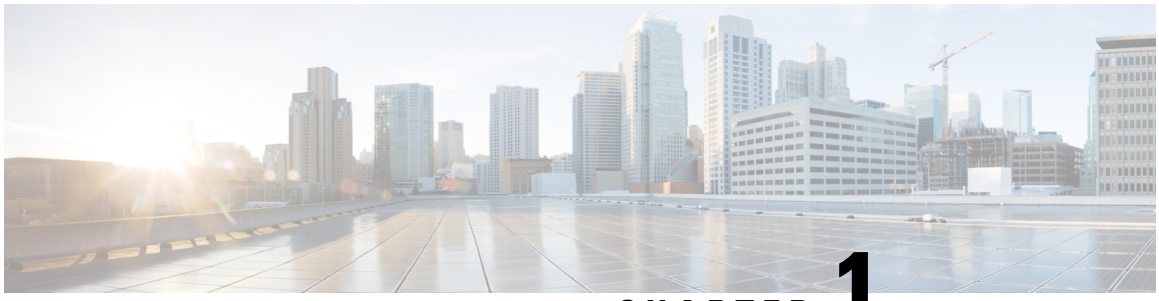
Configuration Guide for Cisco NCS 1001, IOS XR Release 6.2.x

First Published: 2017-07-14

Last Modified: 2023-10-30

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883



CHAPTER 1

Configure Controllers

Note *This software release has reached end-of-life status. For more information, see the* End-of-Life and End-of-Sale Notices.

This chapter describes how to configure OTS and OTS OCH controllers.

Controllers

Controllers are represented in the Rack/Slot/Instance/Port format; for example, 0/1/0/1.

Rack	0
Slot	1 to 3. Slots for pluggable optical modules.
Instance	0
Port	Depends on the specific pluggable optical module.

Configure OTS Controller

The Optical Transport Section (OTS) controller holds all the optical parameters for the OTS optical interfaces. The optical interface has different capabilities depending on its hardware components such as photodiode, VOA, amplifier, and OCM. Hence, the parameters enabled or disabled on the OTS controller depend on the actual hardware capability on the specific optical interface. Each parameter might refer to RX or TX section. For example, if a photodiode is present, the OTS controller can read the total optical power. When the controller is created, each hardware capability is enabled or disabled.

You can configure parameters such as low power threshold, VOA attenuation setpoint, amplifier gain range, amplifier tilt, and amplifier gain set point for the OTS controller. The description on OTS interfaces cannot

be added as they are on the optical amplifier module. To configure the OTS controller, use the following commands.

configure

controller *controllertype Rack/Slot/Instance/Port*

rx enable

rx-low-threshold *value*

tx enable

tx-low-threshold *value*

rx-voa-attenuation *value*

tx-voa-attenuation *value*

ampli-control-mode {**automatic** | **manual**}

ampli-gain-range {**normal** | **extended**}

ampli-gain *value*

ampli-tilt *value*

ampli-channel-power *value*

channel-power-max-delta *value*

osri {**on** | **off**}

safety-control-mode {**auto** | **disabled**}

commit

end

Example

The following is a sample in which the amplifier gain range is set to extended and amplifier gain set point is set to 29.0 dB.

```
configure
    controller ots 0/3/0/0
    ampli-gain-range extended
    ampli-gain 290
    commit
end
```

The following is a sample in which the safety control mode of the pre-amplifier is set to auto.

```
configure
    controller ots 0/3/0/0
    safety-control-mode auto
    commit
end
```

The following is a sample in which the safety control mode of the booster amplifier is set to disabled.

```
configure
    controller ots 0/3/0/1
```

```
    safety-control-mode disabled
    commit
end
```

