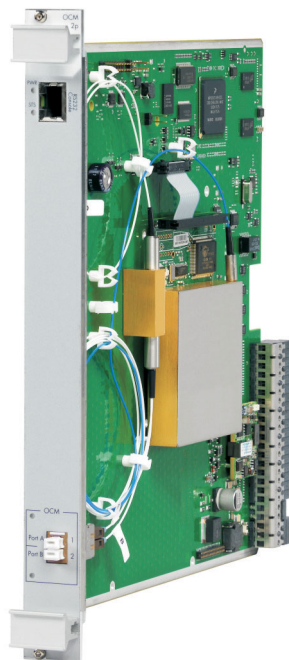


Optical Channel Monitor (OCM)

Technical Description

2-port OCM (OCM/2P)



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1 Introduction

This manual provides an overview of the 2-port Optical Channel Monitor Unit, **OCM/2P**.

1.1 Document Revision History

Table 1 Document Revision History

Revision	Date	Description of changes
A	2011-12-12	Due to introduction of a new documentation tool, the revision is reset to A. For details on previous document changes/updates, please see corresponding document in System Manual release R17. There are no changes in this A-version compared to R17.
B	2012-04-02	Updated with R19 content; addition of VOA-8CH/SFP. Plus insertion of generic ENM-GUI chapter.
C	2012-12-16	Updated ENM GUI chapter reflecting R20 status. Added information that the OCM/2 can be used in a TM-101/TM-102 chassis Added information on compatibility with 100Gbps & 40Gbps signals
D	2014-04-03	R23 GUI updates
E	2014-08-29	Updated information regarding power offset adjustment
F	2014-10-20	Corrected wavelength span.
G	2015-01-07	Added info on mounting options in chapter 8.
H	2017-09-21	Added information on FW releases and wavelength compatibility

2 Functional Description

The 2-port Optical Channel Monitor unit (OCM/2P) measures optical power levels of wavelengths in the C-band. The unit has one power monitoring function and two input ports. An internal optical switch is used to select what port that shall be connected to the monitoring function.

The OCM/2P is to be connected to monitor ports of optical amplifiers and ROADMs units to provide information on power levels that serves as input to e.g. power balancing.

It is possible to take a snap-shot of all power levels and store for future reference.

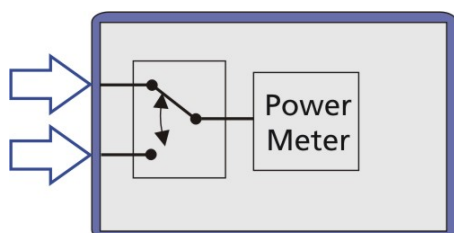


Fig. 1 Generic block diagram, OCM

The OCM/2P is a full-sized unit that shall be placed in an active slot in a TM-3000 or TM-301 chassis.

2.1 Operational Modes

The OCM/2P has two modes:

- Normal - the switch toggles every hour and performs a measurement on both ports.
- Commissioning - the switch is set to one selected port and measurement is only made on this port. After 15 minutes it will automatically change back to normal mode. Note that no updated values on the other port are provided when in this mode.

Default mode is "Normal"

2.2 Connection

It is vital that information is entered to what board type that the OCM/2P is connected, and where this board is located. This information is used by the DNA-M to ease power balancing on network level. The information to be entered includes:

- Subrack number, i.e. where the connected board type is located.
- Slot number, i.e. where the connected board type is placed.
- Port number; the corresponding Tx line port that the monitor port is connected to. The monitor ports have no port numbers, so instead the line port (in transmit direction) is used to define where the OCM measurement is done.
- Board type: i.e. optical amplifier or ROADM.

This information is entered per OCM port and all OCM values are related to the above data.

2.3 Power Offset

An offset value can be added to all power levels to get an accurate presentation of channel powers since this may vary depending on how the OCM is connected to the network.

