Configuration Guide for Cisco NCS 1001, IOS XR Release 6.5.x

First Published: 2018-08-10

Last Modified: 2024-02-28

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New and Changed Information

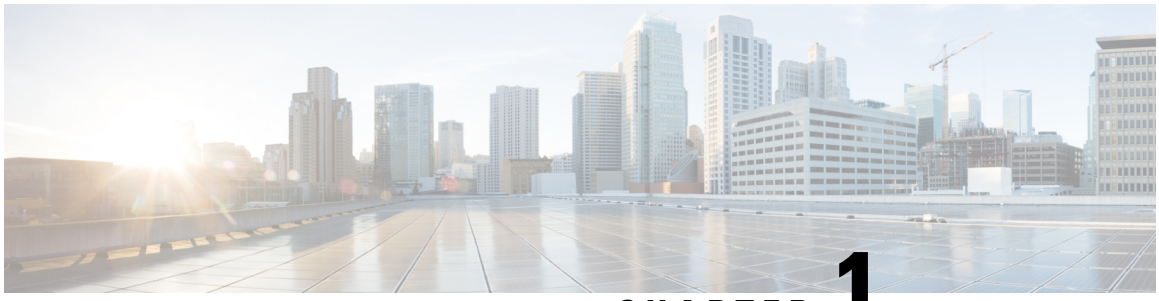
See Data Models Configuration Guide for Cisco NCS 1001 and Telemetry Configuration Guide for Cisco NCS 1000 Series to refer the other configuration guides of NCS 1001.

This table summarizes new and changed information for configuration guide for Release 6.5.1, and lists where the features are documented.

Table 1: New and Changed Features - R6.5.1

Feature	Description	Where Documented
OTDR	Optical Time Domain Reflectometer (OTDR) is a line card supported in NCS 1001. The line card contains 2x bidirectional OTDRs and 2x filter that combines C-band, OSC, and OTDR filters and splits OSC and OTDR. Each internal OTDR can perform measurements on both TX and RX fiber by using an internal optical switch. OTDR line card is connected to the OSC port on the optical amplifier. The OTDR measurement is available in a .SOR file and it can be exported from NCS 1001 using SCP, TFTP, and SFTP. The OTDR line card can be inserted in any slot of NCS 1001.	Configure OTDR Module

Feature	Description	Where Documented
Span Loss Calculation	The Span Loss Calculation is an automatic calculation of span losses between NCS 1001 systems. This feature applies to each topology such as protected or non-protected,linear with or without ILA nodes in the middle. The Span Loss Calculation is a software functionality available for OTS controller so it can be statically enabled or disabled through hw-module configuration.Span loss calculation is made using the TX and RX total power on EDFA ports.	Span Loss Calculation
Dual IP Address	Dual independent XR interfaces allows you to connect the two ethernet interfaces to two different switches of different subnet and also the same subnet. From release 6.5.1, there are different ports from the ethernet switch MGMT RJ45, and Optical SFP MGMT to the CPU.	Dual IP Address
USB Auto Mount	USB Automount feature allows the user to read from or write files and folders onto the USB device. The user can mount and unmount the USB device both in sysadmin-vm and XR. The mounted USB device can be accessed as disk2: file system.	USB Automount
USB Passive Inventory	There are passive units that are part of NCS1001 hardware configuration. It is possible to have information about these passive units as soon as they are connected with a proper USB cable through one of the four available USB ports on the controller card of the box itself. In this case their basic parameters are displayed in the output of "show inventory" command by XR or admin session.	*USB Passive Inventory* section in *Hardware Installation Guide for Cisco NCS 1001*.



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 2: 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	

Parameter	Description	Hardware Capability	Range	Default	Notes
channel-power-max-delta (0.1 dBm)	Maximum difference among all measured channel powers	Amplifier	0 to 200	3.0	
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**

Span Loss Calculation

The Span Loss Calculation is an automatic calculation of span losses between NCS 1001 systems. This feature applies to each topology such as protected or non-protected, linear with or without ILA nodes in the middle.

The Span Loss Calculation is a software functionality available for OTS controller and it can be statically enabled or disabled through `hw-module` configuration. Span Loss calculation is made using the TX and RX total power on EDFA ports.

For this feature 2 new parameters are managed in the show controller ots command for EDFA cards:

- RX Span Loss
- TX Span Loss

The Span Loss Calculation runs automatically every 5 minutes when there is a configuration change. In the order of priority, the possible configurations are:

- Remote node.
- OSC through OSPF.

Limitation

- Span Loss calculation is done by considering the total power of the transmission end and receiver end on the EDFA ports. If the PSM card is connected to the span (for example, in case of Path Protection Topology), the span boundaries are assumed to be the closer EDFA ports.

Display Span Loss Calculation

Once the feature is enabled and after the first span loss calculation, the loss calculated (for both IPv4 and IPv6) can be retrieved using the `show controller ots` command. In the output RX Span Loss and TX Span Loss are added. RX Span Loss and TX Span Loss are obtained as a result of difference between **TX Total Power** and **RX Total Power** read on the edge of the span.

In case of a TERM node, the command is applied to LINE port. For example, in case of EDFA in slot 1, the span loss calculated are shown in the output of the following command:

```
#show controllers ots 0/1/0/1
…
…
 RX Span Loss = 15.20 dB
 TX Span Loss = 14.80 dB
…
…
```

In case of an ILA node, the command is applied to LINE port (`controller ots 0/slot/0/1`) to obtain RX Span Loss of related span, and to COM port (`controllers ots 0/slot/0/0`) to obtain TX Span Loss of related span.

For example, in case of an EDFA of ILA site equipped in slot 3:

```
show controllers ots 0/3/0/1
…
 RX Span Loss = 12.40 dB
show controllers ots 0/3/0/0
…
 TX Span Loss = 11.90 dB
```

Dual IP Address

Dual independent XR interfaces allows you to connect the two ethernet interfaces to two different switches of different subnet and also of the same subnet. From release 6.5.1, there are different ports from the ethernet switch MGMT RJ45, and Optical SFP MGMT to the CPU.

The two different Management Ethernet interfaces in to XR are:

- MgmtEth 0/RP0/CPU0/0 (already existing) representing the RJ45 port.
- MgmtEth 0/RP0/CPU0/1 (new one) representing the SFP port.

iPXE is not supported at power-on over the new optical interface.

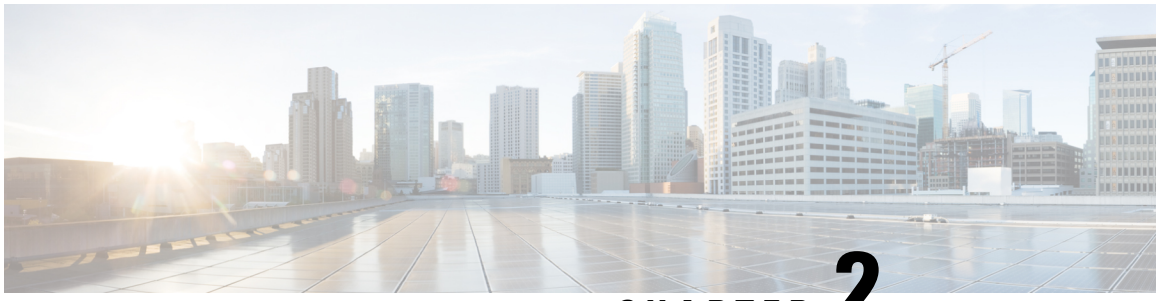
Upgrades from previous releases using only SFP loses MGMT connectivity. In this case, you must configure through Console port.

Before using the two different interfaces, you must upgrade the BIOS and reload the 0/RP0 location.

