of SFP. For example a local link could be extended to a distant site (tail circuit) using a single mode SFP. Please select the scenario that matches your specific environment.

This icon illustrates the fundamental port interconnectivity of the X2G:



3.4.1 Details of Operational Modes

Operational Mode		Port 1	Port 2	Port 3	Port 4
All Ports Disabled		unused	unused	unused	unused
Converter Modes					
Double Converter (P 1-3 & 2-4)		Appl. A	Appl. B	Link A	Link B
Double Converter II (P 1-2 & 3-4)		Appl. A	Link A	Appl. B	Link B
Cross Converter (P 1-4 & 2-3)		Appl. A	Appl. B	Link B	Link A
Converter (P 1-3)		Appl. A	unused	Link A	unused
Converter (P 2-4)		unused	Appl. B	unused	Link B
Backup Modes (Point-to-Point)					
Bidirectional Repeater (P 3-4)		unused	unused	Eastbound Link A	Eastbound Link B
Backup Converter (P 1-3/4)		Appl. A	unused	Normal Link	Backup Link
Priority Backup (P 1-3/4 & (2-4))		Priority Appl. A	Secondary Appl. B	Normal Link	Backup Link
Triple Backup (P 1-2/3/4)		Appl. A	Normal Link	Backup Link A	Backup Link B
Ring Modes					
Ring Express Bypass (P 3-4)		unused	unused	Eastbound WDM Link	Westbound WDM Link
Ring Add/Drop West (P 1-3 & 2-4)		Appl. A Eastbound	Appl. B Westbound	Eastbound WDM Link	Westbound WDM Link
Ring Add/Drop East (P 1-4 & 2-3)		Appl. A Eastbound	Appl. B Westbound	Westbound WDM Link	Eastbound WDM Link
Ring Backup West (P 1-3/4)		Appl. A	unused	Eastbound WDM Link	Westbound WDM Link
Ring Backup East (P 1-4/3)		Appl. A	unused	Westbound WDM Link	Eastbound WDM Link
Unidirectional Modes					
Multicast (P 1rx-/2/3/4tx)		Data Input (Receive only)	Copy (Transmit only)	Copy (Transmit only)	Copy (Transmit only)
Drop & Continue (P 3-4)		Copied Data Output of P3 in	unused	Upstream Link (From)	Downstream Link (To)
Select Modes					
Select 1-2 (P1-2)		Appl. A	Link A	unused	unused
Select 1-3 (P1-3)		Appl. A	unused	Link A	unused
Select 1-4 (P1-4)		Appl. A	unused	unused	Link A
Test Modes					
BERT (P4 only)		unused	unused	unused	Bit Error Rate Test Port

Underline indicates the default setting.

3.4.1.1 Converter Modes

The ***'Double Converter'*** mode connects port 1 to port 3 and port 2 to port 4. There is also the setting ***'Double Converter II'*** which connect ports 1 to 2 and 3 to 4 - this is the default setting.

The most basic use is a 'multimode' to 'single mode' conversion. A multimode SFP is inserted into port 1 and a long distance single mode SFP is inserted into port 3. Thus an X2G can create two independent transponder with its four ports.

The ***'Cross Converter'*** mode is identical to the ***'Double Converter'*** mode, with the data path crossed over. Both modes can be used in combination to switch between data ports and may be helpful in ring setups to ensure that the end user cabling is always identical.

When only a single conversion is required, ***'Single Converter'*** modes should be selected to avoid alarm indication for the unused ports.

3.4.1.2 Backup Modes (Point-to-Point)

The ***'Bidirectional Repeater'*** mode is identical to the ***'Ring Express Bypass'*** mode but recommended for point-to-point setups when data which bypasses an intermediate node needs active 3R retiming to maximize possible link distance.

In ***'Backup Converter'*** mode the X2G functions as full automatic backup system - the application data of port 1 are transmitted onto port 3 and in the event of a link failure automatically switched to port 4.

In ***'Priority Backup'*** mode the X2G usually works as ***'Double Converter'*** (Port 1 connects to port 3 and port 2 connects to port 4) but in event of link failure of the Priority Application A port 1 will be connected to port 4 and the Secondary Application B (port 2) will be offline until link is restored.

In ***'Triple Backup'*** mode port 1 is connected to port 2 and has two possible backup links (port 3 and port 4) when a link failure occurs.

3.4.1.3 Ring Modes

The ***'Ring Express Bypass'*** mode is used when data need to bypass the node. Such an express bypass could be made active or passive. Active express, with the X2G inserted, offers 3R retiming and active signal regeneration which is used to eliminate data distortion that might have accumulated while traversing the ring distance.

Two settings apply: ***'Ring Express Bypass'*** or ***'Double Converter II'*** (use to regenerate two separate data paths with one X2G). A passive setup requires no X2G. This is the most cost effective solution, when optical attenuation is uncritical.

The ***'Ring Add/Drop x'*** modes ('West' and 'East') are used to connect data to the ring. Data that enter (Add) and exit (Drop) are connected to ports 1 and 2. The add/drop mode is used in pairs with one endpoint setup to ***'Ring Add/Drop West'*** and the other to ***'Ring Add/Drop East'***. The 'West End' is defined to connect port 1 to port 3 (=> the west port); Port 2 connects to port 4 (=> the east port). 3R retiming is used to eliminate data distortion that might have accumulated while traversing the ring distance.

The ***'Ring Backup x'*** modes ('West' and 'East') are used for protected channels. Application data are connected to port 1. These data are duplicated and forwarded on ports 3 (westbound) and 4 (eastbound). Data received on port 3 and 4 are qualified and one port is selected.

In ***'Ring Backup West'*** mode the default data path is connected westbound, i.e. port 1 connects to port 3. In ***'Ring Backup East'*** mode the default data path is connected eastbound, i.e. port 1 connects to port 4.

Important: If there are any active transit nodes in between the X2G backup path, these 'Express Bypass' X2G must also be configured for 'LoS Handling' = 'Percolate Thru'! Check with section 'Network Management' → 'Config' → 'Special Items' for details.

3.4.1.4 Unidirectional Modes

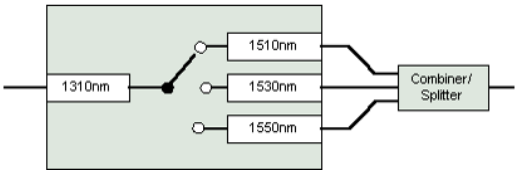
In ***'Multicast'*** mode data input at port 1 are duplicated and send out of port 2, 3 and 4 simultaneously. The return data path is disconnected. This mode can be used to copy data (broadcast).

In ***'Drop & Continue'*** mode data are entered at port 3 and connected to the clock-recovery circuitry. The retimed data are then copied onto ports 1 and 4. The data at port 1 are used as local copy, the data at port 4 are intended to be forwarded via a (long distance) link to connect to the next X2G in the same ***'Drop & Continue'*** mode. Thus several X2G are daisy chained. Due to the re-timing at every node, many units can be cascaded.