The value can be modified manually but can also be modified in two other ways:

- When selecting connected board type there is a choice of applying a board default value to power offset. The default value of an optical amplifier is -20dB. The default value of a 1x4ROADM/100G offset value is - 17dB.
- When creating an optical control group using an optical amplifier, a more accurate value of the power offset can be fetched from the optical amplifier. In the creation of the control loop group select "Read Power Offset From OA" before pressing the Create button. The connection described in previous section need to be specified before creating the control group for this procedure to be possible. If the control group is deleted the modified power offset value will stay. If the OA is replaced with another individual having another monitor port loss value the power offset will not be automatically modified.

The offset range can be set between 0.0 to 25.0dB.

2.4 Power Offset Adjustment

When an OCM port is used in a control loop together with an optical amplifier, the power offset adjustment parameter allows the control loop to regulate with better precision. The parameter can only be modified by the control loop. However, since it is an adjustment of the power offset, a change in power offset will normally give a change in power offset adjustment, but it might take several regulations of the control loop for this to occur.

Range is between -1.0 dB and 1.0 dB.

For more information, see *Optical Control Loop Guide* in the XTM Series System Manual.

2.5 Alarms

The only alarm that is generated from OCM/2P is a temperature alarm.

3 Applications

The normal application is that the OCM/2P is used in an Optical Control Loop to automatically adjust the wavelength power levels. The OCM/2P is then used in combination with the Variable Optical Attenuators (VOA), either the separate VOA-8CH/SFP or the inbuilt VOA functions on the 40ch MDU's (MDU40/50G-EVEN and MDU40/50G-ODD) or ROADMs units. The OCM/2P must then be inserted in the same NE as the units that are part of the Optical Control Loop. The OCM/2P can also be used stand-alone in a TM-102/TM-101 chassis to be used to measure optical power levels. It is not possible to include the OCM/2P in an Optical Control Loop when it is placed in a TM-102/TM-101 chassis.

For stretched networks the power balancing must be done with great care to ensure performance. The measurement of optical power must be done where impact on different losses through optical multiplexers and amplifier gain variations can be taken into account.

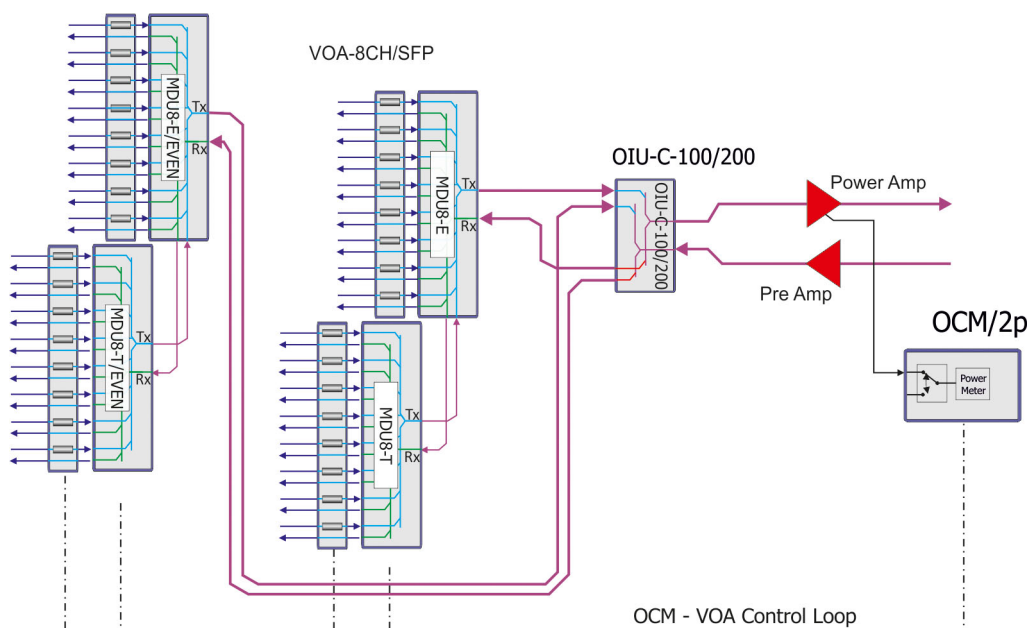


Fig. 2 Example node with VOA-8CH/II and OCM/2P

The figure shows an example node where the OCM/2P is connected to the monitor port of the optical booster amplifier. This setup gives best the power balancing since all loss variations and gain tilt is taken into account. The OCM/2P can be placed at end nodes and intermediate OADM nodes or line amplifier nodes, i.e. where ever it is relevant to enable power level measurements or Optical Control Loops. For these networks it is strongly recommended to use the Dynamic Network Administrator - Metro (DNA-M) where an analysis of the power levels can be done along a link to give guidance on where power adjustments shall be made.