The following example shows the output of the *show running-config* command:

Example

```
RP/0/RP0/CPU0:MYST-144#show running-config
….
 interface MgmtEth0/RP0/CPU0/0
 ipv4 address xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy
!
interface MgmtEth0/RP0/CPU0/1
 ipv6 address xxxx:xxxx:xxxx:xxxx::xxx:xxx/yy
 ipv6 enable
!
interface MgmtEth0/RP0/OSC1/0
 shutdown
!
interface MgmtEth0/RP0/OSC2/0
 shutdown
!
interface MgmtEth0/RP0/OSC3/0
 shutdown
!
```



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.

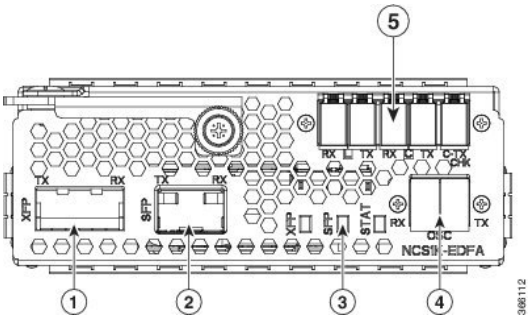
Optical Amplifier Module

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

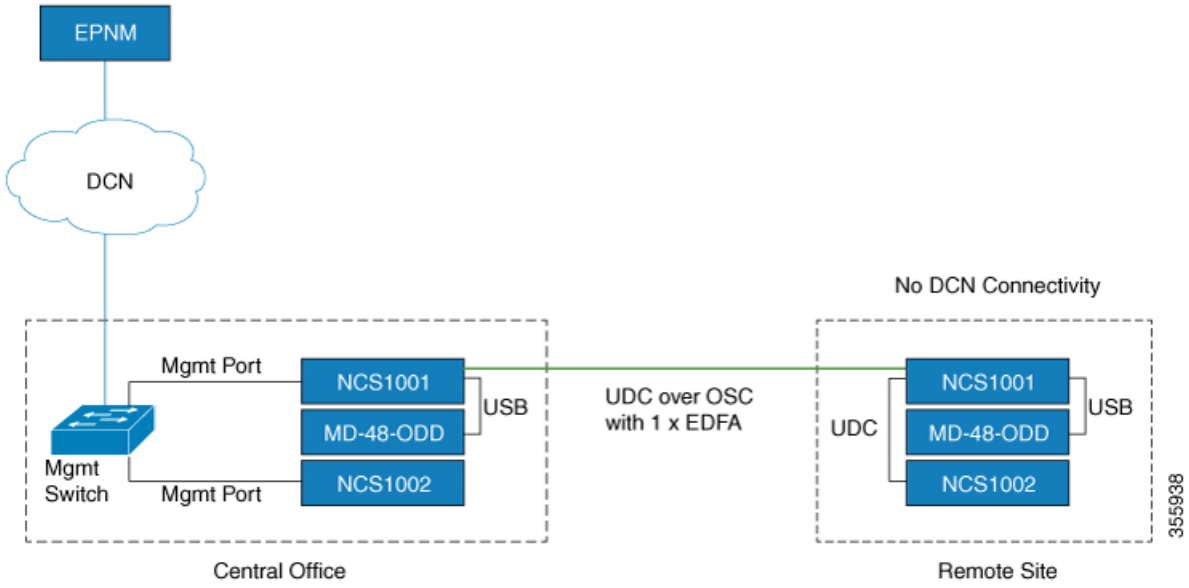
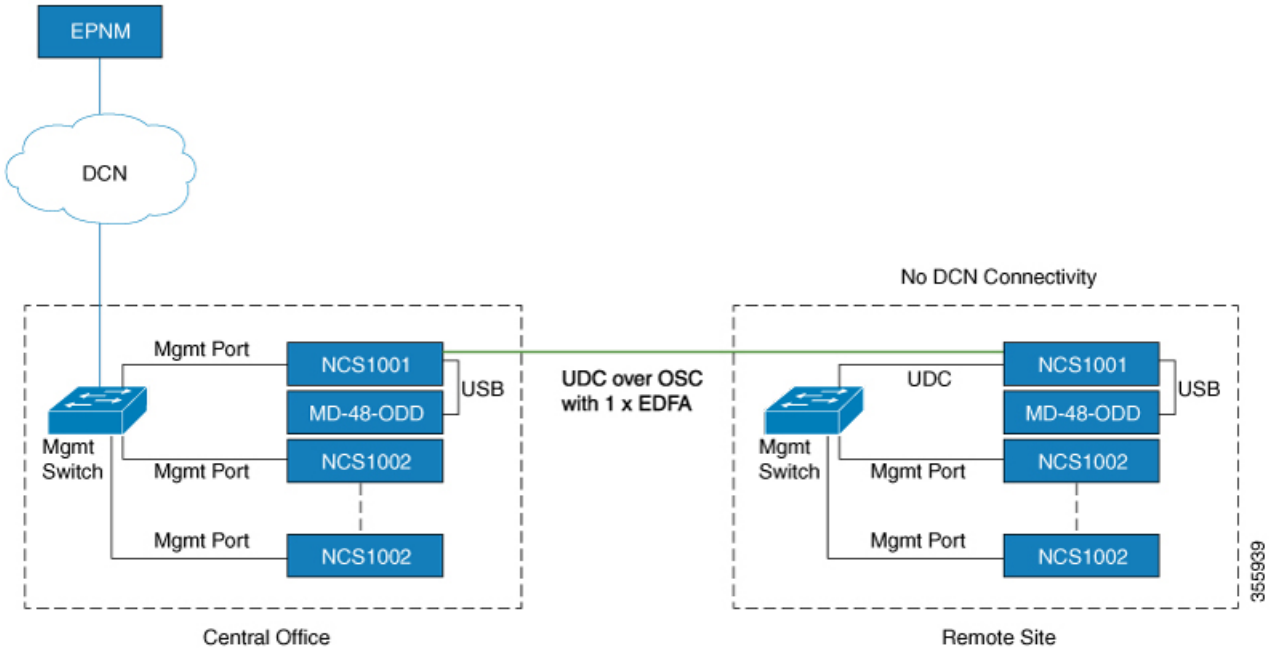


Figure 3: UDC Application for Remote Management - Scenario Two



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 3: 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	

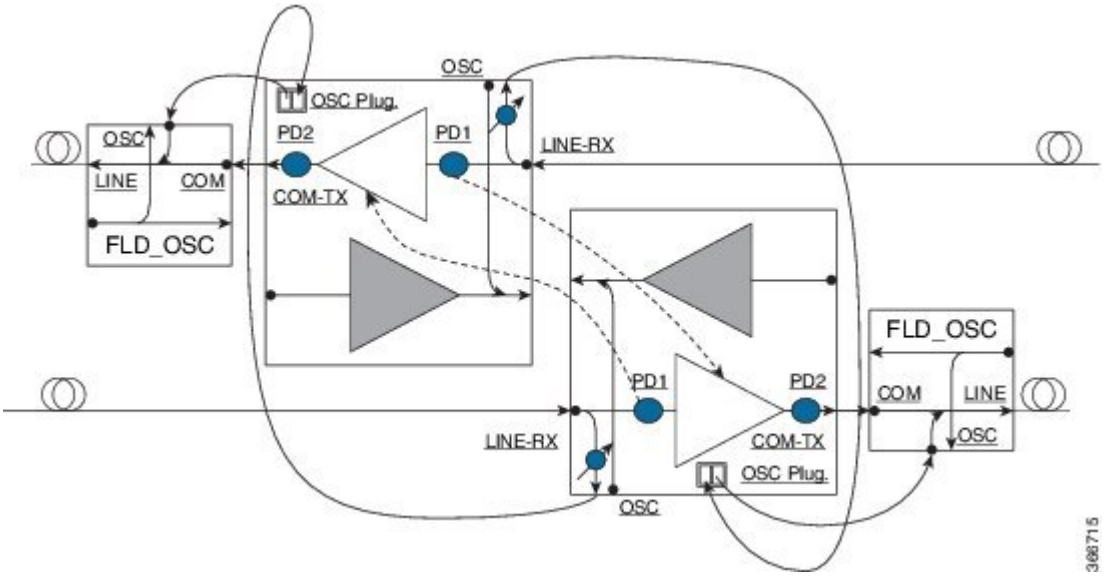
In-Line Amplifier

The optical amplifier module (NCS1K-EDFA) can be configured in In-line amplifier (ILA) mode. ILA mode is used when it is not possible to connect to terminal nodes with a single span. ILA mode is supported only in slots 1 and 3.