3.4.1.5 Select Modes

By using the ***'Select 1-x'*** modes (P1-2, P1-3, or P1-4) the X2G can be used as '1 out of 3' switch. Applications include 'Normal-Alternate' data path selections or use in lab testing environments.

In another example the ports 2, 3 and 4 could use different wavelength. In this case multimode input data could be converted to different wavelength on the fly. Port 2-4 could be fed into an optical combiner to attach a single fiber.



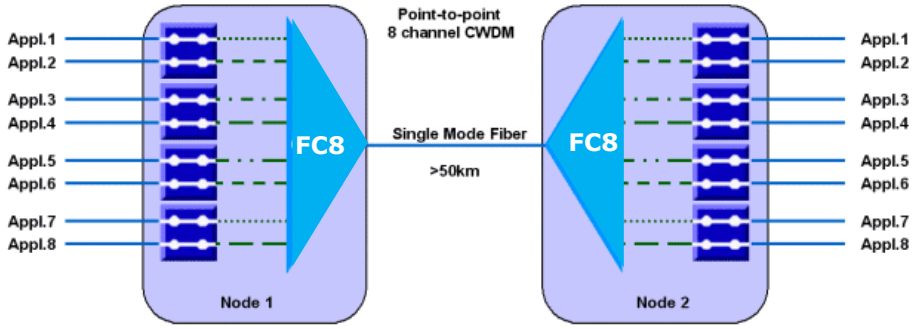
3.4.1.6 Test Modes

In ***'BERT'*** mode only port 4 is active as Bit Error Rate Test Port. All other ports are disabled.

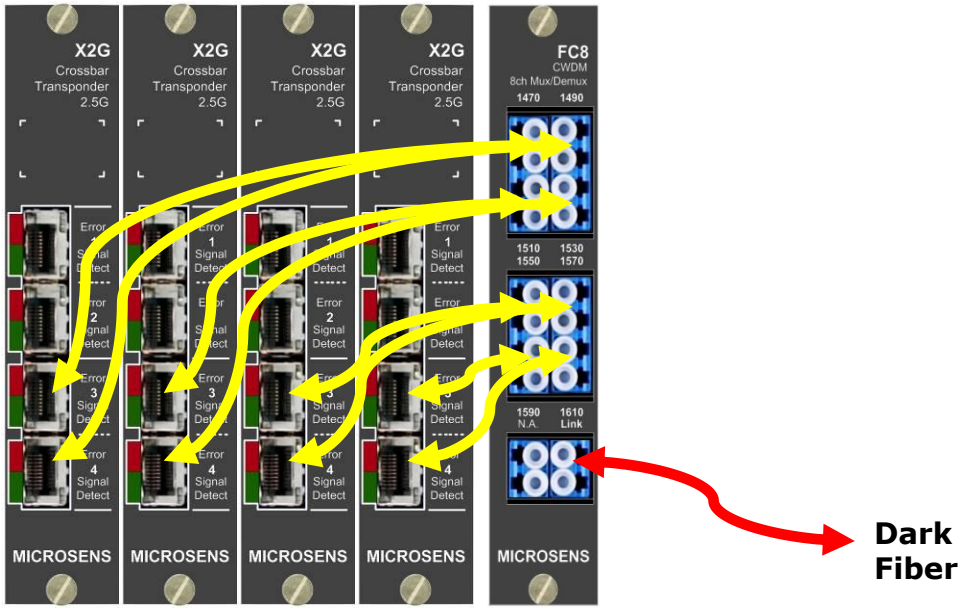
3.5 WDM Example Applications

3.5.1 Point-to-Point Setup

Four X2G configured for 'Double Converter (P1-3 & 2-4)' mode are required to form one node of an 8 channel CWDM multiplexer. The triangle represents an optical multiplex filter which combines the 8 individual wavelengths created by the four X2G modules to one fiber. The MICROSENS FC8 is used here.



Note: The wavelength configuration of the passive multiplexer filter may be different. Be sure to verify filter wavelength assignment with the actual part.



The interconnection cables are of single mode type, with LC connectors on both ends.

Note: The CWDM system may also consist of other modules such as the TXG which shares the multiplex filter. The individual setup depends on the actual needs. Ensure that each link uses an individual laser wavelength and that laser and filter wavelength are properly aligned.

3.5.2 Ring Setup

Several nodes (locations) can be interconnected in a ring configuration. This has the advantage that there are always two paths to each node, allowing for redundant operation. Several CWDM wavelengths can be used in parallel to create the network.

To enter and exit data onto the ring the 'Add/Drop' operation mode is required. Data of a certain wavelength that just transit through a node can passively be bypassed by interconnection of the optical filters.

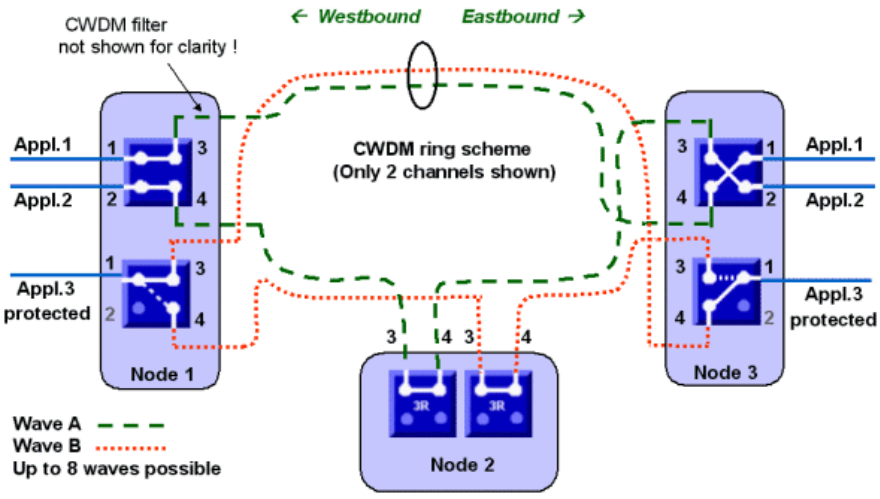
To extend the distance between nodes, active regeneration can be applied. In that case a X2G is inserted in the transit node and configured for 'Ring Express Bypass'.

The very high flexibility of the X2G permits several different cabling and switch settings that perform the same function. We recommend using the following setup which simplifies on-site cabling and shifts the network design to a software configuration issue.

When the X2G at the endpoints of a connection are configured for 'Ring Backup', then entering data are duplicated and forwarded both east- and westbound. The far end selects one data stream, and switches over to the other stream on loss of signal from the originally selected channel. This mode is also referred to as 'Protected'.

With add/drop user interfaces, the eastbound and the westbound data path of the ring can be used for two independent applications. This mode is sometimes referred to 'Unprotected'.

The user interface is always port 1, when backup is required. For add/drop applications (unprotected channels) port 1 travels westbound and port 2 travels eastbound around the ring.