4 Firmware versions

The OCM/2P firmware has been updated during the years to be able to recognize high speed formats and specific formats and measure with enough accuracy. Please see the table below to understand what Firmware revision should be used for specific formats.

The Firmware of the OCM/2P can be upgraded via a separate upgrade script (i.e. not part of the ENM release software package). Please contact Infinera TAC if you need assistance.

Table 2 Firmware revisions

FW revision	Notes
3.47	First release. Supporting up to 16Gbps signals
3.51	Additional support for 40Gbps signals and 100Gbps signals from the CFP based products. Introduced in 2012.
3.80	Additional support for 2x50Gbps signals from AOFx-100. Introduced in 2016
3.85	Additional support for 100Gbps and 200Gbps signals from CFP2 based products. Introduced in 2017. Note: Not including support for AOFx-100

5 ENM GUI

There are two options to manage a Network Element, via a graphical web-based user interface (GUI) or via a Command Line Interface (CLI). See *Command Line Interface Guide* within the Installation & Commissioning volume of the System Manual for more details on the CLI option.

The GUI is launched using an Internet Browser and then entering the IP-address of the NE. After login the initial view is the Subracks view. The appearance will differ depending on the chassis and how it is configured. Fig. 3 *Subracks – Main view* shows the view presented when logging in to a TM-3000 chassis.

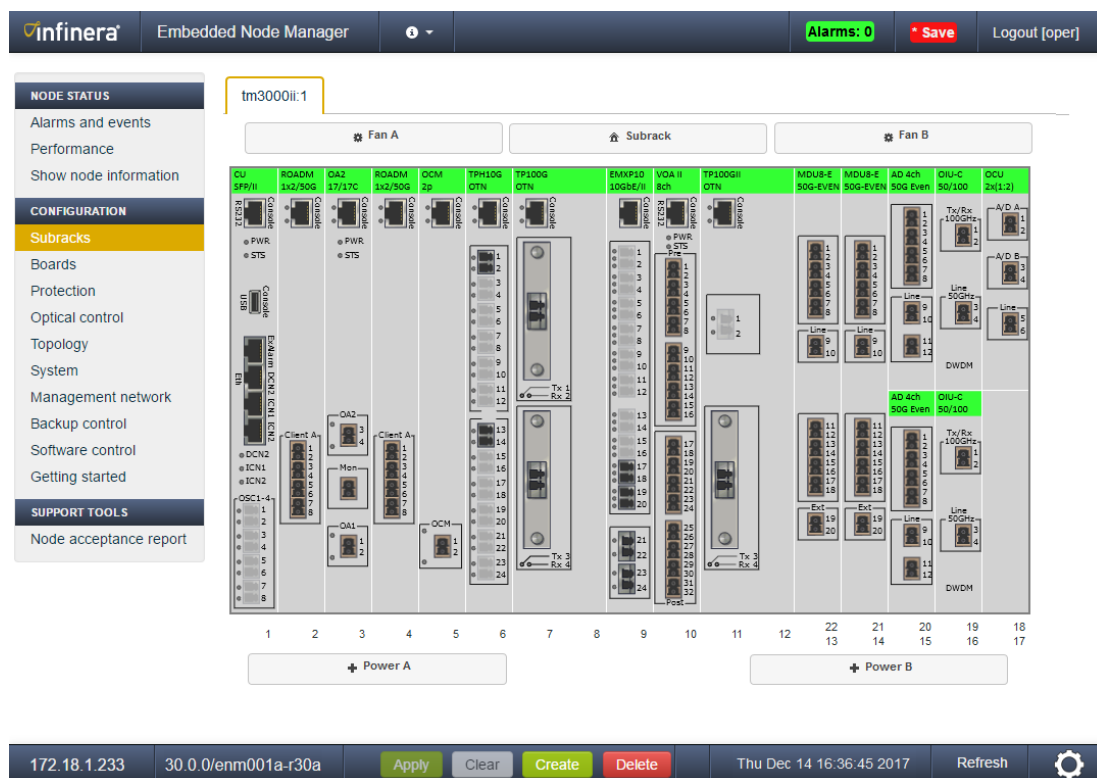


Fig. 3 Subracks – Main view

There are three main areas from which the node can be managed.