ILA mode supports only the operation of preamplifier in the two directions. The booster module is switched off in ILA mode. ILA mode supports gain range 1 and 2 of the preamplifier and provides 23dBm output power pre-amplification.

In the ILA mode, the LINE-RX and COM-TX ports of the optical amplifier module are enabled whereas the LINE-TX and COM-RX ports of the optical amplifier module are disabled. OCM reports LINE-RX and COM-TX port values whereas LINE-TX and COM-RX port values are set to -40.00 dBm. In the ILA mode, the LINE-RX terminates on the LINE-RX on the optical amplifier module whereas the LINE-TX terminates on the external OSC module (15216-FLD-OSC=).

Figure 4: ILA Optical Diagram



Configure Amplifier Module in ILA Manual Mode

When the amplifier is set to ILA, all the configurations are performed only on the pre-amplifier. After the node is set to ILA, the amplifier gain, RX-low threshold, and the amplifier tilt can be configured on the pre-amplifier.

configure

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

commit

end

controller *controllertype Rack/Slot/Instance/Port*

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

ampli-gain *value*

rx-low-threshold *value*

ampli-tilt *value*

commit

end

Example

The following is a sample in which the amplifier module is configured in ILA manual mode. The node type is set to ILA. This parameter switches off the booster side and activate safety between slots 1 and 3.

```
configure
      hw-module location 0/RP0/CPU0 slot 3 ampli node-type iLA
      commit
      end
      controller ots 0/3/0/0
      ampli-control-mode manual
      ampli-gain 200
      rx-low-threshold -300
      ampli-tilt -10
      commit
end
```

Configure Amplifier Module in ILA Automatic Mode

The configurations performed on the amplifier module in ILA automatic mode are similar to the configurations performed on the terminal node. The configurations are performed only on the pre-amplifier as the booster is switched off in ILA mode.

configure

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

grid-mode *value*

node-type *value*

commit

end

controller *controllertype Rack/Slot/Instance/Port*

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

ampli-channel-power *value*

ampli-tilt *value*

rx-low-threshold *value*

channel-power-max-delta *value*

ampli-gain *value*

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

commit

end

Example

The following is a sample in which the amplifier module is configured in ILA automatic mode.

```
configure
      hw-module location 0/RP0/CPU0 slot 3 ampli
      grid-mode 50GHz
      node-type iLA
      commit
      end
      controller ots 0/3/0/0
      ampli-control-mode automatic
      ampli-channel-power 30
      ampli-tilt -10
      rx-low-threshold -331
      ampli-gain 220
      ampli-gain-range extended
      commit
end
```

The following is a sample of **show running-config** command.

```
line console
exec-timeout 0 0
!
line default
exec-timeout 0 0
session-timeout 0
!
ntp
server 10.58.228.1
update-calendar
!
hw-module location 0/RP0/CPU0 slot 1
ampli udc-vlan 11
ampli grid-mode 50GHz
ampli node-type ILA
!
hw-module location 0/RP0/CPU0 slot 3
ampli udc-vlan 10
ampli grid-mode 50GHz
ampli node-type ILA
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 10.58.229.143 255.255.252.0
!
interface MgmtEth0/RP0/OSC1/0
shutdown
!
interface MgmtEth0/RP0/OSC2/0
shutdown
!
interface MgmtEth0/RP0/OSC3/0
shutdown
!
```

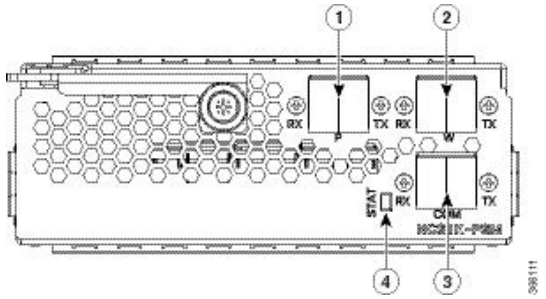
```
controller Ots0/1/0/0
ampli-tilt -12
ampli-control-mode automatic
ampli-channel-power 22
channel-power-max-delta 45
!
controller Ots0/1/0/1
rx-low-threshold -250
!
controller Ots0/3/0/0
ampli-tilt -12
ampli-control-mode automatic
ampli-channel-power 22
channel-power-max-delta 45
!
controller Ots0/3/0/1
rx-low-threshold -250
!
router static
address-family ipv4 unicast
  0.0.0.0/0 10.58.228.1
!
!
netconf-yang agent
ssh
!
ssh server v2
end
```

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 5: 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 4: 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:

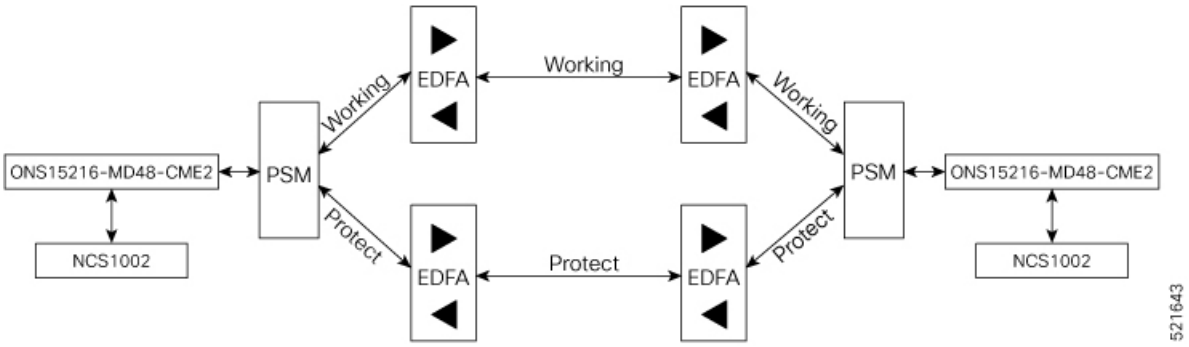
hw-module slot *slot number* **manual-switch-to working | protected**

The switch by user command from the path without the ILA node in the middle is performed bi-directionally. If the ILA and terminal nodes are in section-protection, the manual and lockout switch command from the path with ILA node in the middle are performed uni-directionally.

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 6: Section Protection Topology

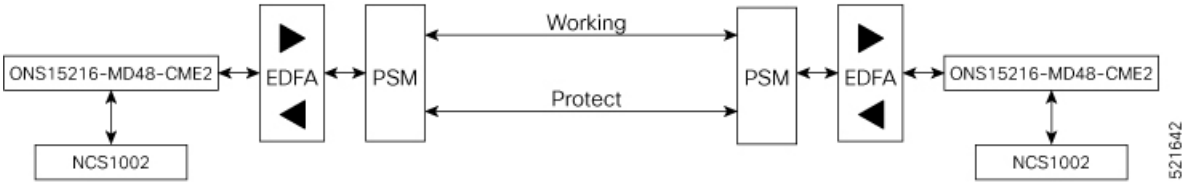


See the PSM Module Configuration Parameters section to set the section-protection parameter on both the PSMs. Ensure that the PSM in a section protection topology is inserted in slot 2. Connect the EDFA in slot 1 to the Protected port of the PSM and EDFA in slot 3 to the Working port of the PSM.

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.