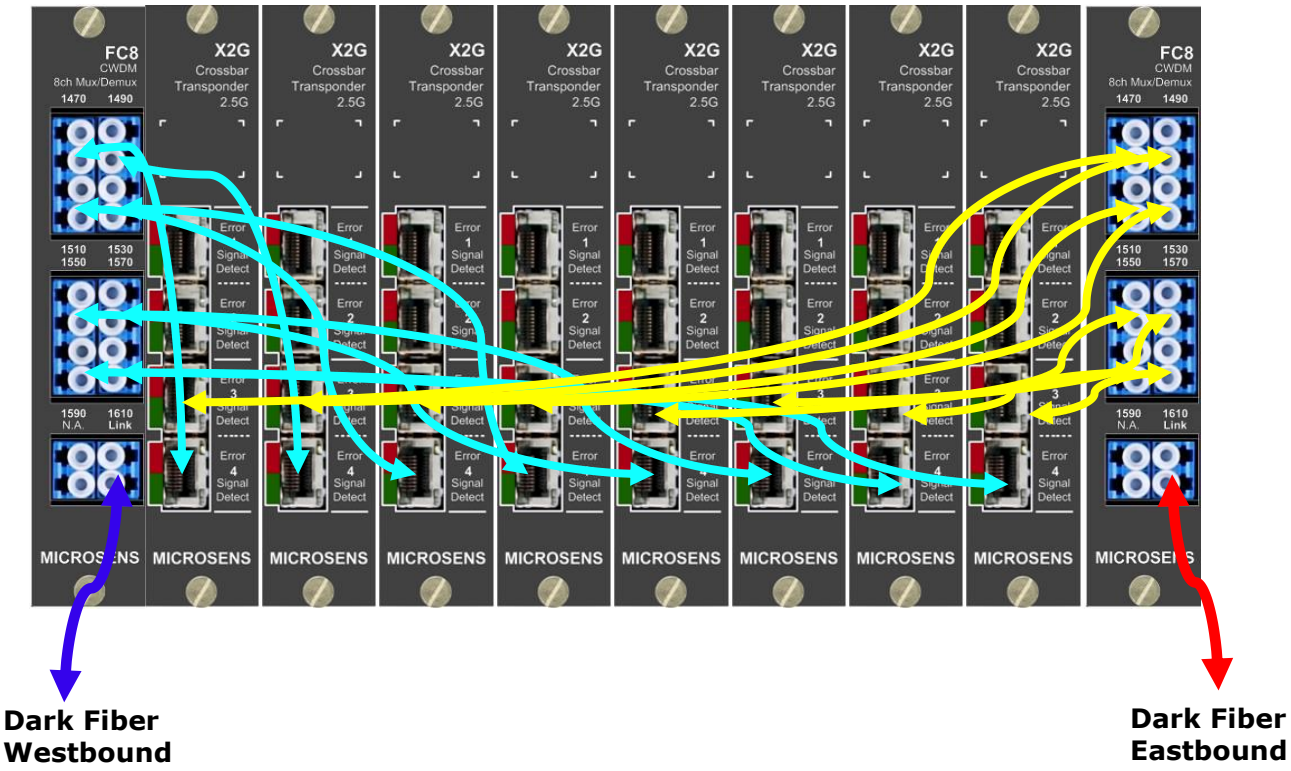


Please note the port numbers when tracing above network.

The west and east nodes (node 1 and 3) use identical cabling but slightly different cross-point switch configuration. The east unit is the inverse of the west unit to ensure that end user cabling is always identical.

Each wavelength can use any mode of operation and with no influence on the other wavelength. Likewise, each wavelength channel can operate at a different data rate and with different protocol.

This setup shows a complete 8 channel ring node (protected). Each wavelength is routed via an X2G module in 'Ring Backup' mode.



The passive optical filter modules (FC8) can be located anywhere within the MSP1400 rack. Practically the FC8 is located left and right of the X2G active channel modules.

The number of wavelength is limited by the number of CWDM wavelength available and the fiber characteristics.

Typically, 8 wavelengths between 1470nm and 1610nm are specified. There are additional 8 wavelengths in 1200-1400nm band which can be used, provided the fiber permits transmission of these wavelengths. Note that 1300nm transmission yields approximately half the distance of an equally performing 1550nm setup.

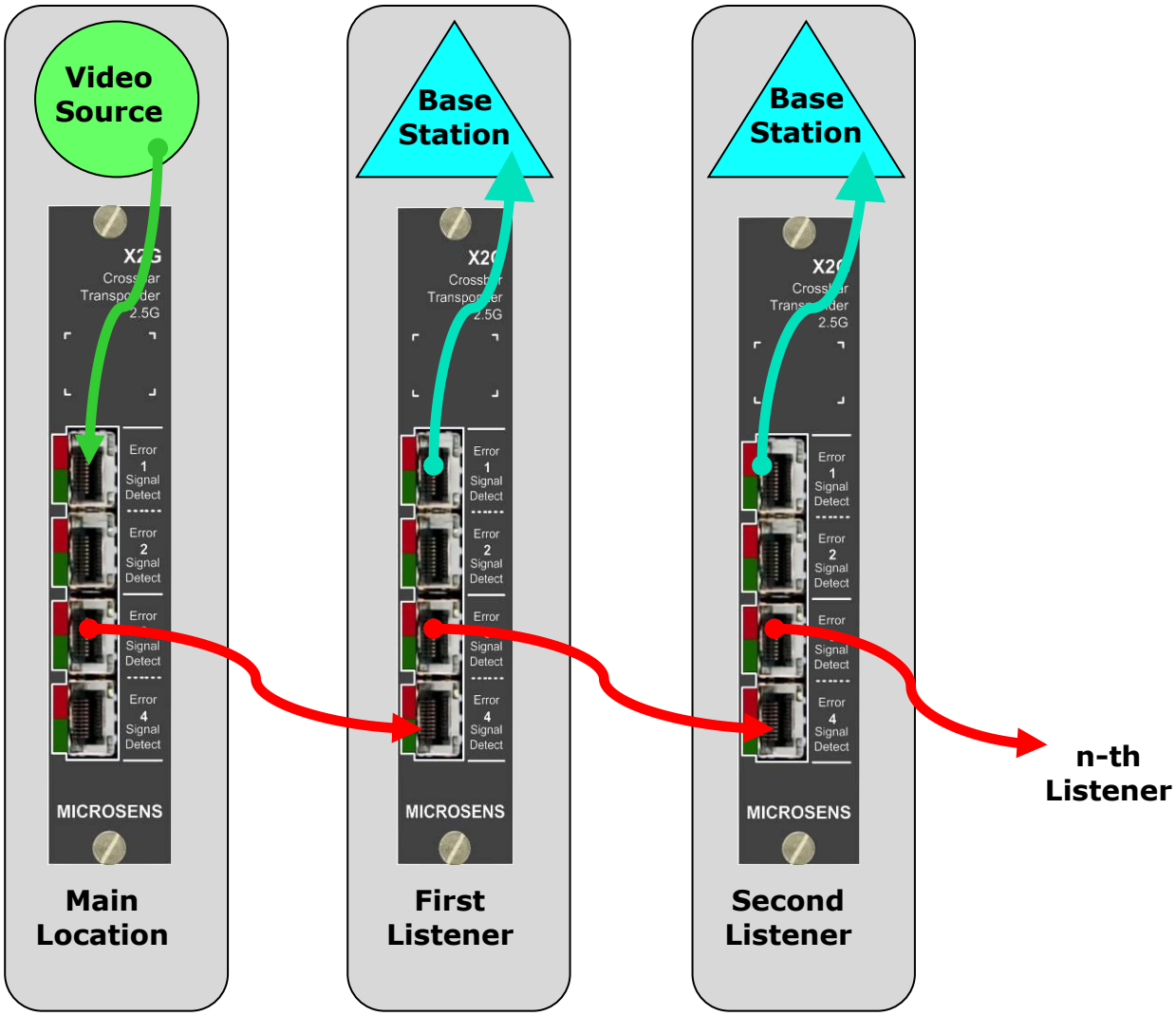
The ring configuration may also be combined with other MICROSENS modules such as the T4G and CXG modules. Please ask your representative for details.