OTS Controller Configuration Parameters

Table 1: OTS Controller Configuration Parameters

Parameter	Description	Hardware Capability	Range	Default	Notes
rx-low-threshold (0.1 dBm)	Low receive power threshold	Photodiode	-400 to +300	-40.0	
tx-low-threshold (0.1 dBm)	Low transmit power threshold	Photodiode	-400 to +300	-20.0	
rx-voa-attenuation (0.1 dBm)	RX VOA attenuation set point	VOA	0 to 200	0.0	
tx-voa-attenuation (0.1 dBm)	TX VOA attenuation set point	VOA	0 to 200	0.0	
ampli-control-mode	Amplifier control mode	Amplifier	automatic and manual	automatic	The Automatic value is compatible only when the grid is specified through the hw-module configuration.
ampli-gain-range	Amplifier gain range	Amplifier	normal and extended	normal	The amplifier gain range is configurable only when the controller is in shutdown state.
ampli-gain (0.1 dBm)	Amplifier gain set point	Amplifier	0 to 500	0.0	The actual range of amplifier gain set point depends on amplifier gain range.
ampli-tilt (0.1 dBm)	Amplifier tilt	Amplifier	-50 to +50	0.0	
channel-power-max-delta (0.1 dBm)	Maximum difference among all measured channel powers	Amplifier	0 to 200	3.0	

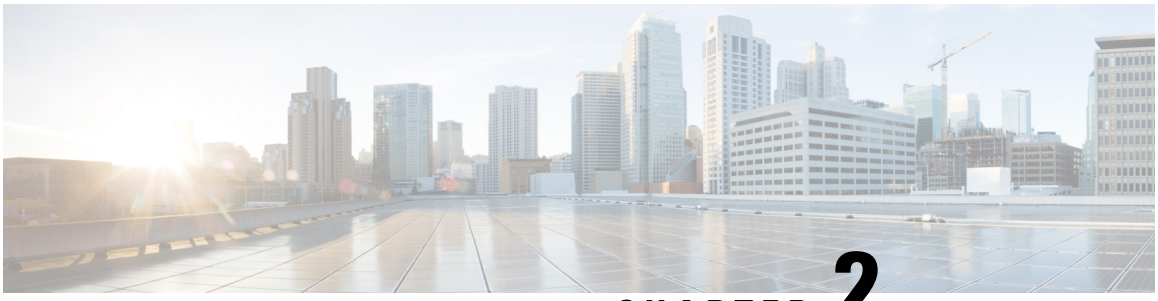
Parameter	Description	Hardware Capability	Range	Default	Notes
ampli-channel-power (0.1 dBm)	Amplifier per channel power set point	Amplifier	-400 to +300	0.0	
osri	Optical safety remote interlock	Amplifier	on and off	off	When osri is on, the laser is off and vice versa.
safety-control-mode	Safety control mode	Amplifier	auto and disabled	auto	If the safety control mode is disabled, the amplifier optical power is less than 20dB for safety.

Display Parameters of OTS Controllers

Use this procedure to display the parameters of OTS controllers.

show controllers *controllertype Rack/Slot/Instance/Port* [**summary**]

- The **show controllers** command displays all the configuration parameters, PM thresholds and alarms when keywords are not provided.
- The **show controllers** command displays the rx/tx power value and minimal information to understand port status when **summary** keyword is provided.
- A * wild card can be used to display all the controllers associated with a slot. For example, **show controllers ots 0/1/0/* summary**



CHAPTER 2

Configure Optical Modules

This chapter describes how to configure the Optical Amplifier Module and Protection Switching Module (PSM).

Note When you plan to replace a configured optical module with a different type of optical module, you must clear the configurations of the old module before you install the new module. For example, when replacing a configured EDFA module with a PSM in the same slot, clear the EDFA configurations.

In general, configurations in a card equipped in an NCS 1001 slot include:

- Card configuration—hw-module parameters configuration related to the slot *S* where the card is equipped
- OTS controller configurations
- Optics controller configurations—only for EDFA cards

The following commands clear the configurations in the previous card.

1. `no hw-module location 0/RP0/CPU0 slot <S>`

   Clear the card parameters configuration.