(From R6.3.2) **Path Protection**

Figure 7: Path Protection Topology



See the PSM Module Configuration Parameters section to set the path-protection parameter on both the PSMs.

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.

Autothreshold for Protection Switching Module

When auto-threshold is not enabled, the RX-low threshold value active on PSM working and protected RX-ports can either be set by the user or the default values can be used.

The current threshold is the configured parameter if the values set are available in the show controller command output. The current value is -38dBm (default values), if the user doesn't have configured any value for those parameters.

If auto-threshold is enabled on the PSM, the RX-low thresholds values for port 1 and 2 configured by the user are ignored (current thresholds is not the configured parameter). When the auto threshold is enabled on the PSM card:

- If optical Power at Working-RX and Protected-RX port is stable (+/- 1 dB) for 2 minutes, related RX-Low threshold is automatically set to RX power – 3dB.
- If power is not stable, the releated thresholds do not change.
- W-RX and P-RX are regulated independently.

The LOS-P behavior on the auto-threshold are:

- When a LOS-P alarm is detected on the working or protected RX-port, in case of auto-threshold is enabled, the related threshold remains the same. This behavior happens when the RX power is less than the related threshold on the RX-port working or protected.
- When the LOS-P alarm is cleared in the first 30 seconds, the ordinary auto-threshold mechanism is applied. This behavior happens after 2 minutes of stable RX-power and when the RX-low threshold is changed to the new RX power -3 dB.
- When the LOS-P is present after 30 seconds, the RX-low threshold is automatically moved to the values set by the user.
- When the LOS-P is cleared, the ordinary auto-threshold mechanism is applied again. This behavior happens when the RX power is higher than the related current threshold.

Enable Autothreshold for PSM

This procedure enables automatic thresholds for PSM. The configuration to set auto threshold mechanism are:

configure

hw-module location 0/RP0/CPU0 slot *slot number* **psm auto-threshold**

commit

end

slot number is the slot where the PSM is inserted.

Example

The following is a sample for enabling autothreshold on a PSM equipped in slot 1.

```
RP/0/RP0/CPU0:MYS-237#configure terminal
RP/0/RP0/CPU0:MYS-237(config)#hw-module location 0/RP0/CPU0 slot 1 psm auto-threshold
RP/0/RP0/CPU0:MYS-237(config)#commit
eRP/0/RP0/CPU0:MYS-237(config)#end
```

PSM Virtual Photodiode

Protection Switching Module (PSM) Virtual diode provides an optical power reading even if photodiodes are not available. PSM does not have photodiode on COM-RX. There are two photodiodes on Working-TX and Protected-TX present after the VOA.

The value of power on Com-RX is real, if at least one value between the W-TX and the P-TX power is not equal to -40 dB (related port in AVS).

When both the power of W-TX and P-TX are equal to -40dB (both related VOA in AVS-Automatic VOA Shutdown), it is impossible to calculate the real power on Com-RX port, and the value will be shown as -40dB.

The feature does not require any configuration. There is a change only in the *show controllers ots 0/<slot>/0/0* command, which shows the RX power on Com-RX port. RX low power alarm is not managed on Com-RX port.

Example for show controller

RP/0/RP0/CPU0:ios#**show controllers ots 0/2/0/0**

```
Wed Jan 24 14:33:22.898 CET

 Controller State: Up

 Transport Admin State: In Service

 Port Type: Com

 Laser State: Unknown

 Optics Status::


 Alarm Status:
 -------------
 Detected Alarms: None


 Alarm Statistics:
 -----------------
 LOW-RX-PWR = 0
 LOW-TX-PWR = 0
 RX-LOS-P = 0
```

```
RX-LOC = 0
AMPLI-GAIN-DEG-LOW = 0
AMPLI-GAIN-DEG-HIGH = 0
AUTO-LASER-SHUT = 0
AUTO-POW-RED = 0
AUTO-AMPLI-CTRL-DISABLED = 0
AUTO-AMPLI-CFG-MISMATCH = 0
SWITCH-TO-PROTECT = 0
AUTO-AMPLI-CTRL-RUNNING = 0

Parameter Statistics:
---------------------
TX Power = 15.30 dBm
RX Power = 5.30 dBm
tx-enable = 1
rx-enable = 1

Configured Parameters:
-------------
tx-enable = 1
rx-enable = 1
```

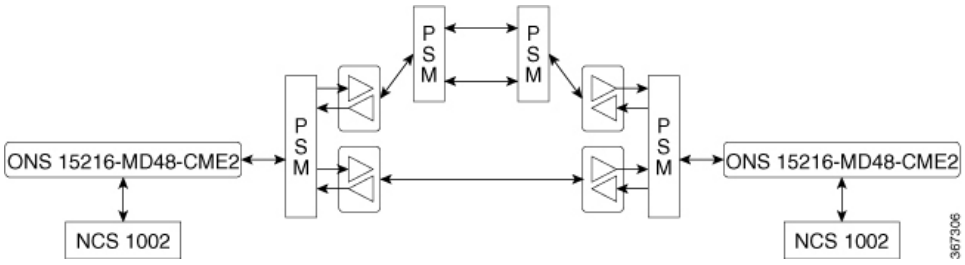
PSM 3-way Protection

NCS 1001 supports Protection Switching Module (PSM) 3-way protection scheme formed by combining a Section Protection scheme with a Path Protection scheme. There is no confiugration change required in PSM to implement the PSM 3- way protection scheme. The Path Protection scheme is in the middle of one of the two paths of Section Protection scheme.

For the outer section protection it is suggested to use the PSM automatic threshold configuration.

Figure 8: 3-way Protection Network Topology

Figure 9: 3-way Protection Network Topology



The 3-way Protection Scheme has the following limitations:

- For each PSM switching the bi-directionality is not definite.
- The manual switching used to change the active path is sometimes unsuccessful.

The lockout configuration is recommended to control the switching operation from one path to another on all the 4 PSMs of the protection scheme. The lockout configuration must be applied on both local and corresponding remote PSM to ensure the bi-directionality.

OSC

OSC (Optical Service Channel) is an out-band channel added and dropped into the optical amplifier module. The wavelengths supported by OSC are 1510 nm and 1610 nm.

OSC provides a communication channel for the following types of traffic.

- Traffic coming from a UDC port
- Traffic for remote management of NCS 1001

Remote Management

Remote Management feature, introduced in R6.3.1, allows to configure the IP addresses of the local and remote nodes, to remotely manage NCS 1001.

Three OSC interfaces are configured to support remote management. The OSC interfaces are configured to provide static routes to remote nodes. Each OSC interface is statically associated with a slot (OSC1 to slot 1, OSC2 to slot 2, and OSC3 to slot3).

Configuration Steps

1. Configure Management and OSC Interfaces
2. Configure Static Routes

Network Topology Discovery

Network topology discovery feature based on OSPF protocol, introduced in R6.3.2, allows to discover NCS 1001 nodes connected to each other through OSC links without configuring the static routes. This feature checks for compatibility only between NCS 1001 nodes.

OSPF must be properly configured on the NCS 1001 nodes by defining the name, router ID, interfaces in the Area 0 section, and optionally, configuring the interfaces as passive. OSPF and OSPFv3 protocols are supported.

The following network topologies are supported.