3.5.3 Multicast Drop and Continue

This mode is suitable for unidirectional multicasting applications such as distribution of a video signal to several antenna stations.

In below drawing each sections represents a geographically distributed location. Only a single fiber is required between sites.

The network can be extended to virtually any number of nodes.



Note: When strict timing relation between the sites is required, the signal delay through the fiber (roughly speed of light) must be taken into account. The X2G itself, does not impose any significant delay (< 4ns).

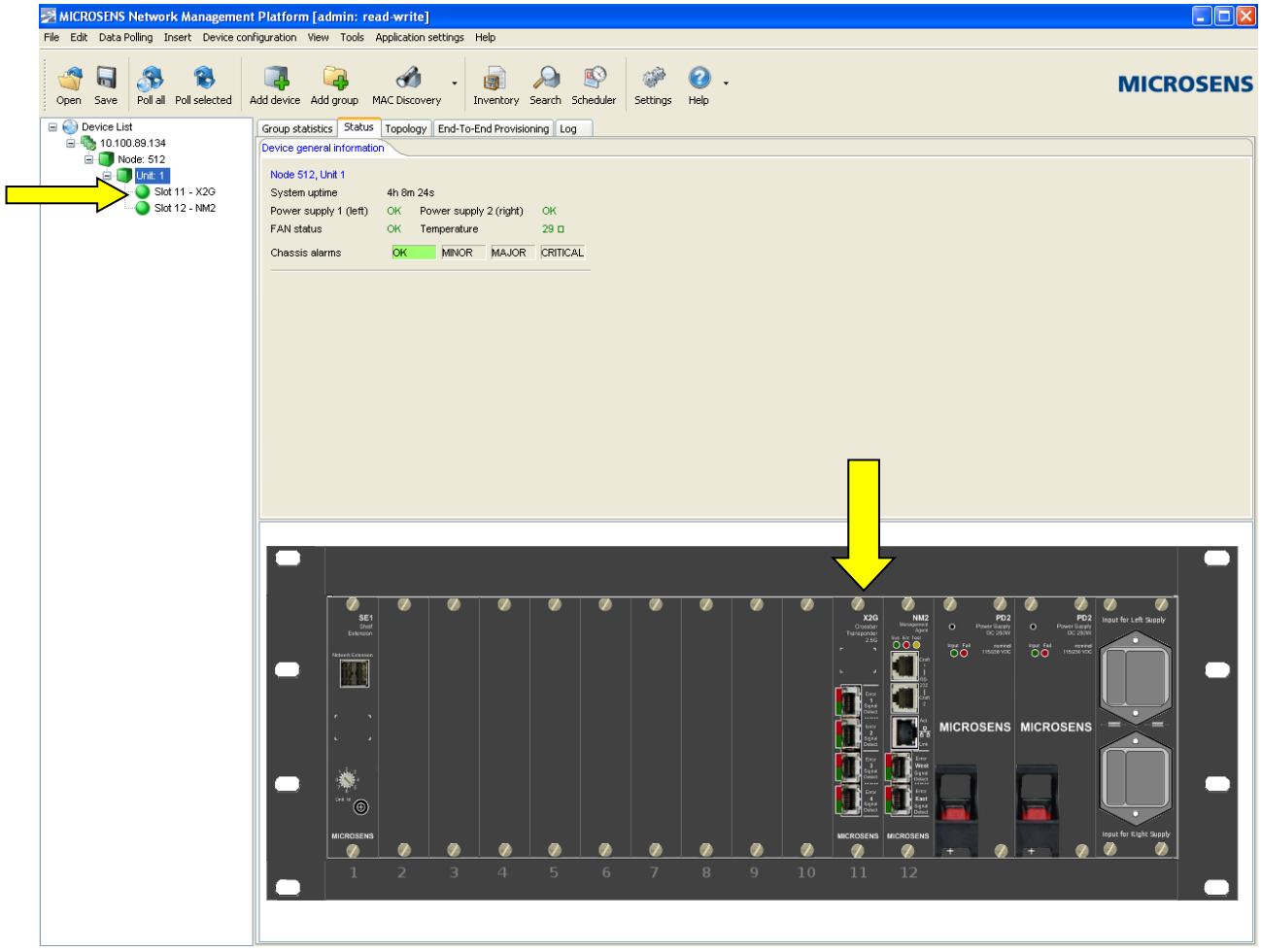
4 Network Management

The MICROSENS Network Management Platform ('NMP') is a universal tool, with which all MICROSENS network components can be configured and monitored from a remote site. NMP permits an easy to use graphical interface for the monitoring, configuration and administration of all manageable devices.

For detailed descriptions of the NMP commands and features, please refer to the NMP User Manual. This document describes only the commands, features and windows that specifically supports the X2G.