2. `no controller ots Rack/Slot/Instance/Port`

   Clear each OTS controller configuration.

3. `no controller optics Rack/Slot/Instance/Port`

   (Optional) Clear the controller optics configurations. This must be done only if the card previously equipped in slot *S* was an EDFA.

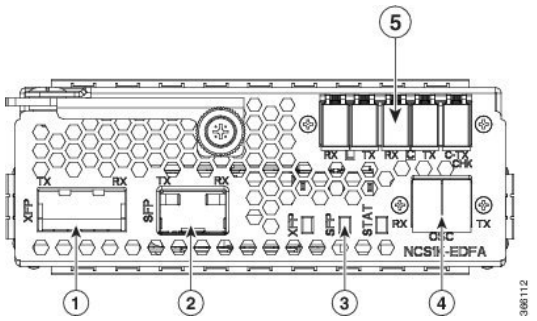
Optical Amplifier Module

The optical amplifier module (NCS1K-EDFA) has pre-amplifier and booster amplifier.

The optical amplifier module provides the following functionality.

- Preamplifier (LINE-RX to COM-TX) - Single preamplifier variant, with switchable gain ranges, according to link loss:
  - Range # 1: 0 to 24 dB gain, Tilt control: 24 to 27 gain, with tilt uncontrolled
  - Range # 2: 20 to 34 dB gain, Tilt control: 34 to 37 dB gain, with tilt uncontrolled
  - 23dBm output power @ COM-TX port
- Booster amplifier (COM-RX to LINE-TX) - True variable gain booster amplifier
  - Gain range: 1 to 20. 20 to 25 uncontrolled tilt.
  - 23dBm output power @ LINE-TX port
- ADD/DROP OSC channel supports both 1510nm and 1610nm +/-10nm
- OCM assesses channel presence and Gain regulation and per channel power monitoring.

Figure 1: EDFA Front View



1	XFP for OSC and additional OTDR feature
2	SFP for OSC (Optical Service Channel)
3	Status LED
4	Service Channel input and output port [OSC - RX, TX]
5	PRE and BST amplifier inputs and output ports [L (LINE) - RX, TX] [C (COM) - RX, TX] [COM - TX CHECK]

The following table describes the mapping of controllers and optical ports for the optical amplifier module.

Controller	Optical Ports
Ots 0/slot/0/0	• COM-RX (booster input) • COM-TX (preamplifier output)
Ots 0/slot/0/1	• LINE-RX (preamplifier input) • LINE-TX (booster output)
Ots 0/slot/0/2	• OSC-RX • OSC-TX
Ots 0/slot/0/3	COM-CHECK

Amplifier Configuration

NCS 1001 supports two methods to control amplifiers.

- Manual-All the amplifier settings are controlled by the user.
- Automatic-All the amplifier settings are controlled by the internal amplifier power regulator.

UDC Port Configuration

There are three UDC RJ-45 ports on the faceplate of NCS 1001. Each port is statically associated with a slot (UDC1 to slot 1, UDC2 to slot 2 and UDC3 to slot3). UDC ports are one Gigabit Ethernet ports and the user can transmit any Ethernet traffic into these ports.

UDC traffic flows through the line, added and dropped by the OSC add/drop filters in the optical amplifier module (NCS1K-EDFA). UDC traffic flows through the line tagged. The tagging and untagging operations are performed by NCS 1001, based on the UDC VLAN specified in the configuration, without any limit on the transmitted traffic. The traffic can be tagged, multiple tagged, or untagged. However, 100% utilization cannot be achieved because four bytes of tag are added to each packet.

UDC Application for Remote Management

The following diagrams describe the application of UDC that can be used by EPNM to manage NCS 1000 series at the remote site.