The left area is a menu always available in the browser. Clicking the **Subracks** or the logotype in the left top corner brings back the starting page where all the traffic units can be seen.

The top area is updated dynamically and shows the number of alarms and the highest severity among them.

The main area is the equipment area. This area is changed according to selections made from other areas.

Some items will change color to reflect alarm status, for example the fan and power areas. When hovering over a plug-in unit, the CLI name will appear as a tool-tip. For more information on items and menu links, see section 5.1 *Subracks view*.

5.2 Verbose mode

The ENM GUI can be set in two modes where different depth of information is presented. Clicking **Settings** in the lower right corner enables changes to the browser view.

For normal operation of a NE the browser shall be set in **Verbose mode off**. This will present the most relevant information and settings, and provides a more compact display of the different windows.

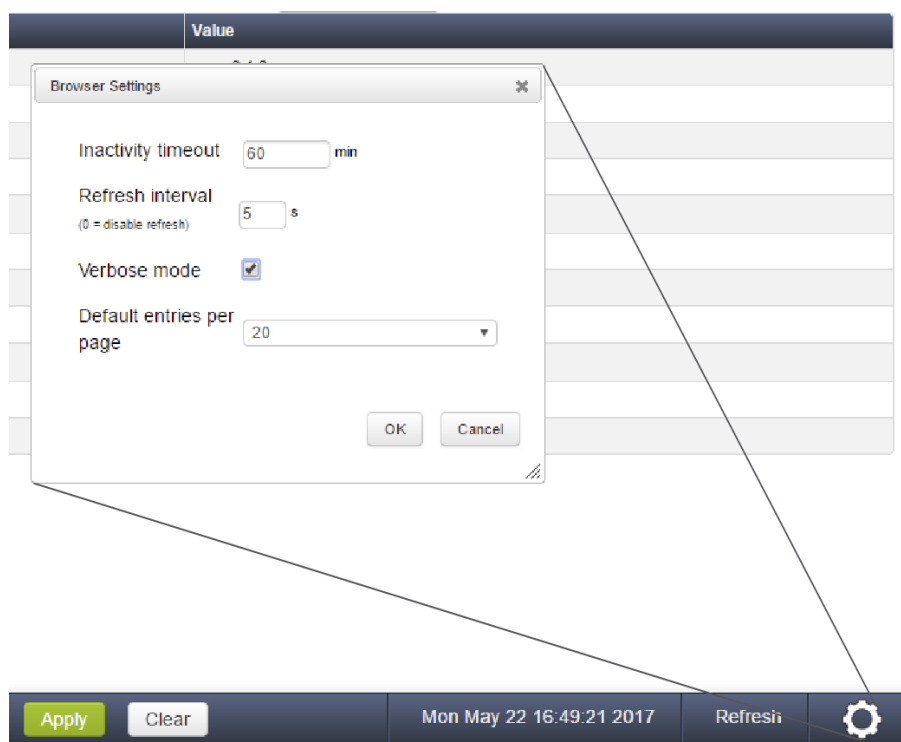


Fig. 5 Verbose mode

The default setting for **Verbose mode** is **off**. Select **Settings** and **Verbose mode** and click **OK** to activate **Verbose mode**. Some configurations can only be done with the verbose mode activated, this will vary from unit to unit.

It is recommended to deactivate verbose mode when necessary configurations have been done.

5.3 Board settings

When clicking on the lower part of a configured board a number of menu tabs containing information and configuration parameters are shown.

The screenshot shows the 'Board' view in the ENM GUI. At the top, there are 'Main Menu Tabs' (tp100gotnii:1:4, Client, Line, Performance Monitoring, Protection) and 'Sub Menu Tabs' (Board, Inventory, TRX). A 'Save table to .csv' button is located above the table. The table below lists various attributes and their values.