- Point to Point
- Point to Point with ILA nodes (up to three ILA nodes)

Configuration Steps

1. Configure Management and OSC Interfaces
2. Configure OSPF Routes

Configure Management and OSC Interfaces

configure

interface mgmtEth *rack/slot/instance/port*

ipv4 address *ipv4-address subnet-mask*

shutdown

exit

Example

The following are samples of configuring the management and OSC interfaces.

```
configure
interface MgmtEth 0/RP0/CPU0/0
ipv4 address 10.58.227.198 255.255.255.0
shutdown
exit
```

```
configure
interface MgmtEth 0/RP0/OSC1/0
ipv4 address 10.1.1.1 255.255.255.0
shutdown
exit
```

```
configure
interface MgmtEth 0/RP0/OSC2/0
ipv4 address 10.1.2.1 255.255.255.0
shutdown
exit
```

```
configure
interface MgmtEth 0/RP0/OSC3/0
ipv4 address 10.1.3.1 255.255.255.0
shutdown
exit
```

Configure Static Routes

This procedure configures all the static routes into the NCS 1001 node.

configure

router static address-family ipv4 unicast 0.0.0.0/0 *default-gateway*

exit

Example

The following sample shows the NCS 1001 node connected to three different nodes using static routes.

```
configure
```

```
router static address-family ipv4 unicast
0.0.0.0/0 MgmtEth 0/RP0/CPU0/0 10.58.227.1
10.1.1.0/24 MgmtEth 0/RP0/OSC1/0 10.1.1.2
10.1.2.0/24 MgmtEth 0/RP0/OSC2/0 10.1.2.2
10.1.3.0/24 MgmtEth 0/RP0/OSC3/0 10.1.3.2
exit
```

Configure OSPF Routes

configure

router ospf *process-id*

router-id *ip-address*

area *area-id*

exit

Example

The following is a sample of configuring OSPF routes.

```
configure
interface MgmtEth0/RP0/CPU0/0
 ipv4 address 10.1.1.2 255.255.255.0
!
interface MgmtEth0/RP0/OSC1/0
 shutdown
!
interface MgmtEth0/RP0/OSC2/0
 ipv4 address 10.1.3.2 255.255.255.0
!
interface MgmtEth0/RP0/OSC3/0
 ipv4 address 10.1.4.2 255.255.255.0
!
router ospf remote
 router-id 10.1.1.2
 area 0
  interface MgmtEth0/RP0/CPU0/0
   passive enable
  !
  interface MgmtEth0/RP0/OSC2/0
  !
  interface MgmtEth0/RP0/OSC3/0
  !
 !
!
end
```

Verify OSPF Routing Table

RP/0/RP0/CPU0:ios# **show ospf routes**

```
Sat Jul 29 09:54:25.937 UTC

Topology Table for ospf local with ID 10.1.4.1
```

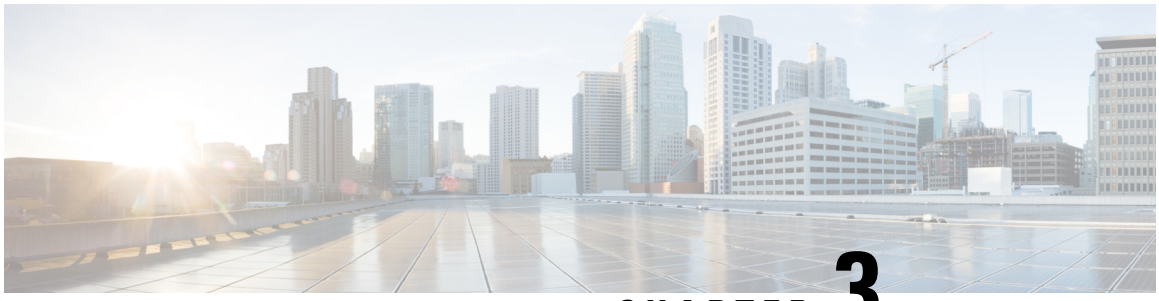
```
Codes: O - Intra area, O IA - Inter area
       O E1 - External type 1, O E2 - External type 2
       O N1 - NSSA external type 1, O N2 - NSSA external type 2

O    10.1.1.0/24, metric 1
       10.1.1.2, directly connected, via MgmtEth0/RP0/CPU0/0
O    10.1.3.0/24, metric 1
       10.1.3.2, directly connected, via MgmtEth0/RP0/OSC2/0
O    10.1.7.0/24, metric 2
       10.1.3.1, from 10.58.227.198, via MgmtEth0/RP0/OSC2/0
O    10.58.227.0/24, metric 1
       10.1.3.1, from 10.58.227.198, via MgmtEth0/RP0/OSC2/0
```

Troubleshooting Network Issues

Troubleshooting must be performed by checking the status of the interfaces, subnets, static routing, and OSPF sections.

Problem	Command
Interfaces are in down state	**show interfaces MgmtEth** *rack/slot/instance/port*
Route to default gateway is not defined	**show running-config**
Wrong IP addresses or subnet are planned in design phase	**show running-config**
Wrong static routes are defined that overwrite OSPF routes	Compare the output of **show ip route** command with **show ospf routes** command
Interfaces are not added in the OSPF section configured	**show running-config**
Interfaces are in passive mode in the OSPF section configured	**show running-config**



CHAPTER 3

Configure OTDR Module

This chapter describes how to configure the Optical Time Domain Reflectometer (OTDR) module.

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 an OTDR 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.

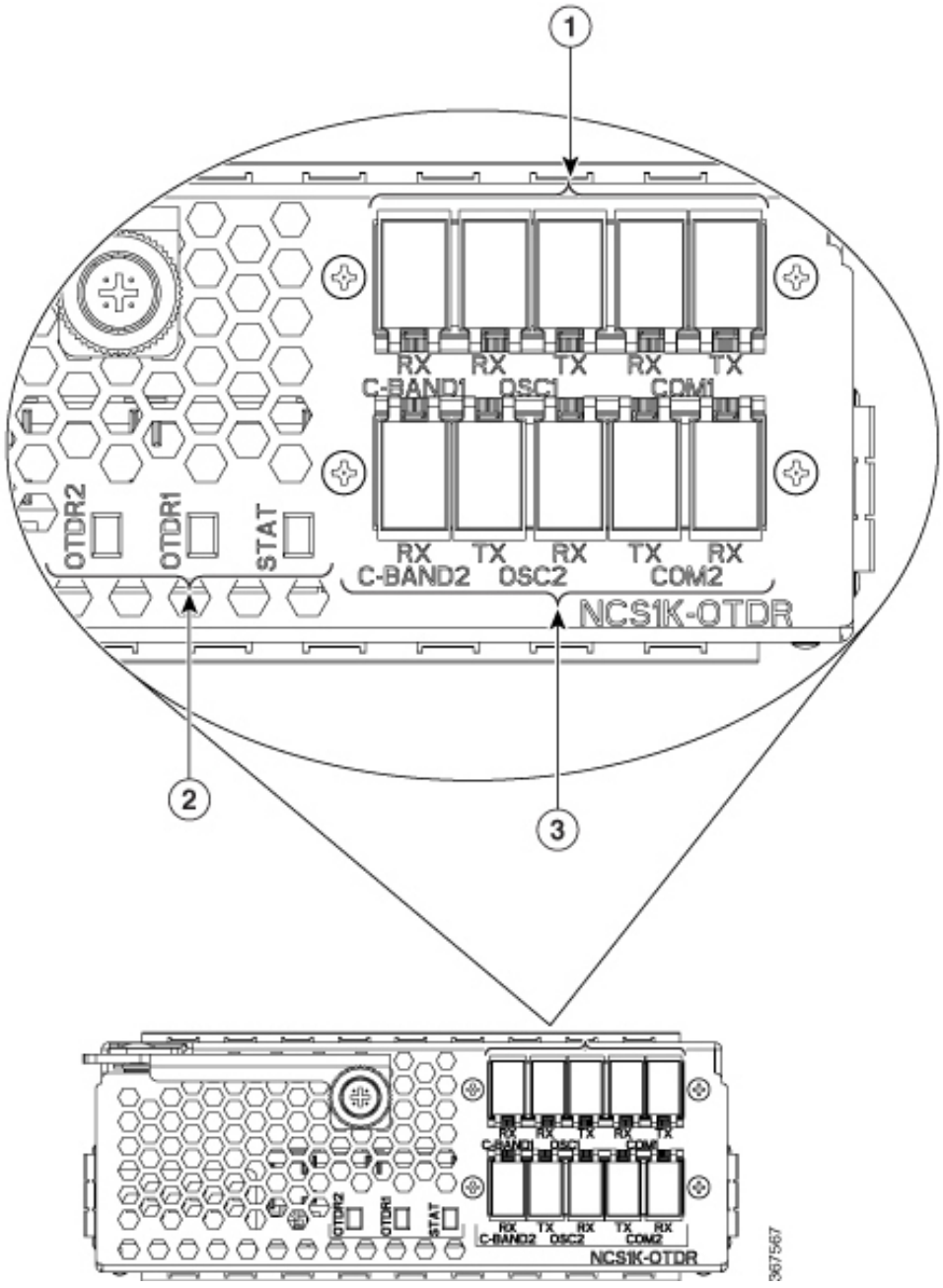
3. `no controller optics Rack/Slot/Instance/Port`