Figure 2: UDC Application for Remote Management - Scenario One

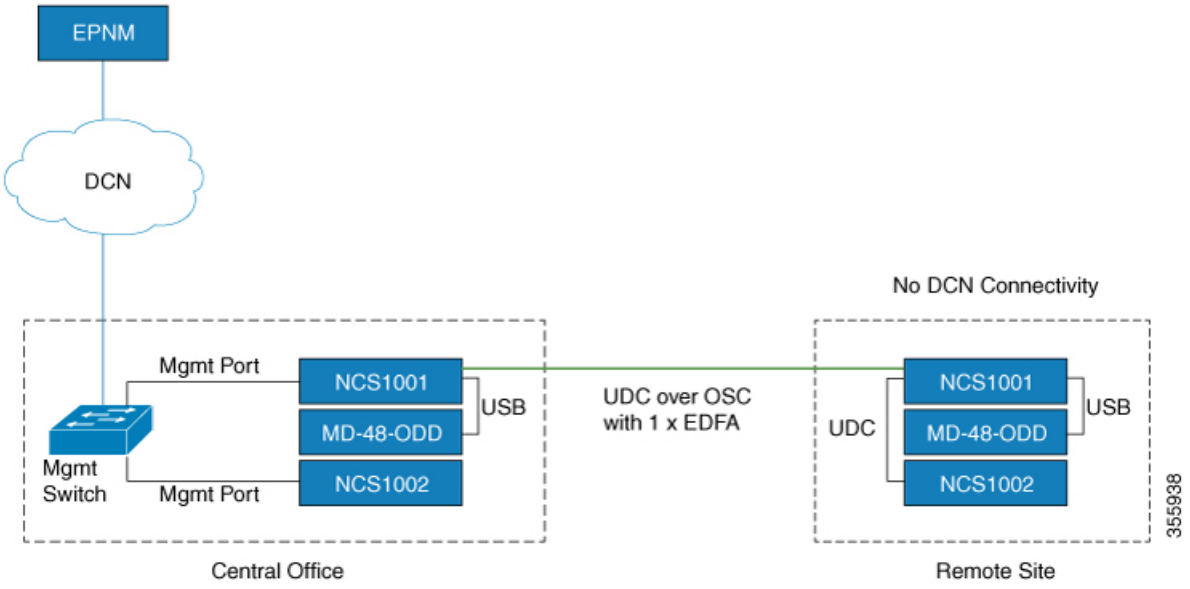
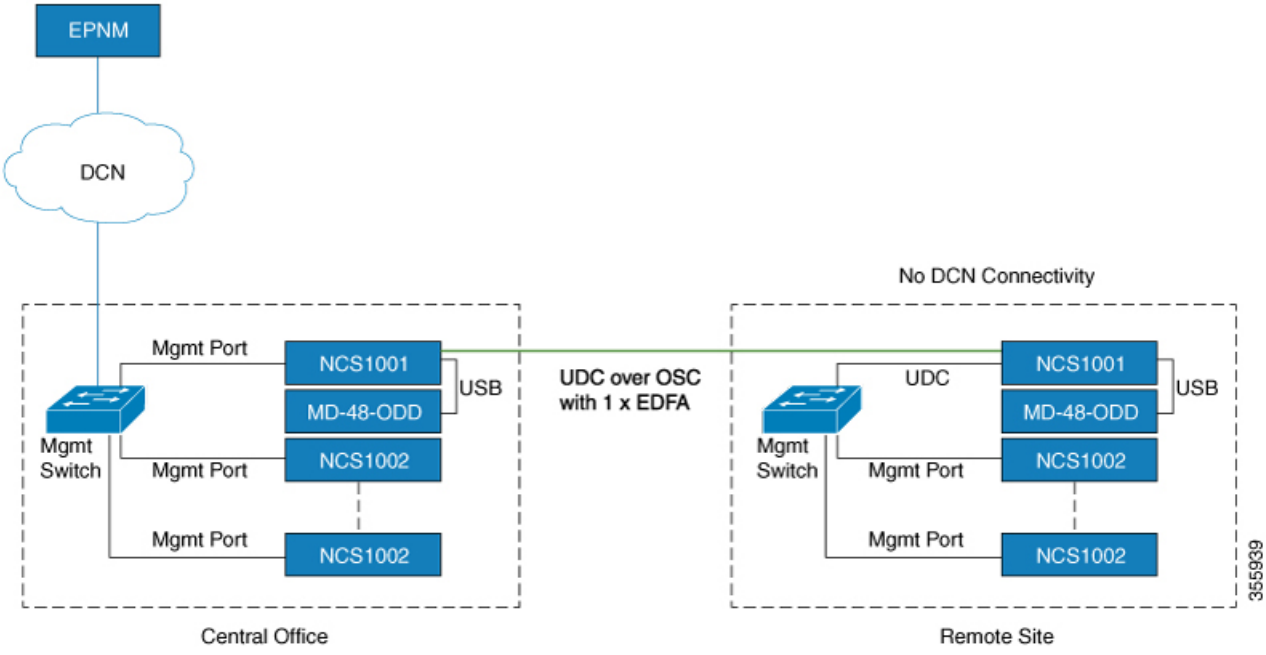