Attribute	Value
Management name	tp100gotnii:1:4
Description	Otn Transponder 100G-II
Class	module
HW product	TP100GOTN/II
HW revision	P1A_A
SW product	ENM_TUAPPL_05A
SW revision	r29a-10
Firmware revision	r29a-1/r29a-1
Product data revision	1.30
Serial number	212TM000013
Manufacturer	Infinera
CLEI	-
AID	BRD-1-4

Fig. 6 Board view

The information is structured in two levels having a set of main menu tabs and sub-menu tabs. Some views have a series of buttons at the bottom.

The screenshot shows a horizontal bar with various buttons and information. From left to right: IP address '172.18.5.3', a URL '29.0.0/enm001a-r29a', a group of buttons (Apply, Clear, Create, Delete), a timestamp 'Mon May 22 16:11:08 2017', a 'Refresh' button, and a settings gear icon.

Fig. 7 ENM buttons

- Apply** Performed changes are activated (note that the change is not saved).
- Clear** Clear all unsaved changes on the page.
- Multi Set** Enables setting of multiple parameters.
- View Table** All related and relevant data is listed in a table format.
- Help** Help texts for the configuration parameters.
- Create** Opens a Create dialog for adding new configuration objects in the current view.

Delete Deletes selected configuration objects.

Refresh Updates the page.

5.4 Network Element Parameters

When a node is to be commissioned for the first time, a number of configuration steps must be taken on both NE and board level. To ease this process a Getting started guide presents a series of steps where configuration data is entered.

The NE related configuration is activated via the menu item **Getting started**. Typical NE related data is:

- DNS and Node Name
- IP address
- Default Gateway
- Date and time (NTP)
- SNMP Traps
- Passwords
- Radius and Tacacs+ settings
- Backup and upload settings

The entered values are saved and activated when clicking **Apply** after the last step. The parameters can also be set using the menus and tabs under the **Management network** menu item.

The configuration parameters related to the boards is set when creating a board.

6 OCM/2P Settings in ENM GUI

A number of tabs enable access to information and entering of data related to the unit/board and interfaces. Fig. 8 *Equipment tab* shows the tabs that are presented for the OCM/2.

Attribute	Current	New
Name	ocm2p:1.5	
Description		
Expected type	ocm2p	
Actual type	ocm2p	
Administrative status	up	up v
Operational status	up	
Module information	FW:3.47	
Temperature	26.7 degC	
High temp threshold	70.0	70.0 v degC
Led test	off	off v

Refresh Apply Multi Set View Table Help

Fig. 8 *Equipment tab*

6.1 Inventory Tab

Attribute	Current	New
Description	2-port Optical Channel Monitor	
Management name	ocm2p:1.5	
HW product	OCM/2P	
HW revision	R1B	
SW product	ENM_TUAPPL_02A	
SW revision	r23a-12	
Firmware revision	r23a-1/r23a-1	
Product data revision	1.30	
Serial number	104KM000503	
Manufacturer	Transmode Systems AB	

Refresh Apply Multi Set View Table Help

Fig. 9 *Inventory tab*

6.2 OCM Tab

ocm2p
Ocm
Channel
Active channels
OCTRL
Prev board
Next board

Attribute	Current	New
Name ocm:1:13:1-A	ocm:1:13:1-A	
Description		
Administrative status	(up)	
Operational status	up	
Power offset	19.2 dB	Change
Power offset adjustment	-0.4 dB	
Connected subrack number	1	
Connected slot number	9	
Connected port number	1	Change
Connected board type	oa	Change
Control mode	(normal)	
Reference time		
Save reference		

Fig. 10 OCM Tab

This is where the vital connectivity data is entered. The OCM/2P has two ports; “A” and “B” and it is imperative to enter information to where these ports are connected, i.e. what line signal is port A and port B taking its measurements from.

Data is entered per OCM port by selecting port A or B via the drop-down menu **Name**.