4.1 X2G specific NMP handling

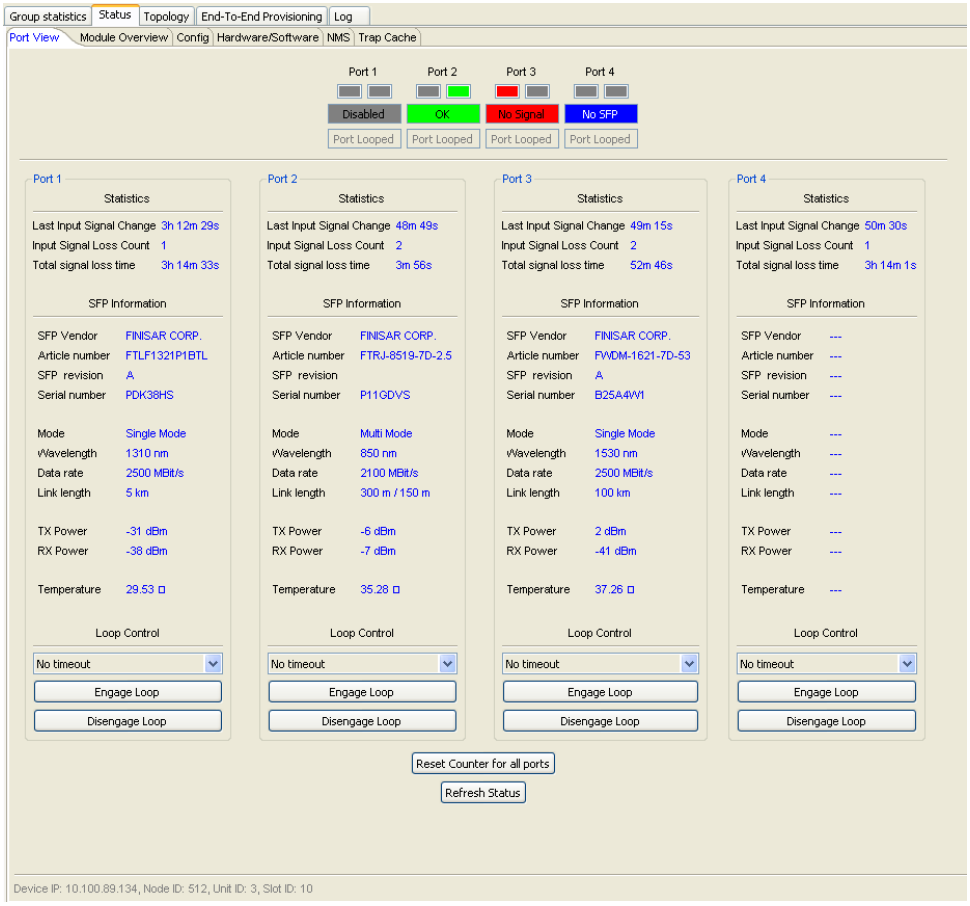
To show details and configure a particular module plugged into a chassis, you must select the X2G by clicking on its specific slot in the 'Device List tree' on the left side of the NMP Main window or directly on its picture in the visualisation window.



The X2G specific tabs of the 'Status' page will appear.

4.1.1 Port View

This page displays static as well as online information about each port.



The lower window border always shows the complete identification of the selected module including Device IP, Node ID, Unit ID and Slot ID.

The LEDs (lights) are animated to match those of the actual module. The LEDs are updated with any trap from the unit or by clicking on the 'Refresh Status' button. They are also updated when the window is opened.

The 4 colored rectangles below the LEDs indicate the most severe error condition present at this port. The indicated error conditions are:

No SFP	SFP Laser module not inserted. This might be OK, depending on the operational mode.
Disabled	Port is completely disabled by configuration.
SFP Error	SFP is inserted but a failure is detected. Exchange SFP.
No Signal	No optical input signal detected. Cable unplugged or other end of cable is not driven or attenuation too high.
PLL Error	The clock recovery function (3R) is configured but the attached application does not supply data with the selected data rate.
OK	No error. Port can operate.

4.1.1.1 Statistics

This part displays online data that are read from the unit when the 'Refresh Status' button is pressed. The timers associated with the status are calculated to show days, hours, minutes and seconds in an adaptive display.

Last Input Signal Change	This timer restarts every time the optical input signal state changes.
Input Signal Loss Count	Increments any time the optical signal on this port changes state.
Total Signal Loss Time	This timer accumulates for how long the optical signal was missing altogether.

Click 'Reset Counter' to set all timers and counters to '0'. This requires password access.

4.1.1.2 SFP Information

This part displays technical data of the optical ports. The first four fields show SFP manufacturer, Article number, SFP revision and serial number.

The next section shows fiber mode (Multi mode, Single mode), wavelength, maximal data rate and theoretical link length according to datasheet (without filter attenuation).

The next section indicates the current transmit power (TX) and received input power (RX). The accuracy of these values depends on the SFP type. Worst case accuracy is defined as 3dB, typical accuracy is 1dB. Therefore, no decimal digits that would suggest higher accuracy are shown.

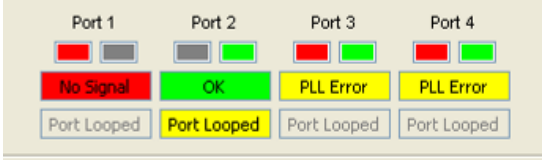
Additionally the actual SFP temperature is shown.

4.1.1.3 Loop Control

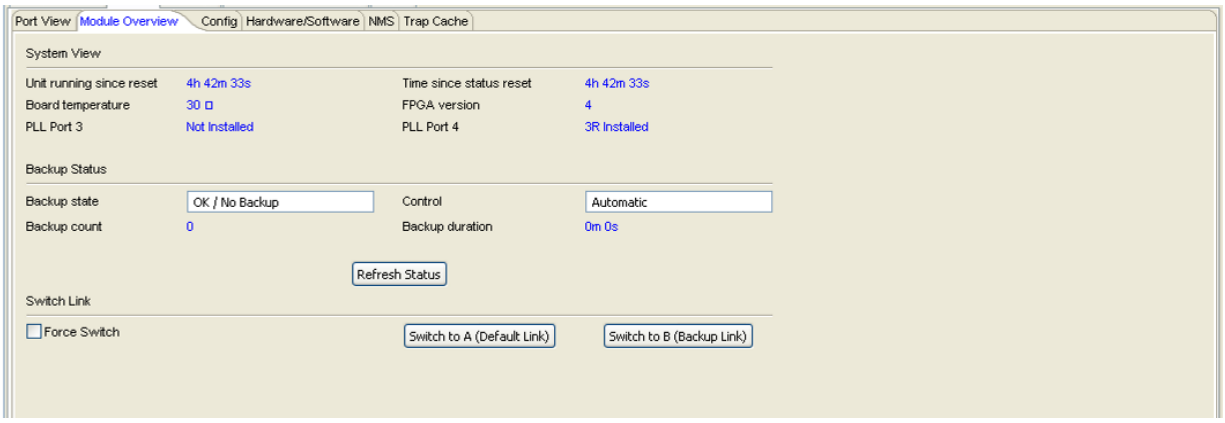
The loop back function permits port testing. When a loop is engaged, the received data are reflected back to the transmitter. ***As the normal flow of data is disrupted, only use this function when trouble shooting an installation!***

With the buttons 'Engage Loop' and 'Disengage Loop' this function can be controlled manually. When a timeout option (10 Seconds, 30 Seconds, or 5 Minutes) is selected before engaging it, the loop is taken out again automatically after that time.

As long as the loop is engaged the rectangle 'Port Looped' is highlighted yellow.



4.1.2 Module Overview



This page displays online information about module and the actual backup status.