Figure 3: UDC Application for Remote Management - Scenario Two



Configure Amplifier Module

configure

hw-module location 0/RP0/CPU0 slot *slot-number* **ampli**

node-type *value*

grid-mode *value*

udc-vlan *value*

commit

end

Example

The following is a sample in which the amplifier module is inserted in slot 3 and udc-vlan is set to 4000.

```
configure
hw-module location 0/RP0/CPU0 slot 3 ampli
   [
       grid-mode 100GHz
       udc-vlan 4000
   ]
```

Amplifier Module Configuration Parameters

Table 2: Amplifier Module Configuration Parameters

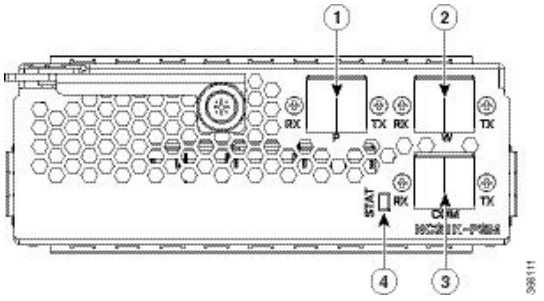
Parameter	Description	Range/Values	Default
grid-mode	Defines the optical spectrum on the interfaces of the amplifier module.	• 100GHz-Configures the amplifier with 100GHz grid of channels with 48 channel spacing. • 50GHz-Configures the amplifier with 50GHz grid of channels with 96 channel spacing. • gridless-Configures the amplifier in the flex spectrum.	50GHz
node-type	Defines the type of the node in which the amplifier is set to work.	TERM, ILA	TERM
udc-vlan	Defines the VLAN associated to the selected slot and its UDC port.	2 to 4080	

Protection Switching Module

The protection switching module (NCS1K-PSM) provides the following functionality.

- In TX section:
  - Splits input optical channels to both working and protection lines.
  - Forces the switch in the remote site by opening one of the two line paths (by putting the related VOA in AVS).
- In RX section:
  - Selects the signals from working or protection line. Each line is monitored through a PD.
  - Balances the two line losses by changing the VOA attenuation value at the same time of the switch change of state.

Figure 4: PSM Front View



1	Protected path input and output port [P - RX, TX]
2	Working path input and output port [W - RX, TX]
3	COM input and output port [COM - RX, TX]
4	Status LED

The following table describes the mapping of controllers and optical ports for the protection switching module.