The information is also used by the DNA-M to ease power balancing on network level. The information to be entered includes:

- Subrack number, i.e. where the connected board type is located.
- Slot number, i.e. where the connected board type is placed.
- Port number; the corresponding Tx line port that the monitor port is connected to. The monitor ports have no port numbers, so instead the line port (in transmit direction) is used to define where the OCM measurement is done.
- Board type: i.e. optical amplifier or 1x4ROADM/100G.

The monitor ports of all optical amplifier units have the same coupling factor, i.e. the actual power levels are 20dB higher than what is measured at the monitor port. An offset of -20dB is entered at **Power offset** to ensure that correct power values are presented. The monitor port of the 1x4ROADM/100G has another coupling factor and thus another offset value (-17dB) must be entered. Click the **Help** button for proposed offset values.

The max and min measured wavelength power levels as well as delta power level is presented to indicate level of power balancing. A reference measurement can be performed and stored for later comparison. This can be used to detect any variations in power levels.



Note

*A change in **Power offset** will change the presented power values per channel, but the reference values will not change. A new **Save reference** must be done after a change in **Power offset**.*

6.3 Channel Tab

Data for each of the 80 channels is presented in the Channel tab by selecting the channel at **Name**.

The screenshot shows the 'Channel' tab in the ENM GUI. The sidebar on the left has 'NODE STATUS' and 'CONFIGURATION' sections. The 'Channel' tab is selected, showing a table with the following data:

Attribute	Current	New
Name	Channel:1.5:1-A:9185	
Frequency	ch9185	
Power level	n/a dBm	
Update last change time-stamp	Mon May 19 16:22:29 CEST 2014	
Reference power level	5.4 dBm	

Below the table are buttons: Refresh, Apply, Multi Set, View Table, and Help.

Fig. 11 Channel Tab

If multiple OCM/2P units are placed in the node, power values from all OCM units are presented via the **View Table** button. The values are tagged as in the below example:

Channel:1:5:1-A:923

Subrack number Slot number Tx port number OCM port Channel number

Fig. 12 Channel Labeling

Channels that have power levels below the min level are displayed as “n/a”.

The min level for the OCM/2P is -40dBm as stated in Table 3 *Optical Data*. When connected to a monitor port of an optical amplifier (having a power offset of 20dB) this means that power levels below -20dBm will be regarded as non-present.

6.4 Active Channels Tab

This is the primary window for analysis of power levels. The absolute values in dBm are presented and is used as a base for how much attenuation that shall be applied via the VOA-8CH/II units to achieve proper power balancing.

The screenshot shows the 'Active Channels' tab in the ENM GUI. The sidebar on the left contains navigation links under 'NODE STATUS' (Alarms and events, Performance, Show node information), 'CONFIGURATION' (Equipment, System, Getting started, Protection, Optical control, Management network, Topology, Backup control, Software control), and 'Equipment'. The main content area has tabs for 'ocm2p', 'Ocm', 'Channel', 'Active channels' (selected), and 'OCTRL'. Below these tabs are sub-tabs 'A' and 'B'. Under 'A', a table displays the following data:

Channel	Power (dBm)	Reference Power (dBm)	Time
Channel:1:5:1-A:919	0.9	1.0	Mon May 19 16:23:12 CEST 2014
Channel:1:5:1-A:934	1.0	0.9	Mon May 19 16:23:12 CEST 2014
Channel:1:5:1-A:939	0.9	1.0	Mon May 19 16:23:12 CEST 2014
Channel:1:5:1-A:943	1.0	1.0	Mon May 19 16:23:12 CEST 2014

Below the table are buttons: Refresh, Apply, Multi Set, View Table, and Help. On the right side of the main area, there are links for 'Prev board' and 'Next board'.

Fig. 13 Active Channels Tab

Only channels at port A having power levels above the min level are presented in this window. Similarly this is done under the tab "Active channels B" for channels at port B.