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

OTDR

The optical Time Domain Reflectometer (OTDR) is a line card supported in NCS 1001. The line card contains 2x bidirectional OTDRs and 2x filter that combines C-band, OSC, and OTDR filters and splits OSC and OTDR. Each internal OTDR can perform measurements on both TX and RX fibers by using an internal optical switch. The OTDR line card is connected to the OSC port on the optical amplifier. The OTDR measurement is available in a .SOR file and it can be exported from NCS 1001 using SCP, TFTP, and SFTP. The OTDR line card can be inserted in any slot of NCS 1001.

Figure 10: Front View of OTDR Card



1	OTDR1 interface
2	LED status
3	OTDR2 interface

The following table lists the logical ports (OTS controller ports) that are associated with the physical ports in the OTDR card.

Table 5: OTDR Physical Ports and the Associated Logical Ports

OTDR Ports	Logical Ports Corresponding to the Ports
C-Band-1 RX	controller OTS 0/slot/0/0
COM1 (RX, TX)	controller OTS 0/slot/0/1
OSC1 (RX, TX)	controller OTS 0/slot/0/2
C-Band-2 RX	controller OTS 0/slot/0/3
COM2 (RX, TX)	controller OTS 0/slot/0/4
OSC2 (RX, TX)	controller OTS 0/slot/0/5

You can also view the logical ports details available in the table Table 5: OTDR Physical Ports and the Associated Logical Ports, on page 30 using the CLI command. See View the Logical Ports and the Photodiode Power Levels, on page 44.

The OTDR line card allows the user to perform the following:

- Provides information about basic characteristics of the optical fiber among optical nodes, such as Insertion Loss and concentrate point of reflection.
- Inspects the transmission fiber.
- Identifies discontinuities or defects on the fiber.
- Measures the distance and magnitude of defects like insertion loss, reflection loss, and so on.
- Improves scan performance using specific scan parameters targeted on the characteristics of the fiber plant such as span length, reflection contributions, and major events.

Note When an EDFA module is connected to the OTDR module without an OSC channel between them, an LOS-P alarm is raised on the OTS 0/x/0/2 port of the EDFA module. To suppress this alarm and resume normal OTDR operation, we recommend you perform one of the following configurations on the port 0/x/0/2 of the EDFA module:

- Configure the OTS controller to be under maintenance.

  Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller ots 0/3/0/2
RP/0/RP0/CPU0:ios(config-ots)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-ots)#commit
```

- Shut down the EDFA port in receive direction.

  Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller ots 0/3/0/2
RP/0/RP0/CPU0:ios(config-ots)#rx-enable 0
RP/0/RP0/CPU0:ios(config-ots)#commit
```

OTDR Modes

OTDR can be configured in two modes.

- Auto-This mode has two internal phases: Training and Measurement. These two phases are fully automated and proceed in sequence. The training phase has two internal steps. The first step measures the Optical Return Loss (ORL) and the second step prepares internal parameters for OTDR measurement. The actual OTDR measurement starts after the training phase.
- Expert-In this mode, the user must configure all the OTDR scan parameters with the proper values required by OTDR measurement. Automatic adjustments are not performed in expert mode configuration. There is no training phase in this mode. There is no prerequisite to run OTDR scan in expert mode apart from proper configuration.

Limitations of OTDR

- When NCS 1001 uses the OTDR line card, the OSC channel is on 1610 nm, and OTDR is on 1518 nm.
- OTDR supports up to 20 dB span loss or 100 km length of fiber.
- It is not recommended to start OTDR measurement simultaneously from two different nodes; the results and graph will not be valid.
- OTDR measurement performed in the presence of the OTDR-HIGH-REFLECTION alarm (reflections roughly greater than -25dB) may provide a low event accuracy.
- OTDR graph may be truncated if the measurements are performed on a fiber spool with the following length.
  - 1.00km to 1.05km
  - 25.0km to 25.6km
  - 80.0km to 83.9km
- OTDR can support up to -14 dB of reflection. OTDR-HIGH-REFLECTION alarm is raised when R(dB) – 2*NL(dB) > -20 dB where R is the reflectivity and NL is the loss.
-

Cabling Considerations for Terminal Node

In the terminal node configuration, EDFA and OTDR line cards are plugged into the same NCS 1001 system. The filter on OTDR card will combine OSC SFP signal from EDFA port with OTDR and feed into OSC input of EDFA card.

The sequence of fiber connection for port 1 is the following:

1. Connect a LC/LC fiber from OTDR COM TX port to EDFA OSC RX port
2. Connect a LC/LC fiber from EDFA OSC TX port to OTDR COM RX port
3. Connect a LC/LC fiber from OTDR OSC TX port to pluggable RX port inserted into EDFA
4. Connect a LC/LC fiber from pluggable TX port inserted into EDFA to OTDR OSC RX port

Repeat the same sequence to connect the second OTDR port if required.

Figure 11: Cabling for Terminal Configuration with One EDFA Module

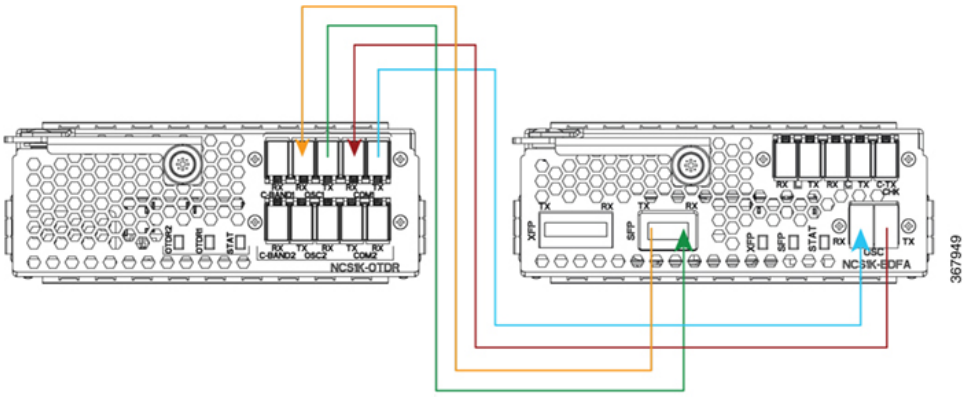
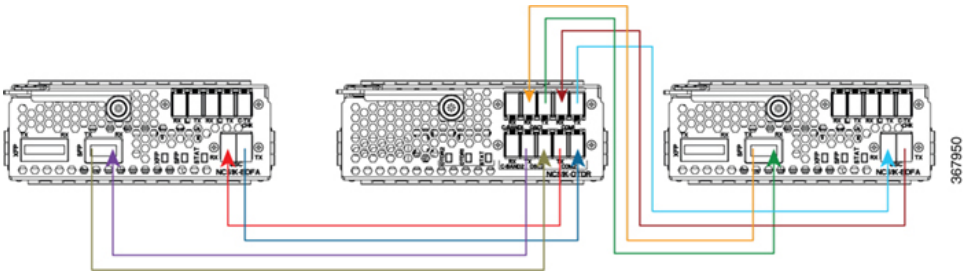