Controller	Optical Ports
Ots 0/slot/0/0	COM-TX
Ots 0/slot/0/1	Working path input and output port [W - RX, TX]
Ots 0/slot/0/2	Protected path input and output port [P - RX, TX]

Configure Protection Switching Module

The following table explains the possible configuration on Protection Switching Module:

PSM Module Configuration Parameters

Table 3: PSM Module Configuration Parameters

Parameter	Description	Range/Values
lockout-from	Excludes the selected port from protection. Triggers a switch when the active port is specified in the lockout. For example, configuring a lockout-from working port triggers a switch to protect when working port is the active one. While lockout-from protected port triggers a switch to working when protected port is the active one.	Working and Protected
path-protection	Enables the PSM path protection.	
section-protection	Enables the PSM section protection.	
uni-dir	Enables the PSM uni directional (in switches only).	
auto-threshold	Enables the PSM auto threshold setting.	

Example

The following is an example of configuration of a lockout from working in which the PSM is inserted in slot 2.

```
conf t
#hw-module location 0/RP0/CPU0 slot 2 psm lockout-from "working"
commit
```

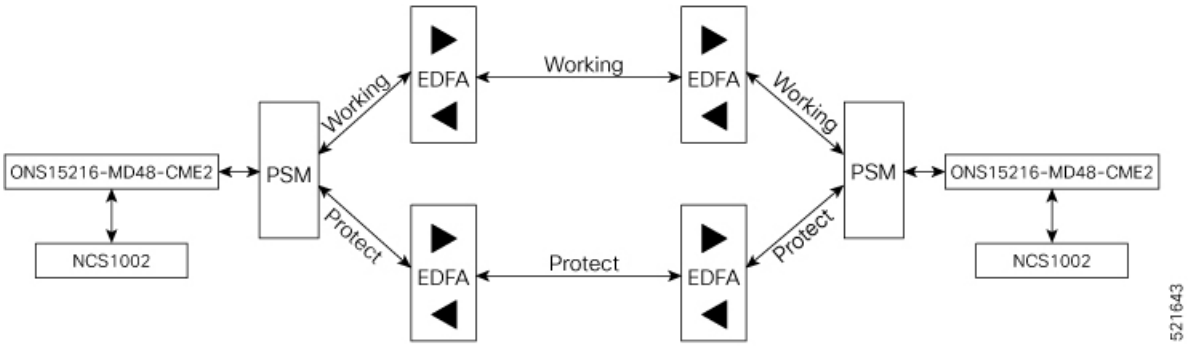
You can apply manual switching by using the following command:

hw-module slot *slot number* **manual-switch-to working | protected**

Note FPD upgrade on FW_PSMv1 from FW 1.43 and FW 1.44 to FW 1.45 affects the traffic.

(From R6.2.1) **Section Protection**

Figure 5: Section Protection Topology



See the PSM Module Configuration Parameters section to set the section-protection parameter on both the PSMs. Ensure that the PSM in a section protection topology is inserted in slot 2. Connect the EDFA in slot 1 to the Protected port of the PSM and EDFA in slot 3 to the Working port of the PSM.

Note To measure the correct switching time while testing the section protection topology, we recommend you to wait for 120 seconds between two subsequent switching events (or between a switching event and the restoration). This waiting period allows the EDFAs to stabilize after the first switching occurrence, thus avoiding the power at the PSM to oscillate around the threshold.

Protection Switching Module with Manual Threshold

The switch can operate in all conditions, if it is set in Autothreshold.

When the path protection is configured with a manual threshold, you must ensure that:

- During the first installation, the value on the PSM RX-low Threshold should be set as 3 dB below the minimum power for a single channel. The value must ensure that the PSM is able to switch on with a single channel or when the EDFA is in APR (+8 dBm).
- When the system is up and running with the final number of channels, the PSM RX-low Threshold must be set 3 dB below the target power.
- After a fiber cut and restore, in order to ensure that the PSM is able to switch on, it is necessary to set the value of PSM RX-low Threshold similar to the value set during the first installation.