4.1.2.1 System View

The 'Unit running since reset' timer starts on power up or after system reset. It does not reset when the counters are cleared.

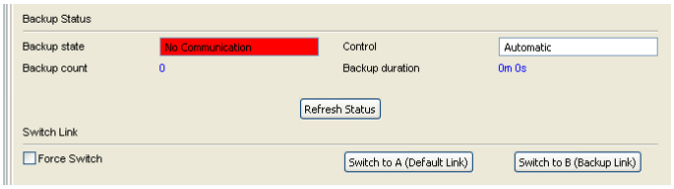
The 'Time since status reset' timer starts on power up or after system reset. This counter is reset when the 'Reset Counter for all ports' function is executed. Use this counter to qualify the other statistics counter.

An on-board thermometer monitors the 'Board temperature'. A trap is generated when over-temperature is detected. In that case check the fan system and verify that no vents are blocked. Do not place unit near heat emitting source.

'FPGA Version' indicates the hardware version of the main logic chip.

4.1.2.2 Backup Status

Normally the 'Backup state' should be indicated as 'OK / No Backup' and will change to 'Backup' while the backup link (B) is active. Colour of this box turns red, to indicate the 'No Communication' state.



The 'Control' usually is 'Automatic' but when backup is selected via NMP then 'Manual' is shown.

The 'Backup Count' increments each time the data link switches from A to B and the 'Backup Duration' timer indicates how long link B was active.

Click 'Refresh Status' to re-read the data from the module. The data are also refreshed any time the page is opened.

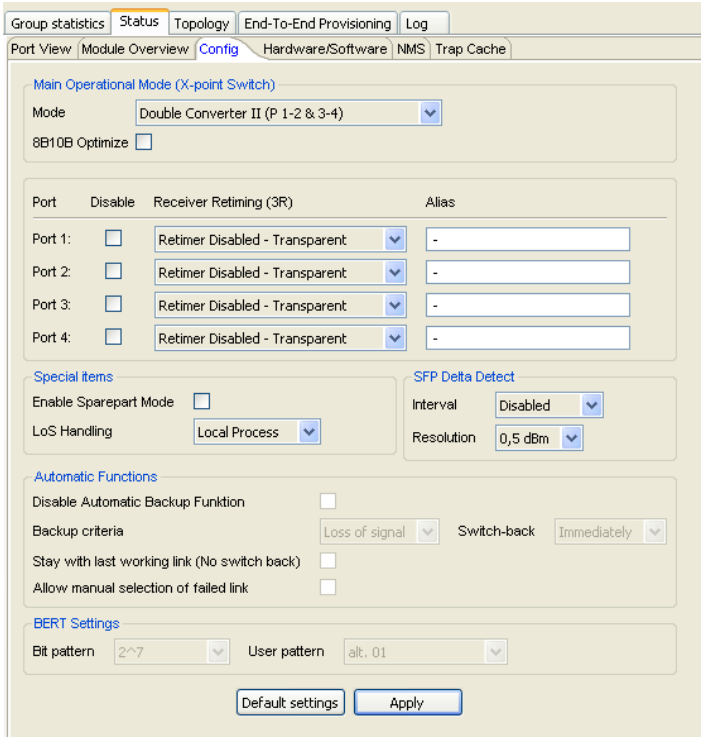
4.1.2.3 Switch Link

With the two buttons 'Switch to A (Default link)' and 'Switch to B (Backup link)' the backup state may be changed manually. This function switches the active data link between port 3 and port 4. The switch will only occur if both data links are in OK status or when all protection is overridden.

'Force Switch' – please read section 'Config' → 'Automatic Functions (Backup)' for details.

4.1.3 Config

The X2G works in many different applications but is simple to configure. Most important, the 'Main Operational Mode' and the 'Receiver Retiming' (data rate) of the ports need to be configured to match the applications.



Note: Only after pressing 'Apply' the new setting will be activated within the unit, this requires password access.

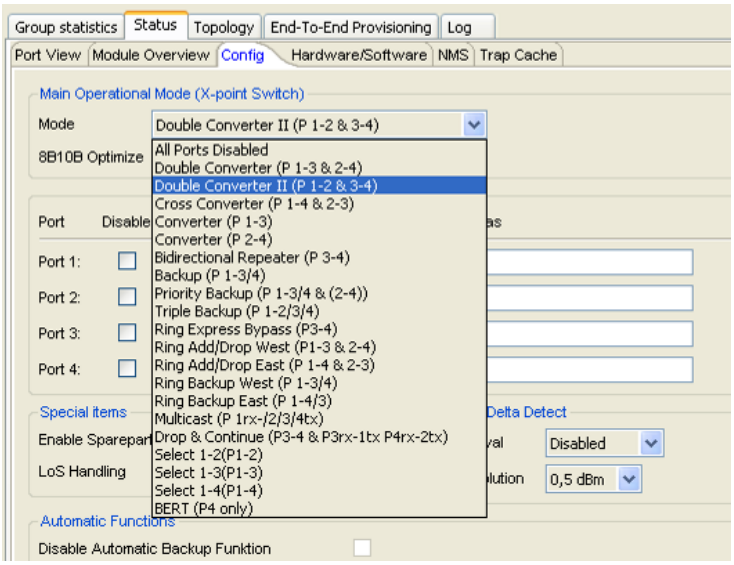
Once the configuration is written and accepted by the module, a trap is generated and displayed in the log window.

By switching the button 'Default settings' (followed by 'Apply') the above configuration will be restored.

4.1.3.1 Main Operational Mode (X-point Switch)

The first pull down menu 'Mode' offers many different settings that define the main operational mode of the X2G. Depending on this setting, the data path between the optical ports is created within the X-point switch.

Possible operational modes are:



Check with section 'Installation' → 'X2G Port assignment' for more details.

According to the selected mode unused ports will automatically be disabled and the 'Receiver Retiming' options for that port will be shown greyed out.

4.1.3.2 8B-10B Optimize

This checkbox can be activated when the X2G is used with a mix of Sonet / SDH and Ethernet / FibreChannel on the port pairs. When checked, the internal reference clock is slightly changed to be more precise for the 8B10B ports (FibreChannel / Ethernet). Unchecked, preference is toward the SDH / Sonet frequencies. Usually, there is no noticeable difference. Use only when instructed to do so.