Figure 12: Cabling for Terminal Configuration with Two EDFA Modules



Cabling Considerations for ILA Node

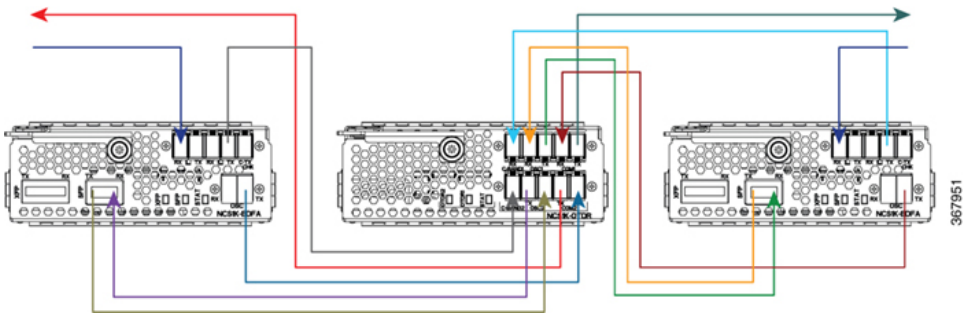
In the ILA node configuration, only one OTDR card is required to support both the directions of ILA node. Two EDFA cards and a single OTDR line card are plugged into the same NCS 1001 system. It is recommended to connect the OTDR port 1 to EDFA in slot 1 and the OTDR port 2 to EDFA in slot 3.

The sequence of fiber connection is the following:

1. Connect a LC/LC fiber from OTDR port 1 COM TX port to fiber span Line TX that is facing EDFA slot 1.
2. Connect a LC/LC fiber from EDFA slot 1 port COM TX to C-band 1 RX port.
3. Connect a LC/LC fiber from OTDR OSC TX port 1 to pluggable RX port inserted into EDFA slot 1.
4. Connect a LC/LC fiber from OSC pluggable TX port inserted into EDFA slot 1 to OTDR OSC RX port 1.
5. Connect a LC/LC fiber from EDFA slot 1 port OSC TX to OTDR COM RX port 1.
6. Connect a LC/LC fiber from OTDR port 2 COM TX port to fiber span Line TX that is facing EDFA slot 3.
7. Connect a LC/LC fiber from EDFA slot 3 port COM TX to C-band 2 RX port.

8. Connect a LC/LC fiber from OTDR OSC TX port 2 to OSC pluggable RX port inserted into EDFA slot 3.
9. Connect a LC/LC fiber from OSC pluggable TX port inserted into EDFA slot 3 to OTDR OSC RX port 2.
10. Connect a LC/LC fiber from from EDFA slot 3 port OSC TX to OTDR COM RX port 2.

Figure 13: Cabling for ILA Configuration

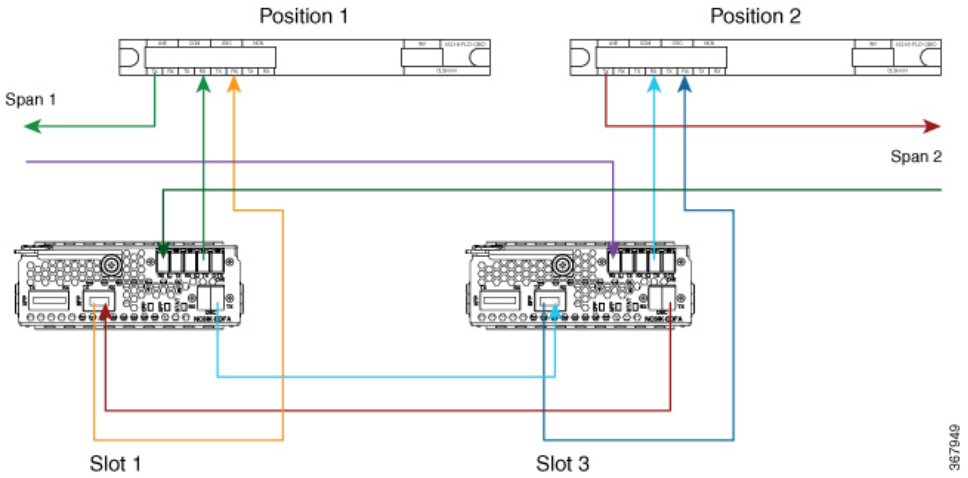


Cabling for ILA Configuration with 15216-FLD-OSC

The sequence of fiber connection is the following:

1. Connect a LC/LC fiber from RX-span 2 to LINE RX port of EDFA slot 1.
2. Connect a LC/LC fiber from COM TX port of EDFA slot 1 to COM RX port of 15216-FLD-OSC position 1.
3. Connect a LC/LC fiber from TX-span 1 to LINE TX port of 15216-FLD-OSC position 1.
4. Connect a LC/LC fiber from OSC pluggable TX port inserted into EDFA slot 1 to OSC RX port of 15216-FLD-OSC position 1.
5. Connect a LC/LC fiber from OSC TX port of EDFA slot 1 to OSC pluggable RX port inserted into EDFA slot 3.
6. Connect a LC/LC fiber from OSC TX port of EDFA slot 3 to OSC pluggable RX port inserted into EDFA slot 1.
7. Connect a LC/LC fiber from RX-span 1 to LINE RX port of EDFA slot 3.
8. Connect a LC/LC fiber from COM TX port of EDFA slot 3 to COM RX port of 15216-FLD-OSC position 2.
9. Connect a LC/LC fiber from TX-span 2 to LINE TX port of 15216-FLD-OSC position 2.
10. Connect a LC/LC fiber from OSC pluggable TX port inserted into EDFA slot 3 to OSC RX port of 15216-FLD-OSC position 2.

Figure 14: Cabling for ILA Configuration with 15216-FLD-OSC



The usage of NCS1K-OTDR module replaces the need of 15216-FLD-OSC module as recommended in the ILA configuration.

Configure OTDR

When the OTDR card is inserted, it has a set of default optical parameters for both ports and both directions. The default parameters are the same for both ports in TX and RX directions.

configure

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

otdr port *port-number* **direction tx total-loss** *value*

otdr port *port-number* **direction tx back-scattering** *value*

otdr port *port-number* **direction tx refractive-index** *value*

otdr port *port-number* **direction tx mode-expert pulse-width** *value*

otdr port *port-number* **direction tx mode-expert measure-time** *value*

otdr port *port-number* **direction tx mode-expert capture-length** *value*

otdr port *port-number* **direction tx mode-expert capture-offset** *value*

otdr port *port-number* **direction tx mode-expert fiber-resolution** *value*

otdr port *port-number* **direction rx total-loss** *value*

otdr port *port-number* **direction rx mode-expert pulse-width** *value*

otdr port *port-number* **direction rx mode-expert measure-time** *value*

otdr port *port-number* **direction rx mode-expert capture-length** *value*

otdr port *port-number* **direction rx mode-expert capture-offset** *value*

otdr port *port-number* **direction rx mode-expert fiber-resolution** *value*

otdr port *port-number* **orl-abs-threshold** *value*

otdr port *port-number* **loss-abs-threshold** *value*

otdr port *port-number* **reflection-abs-threshold** *value*

commit

end

Example

```
configure
hw-module location 0/RP0/CPU0 slot 2
otdr port 1 direction tx total-loss 200
otdr port 1 direction tx back-scattering -820
otdr port 1 direction tx refractive-index 1498962
otdr port 1 direction tx mode-expert pulse-width 1000
otdr port 1 direction tx mode-expert measure-time 180
otdr port 1 direction tx mode-expert capture-length 80
otdr port 1 direction tx mode-expert capture-offset 0
otdr port 1 direction tx mode-expert fiber-resolution 25

otdr port 1 direction rx total-loss 200
otdr port 1 direction rx mode-expert pulse-width 1000
otdr port 1 direction rx mode-expert measure-time 180
otdr port 1 direction rx mode-expert capture-length 80
otdr port 1 direction rx mode-expert capture-offset 0
otdr port 1 direction rx mode-expert fiber-resolution 25

otdr port 1 orl-abs-threshold 280
otdr port 1 loss-abs-threshold 15
otdr port 1 reflection-abs-threshold -300
commit
end
```