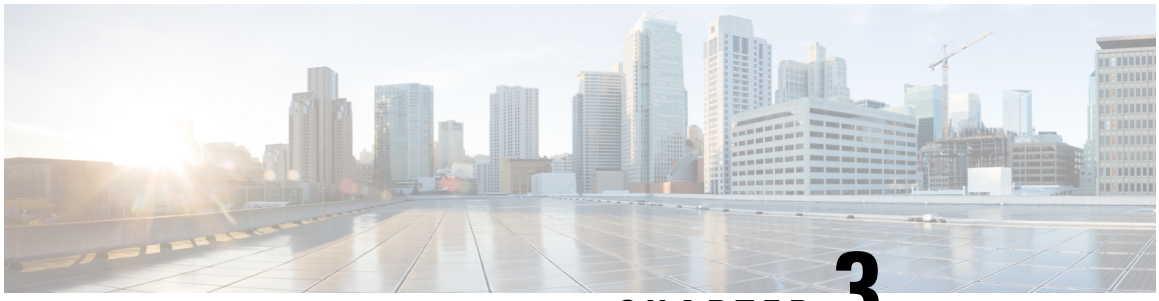
The PSM Auto-threshold configuration is highly recommended for a three-way topology.

In a three-way topology, when the path protection is configured with a manual threshold, you must follow the above steps. If you did not configure all the above steps properly, you may encounter the following issues:

- Switch may not be bidirectional.
- Double switch on PSM in path protection, when set in three-way configuration.

It is possible to configure parameters such as rx-enable, tx-enable in OTS controllers (1 or 2, i.e. working or protected port) of PSM card.

For more information on OTS controllers, see Configure OTS Controller, on page 1.



CHAPTER 3

Configure Performance Monitoring

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds for, and report performance data for early detection of problems. The user can retrieve both the current and historical PM counters for the various controllers in several intervals.

PM for optical parameters include laser bias current, transmit and receive optical power, mean polarization mode dispersion, accumulated chromatic dispersion, and received optical signal-to-noise ratio (OSNR). These parameters simplify troubleshooting operations and enhance data that can be collected directly from the equipment.

Configure PM Parameters

You can configure the performance monitoring parameters for the OTS controllers. To configure PM parameters, use the following commands.

configure

controller *controllertype R/S/I/P* { **pm** { **15-min** | **24-hour** | **30-sec** } **ots** { **report** | **threshold** } { **opr** | **opt** }*value* }

commit

Examples

The following is a sample in which the performance monitoring parameters of OTS controller is configured in 24 hour intervals.

```
configure
controller ots 0/1/0/0 pm 24-hour ots report opr max-tca enable
commit
```

The above command enables the maximum TCA (Threshold Crossing Alert) for opr (optical power received) of ots 0/1/0/0 controller in 24 hour intervals.

```
configure
controller ots 0/1/0/0 pm 24-hour ots threshold opr max 4000
commit
```

The above command sets the maximum TCA for opr of ots 0/1/0/0 controller in 24 hour intervals.

The PM collector starts and collects controller data at the following intervals.

- 30 seconds interval - 30 samples jitter provision of 6 seconds
- 15 minutes interval - 32 samples jitter provision of 45 seconds
- 24 hours interval - 1 sample jitter provision of 45 seconds

The jitter provides for any computation delay for data collected at the data provider PM engine.

View PM Parameters

Use this procedure to view the performance monitoring parameters for OTS controllers.

show controllers *controllertype R/S/I/P* { **pm** { **current** | **history** } { **15-min** | **24-hour** | **30-sec** | **flex-bin** } { **optics** *lane-number* } { **bucket** *bucket-number* }

The **bucket** parameter must be specified for **pm history**.