7 Mechanical Layout

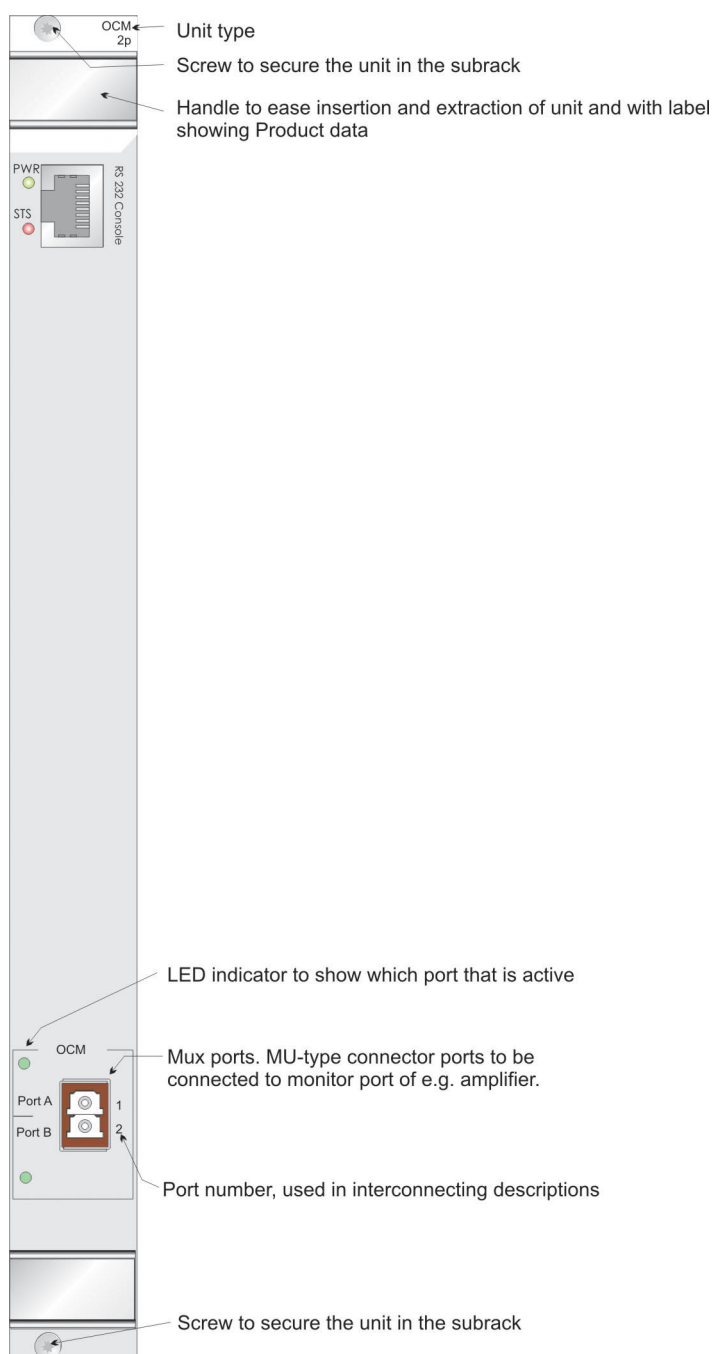


Fig. 14 Front layout

All optical connectors are of MU-type.

8 Technical Data

The primary usage of the OCM/2P is to be part of an Optical Control Loop where an automatic power balancing is performed in amplified links. For these configurations the OCM/2p must be placed in the same NE where the involved plug-in units are located. The OCM/2P can also be mounted stand-alone in a 1U chassis (see Dimensioning Guidelines or Technical Description for the respective chassis versions). This OCM/2P can in this configuration be used to monitor semi-passive links, i.e. to detect presence of wavelength channels.

Table 3 Optical Data

Parameter	Value
Operating wavelength/channel range	1562,6-1531,1 nm (191.85-195.80 THz)
Channel spacing	50 GHz
Frequency readout resolution	±1 GHz
Channel input power range	-40 to -5 dBm
Channel power accuracy	±0.5 dB
Channel power repeatability	±0.2 dB
Channel power resolution	±0.1 dB
Polarization Dependent Loss	<0.3 dB
Optical return loss	>40 dB
Power consumption, max	11W

Table 4 Product Revision Data

Product Number	Rev	Introduced release	Comment
OCM/2	R1A	11.0	1st released version.
	R1B	R13 (June 2009)	Component change to remove risk for voltage spikes.
	R1C	R15 (June 2010)	Flash memory replacement due to LTB. The R1C version requires ENM SW release R13.0 or later.