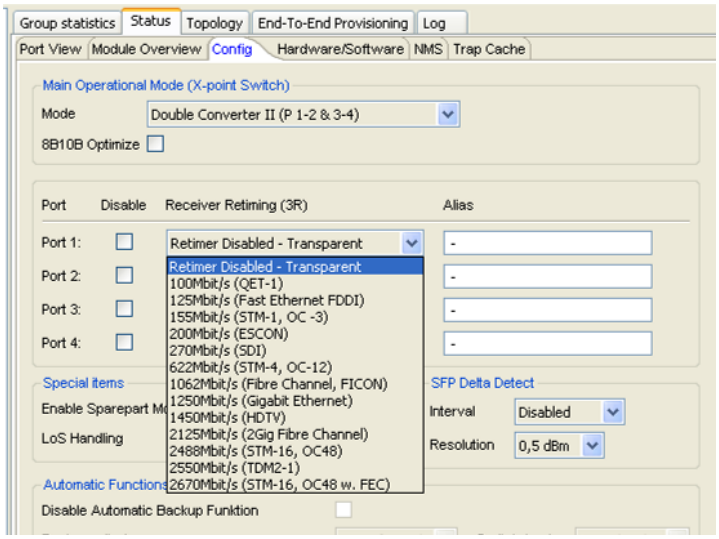
4.1.3.3 Disable (Port)

When checked, the port is disabled. Ports which are not used due to the 'Operational Mode' do not need to be manually disabled. This option may be used to switch-off a used port to force a loss of signal (LoS) to the attached unit.

4.1.3.4 Receiver Retiming (3R)

The X2G can synchronize to the user data to perform 3R regeneration. (re-shaping, re-amplification, re-timing). For that purpose the matching data rate must be setup.

Possible data rates are:



When retiming is not required, the default setting 'Transparent' is used. In this mode, any data are passed.

When setting the data rate of one port, the other ports are not affected.

4.1.3.5 Alias

For each port a different 'Alias' may be defined (max. 15 characters).

4.1.3.6 Special Items (Spare Part Mode and LoS Handling)

Spare Part Mode
When checked, alarm trap generation is suppressed. This is useful to avoid alarm display of X2G modules that are not currently used.

LoS Handling
'Local Process': Loss of signal does not affect any other port.

'Percolate Thru': Loss of signal turns of laser of the associated other port. This depends on the actual 'Operational Mode'. In general this function only works for converter and ring modes. Use this mode in transit repeater nodes when backup is used on the channel (in other X2G along the data path).

4.1.3.7 SFP Delta Detect

This function enables automatic alarm traps when the optical power input level of an SFP changes more than the specified amount within the preset time.

The 'Interval' defines how often a measurement is taken (Options: Disabled, 1 Second, 5 Seconds, 10 Seconds, 30 Seconds, 1 Minute, 4 Minutes). The 'Resolution' (selectable between 0,5dBm and 5dBm) determines how much the input value needs to change during the selected interval to trigger an alarm.

Note that the resolution is 0,5dBm although the Port view only shows full units.

It should be understood that the power level reading of SFPs is not very accurate. The absolute value can be off by 3dBm and still meet the specifications. However, the relative stability is quite good. This is why differential measurement is possible.

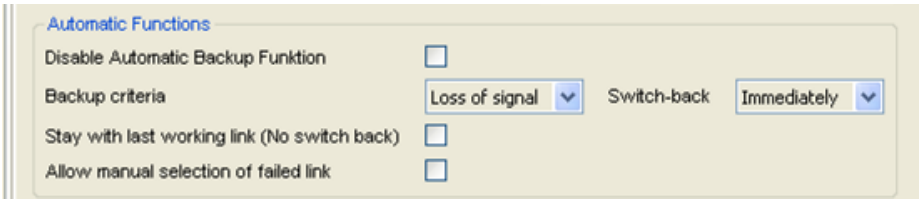
The function may be used to detect changes to a fiber. When several X2G ports traverse a common fiber (WDM) and all X2G detect a power level change, something has changed to the overall fiber attenuation. This could be caused by a kink in the fiber or even by someone trying to tab the fiber in order to spy the data.

When only a single SFP out of a WDM detects a change, it could be caused by the port specific patch cables or the laser at the far end.

Changes in this option don't affect the data.

4.1.3.8 Automatic Functions (Backup)

These functions are only available in backup modes.



Disable Automatic Backup Function
This box is usually unchecked and the following two pull down menus define the reactions when an error occurs. When box is checked, no automatic backup will take place, but manual switching is still possible.

Backup Criteria
Options are: 'Loss of Signal',' Loss of clock'
These options define when a backup is detected. Usually a loss of optical signal is selected.

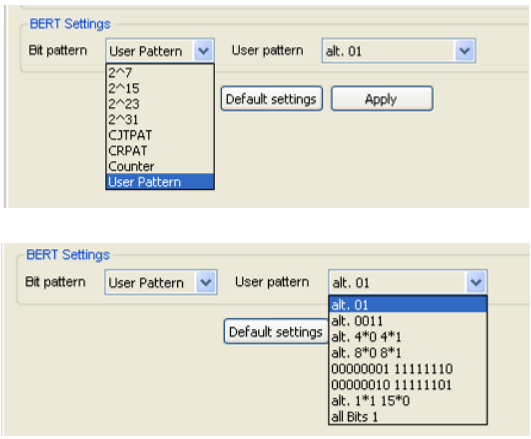
Switch-back
While a backup is always invoked as soon as the criteria are met, the switch-back delay can be adjusted. Options are: 'Immediately', '15 Seconds', '15 Minutes', 'Manually (Never)'

Stay with last working link (No switch back)
Box is normally unchecked. If checked, a backup will not revert back to the normal link A. Instead link B will continue to operate until another failure condition or manual intervention.

Allow manual selection of failed link
This function safeguards the operator from accidental link selection to a failed link. When checked, a failed link can be selected with the 'Switch Link' buttons on the 'Module Overview' page (also needs setting the 'Force Switch' check box). When this box is unchecked, a failed link cannot be selected.

4.1.3.9 BERT Settings

In 'BERT' mode a lot of different BIT pattern may be selected:



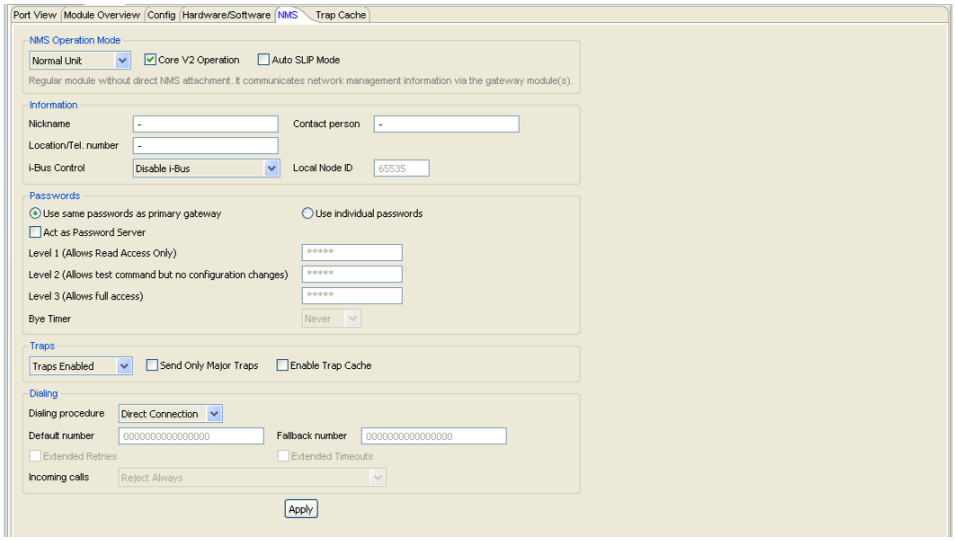
4.1.4 Hardware/Software

This page displays static information about the actual board, such as 'Hardware Version Info' (including 'Serial number'), 'Core Code Version' and 'Application Code Version'.