Example:

```
RP/0/RP0/CPU0:ios# show controllers ots 0/1/0/0 pm current 15-min optics 1
```

Displays the current performance monitoring parameters of the Optics controller in 15 minute intervals.

```
Thu Mar 16 15:07:21.093 CET

Optics in the current interval [15:00:00 - 15:07:21 Thu Mar 16 2017]

Optics current bucket type : Valid
MIN AVG MAX Threshold TCA Threshold TCA
(min) (enable) (max) (enable)
LBC[% ] : 0.2 4.5 18.6 0.0 NO 0.0 NO
OPT[dBm] : -40.00 -0.40 8.00 -50.00 NO 10.00 NO
OPR[dBm] : -17.52 -17.01 -16.90 -50.00 NO 10.00 NO

Last clearing of "show controllers OPTICS" counters never
```

The **show controllers** command occasionally returns the wrong bucket. For example, the following command query at "Mon May 29 15:02:05.697 CEST" must have returned the bucket for the interval [15:01:30 - 15:02:00 Mon May 29 2017] while it returned the previous bucket [15:01:00 - 15:01:30 Mon May 29 2017].

```
RP/0/RP0/CPU0:ios# show controllers optics 0/1/0/4 pm history 30-sec optics 1 bucket 5
```

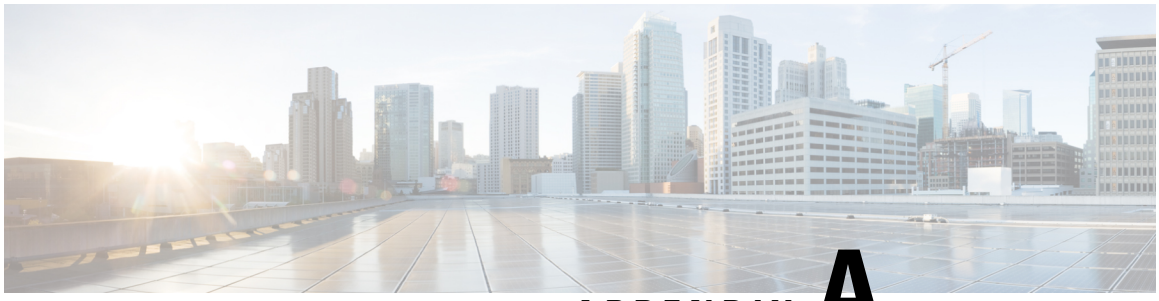
Displays the current performance monitoring parameters of the Optics controller in 15 minute intervals related to bucket 5.

```
Mon May 29 15:02:05.697 CEST

Optics in interval 1 [15:01:00 - 15:01:30 Mon May 29 2017]

Optics history bucket type : Valid
              MIN       AVG       MAX
LBC[% ]     : 335.3     341.3     352.3
OPT[dBm]    : 1.90      2.01      2.10
OPR[dBm]    : -12.20    -12.16    -12.10
```

```
Last clearing of "show controllers OPTICS" counters never
```



APPENDIX A

Configuring SNMP

The following MIBs are supported in NCS 1001.

- CISCO-OPTICAL-OTS-MIB
- CISCO-CONFIG-MAN-MIB
- CISCO-FLASH-MIB
- CISCO-ENTITY-REDUNDANCY-MIB
- CISCO-SYSTEM-MIB
- CISCO-ENTITY-ASSET-MIB
- EVENT-MIB
- DISMAN-EXPRESSION-MIB
- CISCO-FTP-CLIENT-MIB
- NOTIFICATION-LOG-MIB
- CISCO-RF-MIB
- CISCO-TCP-MIB
- UDP-MIB
- CISCO-OTN-IF-MIB
- CISCO-ENHANCED-MEMPOOL-MIB
- CISCO-PROCESS-MIB
- CISCO-SYSLOG-MIB
- ENTITY-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-IF-EXTENSION-MIB
- RMON-MIB
- CISCO-OPTICAL-MIB

- CISCO-ENTITY-SENSOR-MIB

The following table provides more information about SNMP MIBs and the documentation links.

Task	Link
Determine the MIB definitions	SNMP Object Navigator
Configure SNMP	Configure SNMP
Understand the SNMP best practices regarding the recommended order of SNMP query, maximum cache hit, and SNMP retry and timeout recommendation	SNMP Best Practices