4.1.5 NMS

For regular transponder modules (such as the X2G) only the sections 'Information', 'Passwords' and 'Traps' on this page are relevant.

The options 'Core V2 Operation', 'Auto SLIP Mode', 'iBus' and 'Dialing' shall only be changed after consulting the MICROSENS Support.



4.1.5.1 NMS Operation Mode

For X2G modules always select 'Normal Unit'. In this case network management information is communicated via the gateway module (NM1 or NM2).

4.1.5.2 Information

'Nickname' and contact data entered in this section are visible via SNMP and Web Manager.

4.1.5.3 Passwords

Usually the Primary Gateway (such as NM1 or NM2) administrate the local passwords, but it is possible to give the X2G its own passwords, separately for all three levels and with the 'Bye Timer' options (Never, 5 min., 15 min., 1 hour) it's possible to terminate the individual passwords.

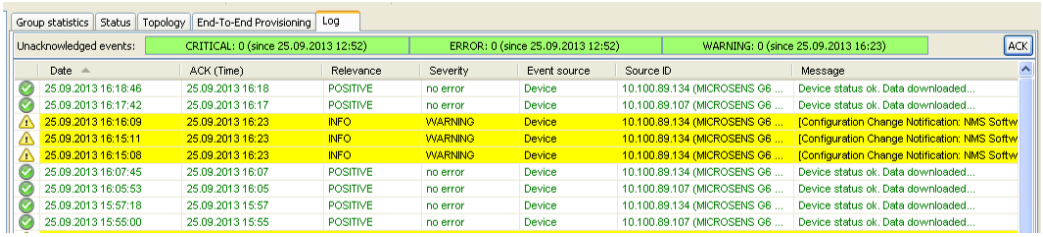
4.1.5.4 Traps

In this section between the options 'Traps Enabled' or 'All Traps Disabled' may be selected and the amount of traps could be reduced by checking the 'Send only major Traps' box.

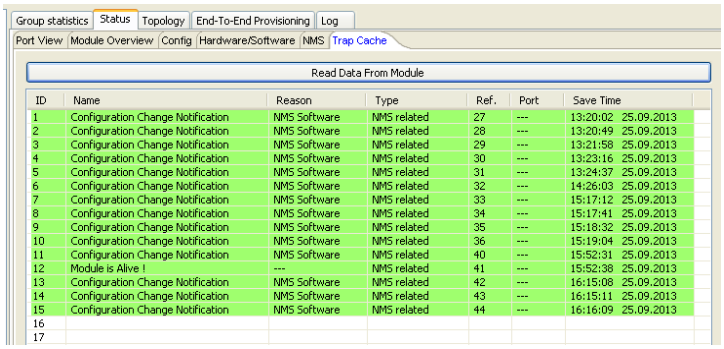
If option 'Enable Trap Cache' is activated, all traps generated by this module will be listed on the 'Trap Cache' page, when button 'Read Data From Module' is pressed (additionally to normal NMP log window).

4.1.6 Trap Cache

Usually all traps are logged in the NMP Log Window.



If option 'Enable Trap Cache' on page 'NMS' is activated, all traps generated by this module will additionally be listed on the 'Trap Cache' page, when button 'Read Data From Module' is pressed.



5 Traps

A trap is an unsolicited alarm that is generated when an unexpected or important event occurs. Traps are usually sent to the NMP PC for display. A trap can also be forwarded to SNMP.

The trap handling and formatting is coordinated by the NMS module (NM1 or NM2) and NMP. Please refer to these handbooks for details. This section only describes which trap codes are supported and can be generated specifically by the X2G.

5.1 Codes supported by the X2G

Major Bit	Pos/ Non	Code (hex)	Trap Text	Reason Codes	Comments
Port Alarms					
0	0	00H	Test Trap	Internal use	Used to test reachability
0	1	07H	Loop Engaged	Console Terminal NMP PC Timeout expiration	Port data are echoed back to sender. Normal data transmission is disrupted
0	0	06H	Loop Disengaged		
1	1	89H	Data Link Down	Loss of Signal PLL not locked	Fiber cable disconnected or broken, remote transmitter off or laser problem
1	0	88H	Data Link Up		
1	1	8BH	Backup Engaged	Loss of Signal Console Terminal NMP PC	Backup link is selected due to link failure or manual intervention
1	0	8AH	Backup Disengaged		
Module Alarms					
1	1	A3H	Module Reset	Power Up NMP Console Watchdog Timer Error	Watch Dog Timer indicated a system crash! Error indicates an internal error has occurred
1	1	A5H	Hardware Error		
1	1	A7H	Software Error		
0	0	28H	Software Download Completed	-	Occurs after download is finished. The new code is then not activated, just downloaded.
0	1	29H	Software Download Failed	-	Software download did not complete. Please try again.
0	0	2CH	Trigger Deactivated	Link Quality	This trap occurs when the SFP Delta Detect function is used and the power level changes above limits.
0	1	2DH	Trigger Activated		
0	0	2EH	Good Operating Condition	Too Hot Too Cold	Module temperature too high. Good … Too Hot indicates that it is NOT too hot anymore.
0	1	2FH	Bad Operating Condition		

System Alarms					
0	0	22H	System Reconfiguration	-	A change in the NMS network was detected. A unit was added / removed or a cable was pulled
0	1	51H	Traps Lost	Count of lost traps	A unit had more traps then it could send out in time
0	0	6CH	Configuration Change Notification	Console NMP	The configuration was altered. Informational only.
0	0	6EH	I am Alive Trap		Reply to the "Are You Alive" request that NMP generates. Use to verify operation is OK.
1	1	EFH	Keep Alive Expired	NMP	Local trap generated by NMS itself when keep alive trap is not received in time

5.2 Codes supported by the shelf

0	0	20H	Module Inserted	Power Supply Fan Tray Module	Module is added or removed to rack or NMS LAN. Generated by NMS module within rack.
0	1	21H	Module Removed		
1	1	CBH	Power Failed	Power Supply	AC input to the power supplies has failed / resumed.
1	0	CAH	Power Recovered		
1	1	CDH	Fan Failed	Power Supply System Fan	The fan within the power supply or the external system fan have failed / resumed operation
	0	CCH	Fan Recovered		
1	1	CFH	Bad System	Temperature Voltage Drift	Ambient temperature too high DC voltage output of the supplies is not within limits.
1	0	CEH	Good System		

Additional information to the power supply related traps please refer to the shelf handbook.

6 Disclaimer

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