OTDR Configuration Parameters

Table 6: OTDR Configuration Parameters

Parameter	Description	Range	Default
total-loss (in 0.1dB)	Loss from the near end OTDR port to far end OTDR port including span loss and additional EDFA filter loss.	+0 to +500	200

Parameter	Description	Range	Default
back-scattering	The back scattering value in TX direction.	–100.0 to 0.0 **Note** NCS 1001 SW accepts any value within the defined range. You shall set actual back scattering value depending on the fiber characteristics.	–82.0 **Note** Default value fits most fiber types. You may adjust the value based on the optimal values for the specific fiber type in your network.
refractive-index	The refractive index value in TX direction.	1.000000 to 2.000000 **Note** NCS 1001 SW accepts any value within the defined range. You shall set actual refractive index value depending on the fiber characteristics.	1.498962 **Note** Default value fits most fiber types. You may adjust the value based on the optimal values for the specific fiber type in your network.

Parameter	Description	Range	Default
mode-expert pulse-width (in ns)	Pulse duration during the measurement.	8 to 100000	1000
mode-expert measure-time (in sec)	Time required to perform a complete optical scan.	0 to 360	180
mode-expert capture-length (in km)	Distance of end point of the measure.	0 to 150	80
mode-expert capture-offset (in km)	Start point.	0 to 150	0
mode-expert fiber-resolution (in m)	Distance from measurement steps.	0 to 100	25
orl-abs-threshold (in 0.1dB)	Threshold to compare with the ORL measurement returned by OTDR run.	+140 to +400	280
loss-abs-threshold (in 0.1dB)	Threshold to compare with the loss events returned by OTDR run.	+1 to +300	15
reflection-abs-threshold (in 0.1dB)	Threshold to compare with the reflection events returned by OTDR run.	–500 to 0	–300
loss-sensitivity (in 0.1dB)	Limit under which the loss is not considered as a real loss.	+4 to +50	6
reflection-sensitivity (in 0.1dB)	Limit under which the reflection is not considered as a real reflection.	–400 to –140	–300

Display Status of OTDR Measurement

The following command displays a table with the status for all the OTDR ports and directions.

show hw-module slot *slot-number* otdr status

Example

show hw-module slot 2 otdr status

Automatic Mode

```
Wed Oct 16 09:06:46.148 CEST
  Port | Rx/Tx |  Date/Time|     Training |   OTDR Measurement| Next scan (min)
-------+-------+-------------------+--------------------+---------------------+-
   1   |   Tx  |           |     UNKNOWN  |       UNKNOWN     |       0
   1   |   Rx  |           |     UNKNOWN  |       UNKNOWN     |       0
   2   |   Tx  |           |     UNKNOWN  |       UNKNOWN     |       0
   2   |   Rx  |           |     UNKNOWN  |       UNKNOWN     |       0
```

The next scan is related to the periodic scan. When the periodic scan is not set, the next scan value is 0.

Expert Mode

```
Port | Rx/Tx |      Date/Time        |     Training       |   OTDR Measurement
----------+-------+-------------------+--------------------+-------------------

   1   |   Tx  |   20180503-181159   |     UNKNOWN         | PROGRESS    10%

   1   |   Rx  |                     |     UNKNOWN         |       UNKNOWN

   2   |   Tx  |                     |     UNKNOWN         |       UNKNOWN

   2   |   Rx  |                     |     UNKNOWN         |       UNKNOWN
```

Configure OTDR in Automatic Mode

The following parameters must be configured to have correct OTDR measurement in automatic mode. The default values for these parameters are provided by this configuration.

configure

hw-module location 0/RP0/CPU0 slot *slot-number* **otdr port** *port-number* **direction** *direction* **mode-auto**

loss-sensitivity *value*

reflection-sensitivity *value*

total-loss *value*

commit

end

OTDR Configuration Parameters in Automatic Mode

Table 7: OTDR Configuration Parameters in Automatic Mode

Parameter	Description	Range	Default
loss-sensitivity (in 0.1dB)	Limit under which the loss is not considered as a real loss.	+4 to +50	6
reflection-sensitivity (in 0.1dB)	Limit under which the reflection is not considered as a real reflection.	-400 to -140	-300
total-loss (in 0.1dB)	Loss from the near end OTDR port to far end OTDR port including span loss and additional EDFA filter loss.	+0 to +500	200

Start OTDR Measurement in Automatic Mode

hw-module slot *slot-number* **otdr port** *port-number* **direction** *direction* **scan auto**

Example

The following example starts the OTDR measurement in automatic mode in TX direction.

```
hw-module slot 3 otdr port 1 direction tx scan auto
```

The user receives a message as "Otdr action will continue in the background". To see the status of OTDR measurement, use the **show hw-module slot slot-number otdr status** command.

Configure OTDR in Expert Mode

configure

hw-module location 0/RP0/CPU0 slot *slot-number* **otdr port** *port-number* **direction** *direction* **mode-expert**

capture-length *value*

capture-offset *value*

fiber-resolution *value*

loss-sensitivity *value*

measure-time *value*

pulse-width *value*

reflection-sensitivity *value*

span-length *value*

commit

end

Examples

The following samples provide a guideline to configure OTDR in expert mode in certain typical cases with a varying span-length parameter. The configuration might need to be modified depending on the fiber status in the field.

Sample configuration for fiber span 1 km:

Sample configuration for fiber span 25 km:

```
configure
hw-module location 0/RP0/CPU0 slot 2
otdr port 1 direction tx mode-expert pulse-width 100
otdr port 1 direction tx mode-expert span-length 25
otdr port 1 direction tx mode-expert measure-time 180
otdr port 1 direction tx mode-expert capture-length 25
otdr port 1 direction tx mode-expert capture-offset 0
otdr port 1 direction tx mode-expert fiber-resolution 5
otdr port 1 direction tx mode-expert loss-sensitivity 6
otdr port 1 direction tx mode-expert reflection-sensitivity -300
```

Sample configuration for fiber span 80 km:

```
configure
hw-module location 0/RP0/CPU0 slot 2
otdr port 1 direction tx mode-expert pulse-width 1000
otdr port 1 direction tx mode-expert span-length 80
otdr port 1 direction tx mode-expert measure-time 180
otdr port 1 direction tx mode-expert capture-length 80
otdr port 1 direction tx mode-expert capture-offset 0
otdr port 1 direction tx mode-expert fiber-resolution 250
otdr port 1 direction tx mode-expert loss-sensitivity 15
otdr port 1 direction tx mode-expert reflection-sensitivity -300
```

Sample configuration for fiber span 100 km:

```
configure
hw-module location 0/RP0/CPU0 slot 2
otdr port 1 direction tx mode-expert pulse-width 7000
otdr port 1 direction tx mode-expert span-length 100
otdr port 1 direction tx mode-expert measure-time 180
otdr port 1 direction tx mode-expert capture-length 100
otdr port 1 direction tx mode-expert capture-offset 0
otdr port 1 direction tx mode-expert fiber-resolution 50
otdr port 1 direction tx mode-expert loss-sensitivity 15
otdr port 1 direction tx mode-expert reflection-sensitivity -300
```

OTDR Configuration Parameters in Expert Mode

Table 8: OTDR Configuration Parameters in Expert Mode

Parameter	Description	Range	Default
capture-length (in km)	Distance of end point of the measure.	0 to 150	100
capture-offset (in km)	Start point.	0 to 150	0
fiber-resolution (in m)	Distance from measurement steps.	0 to 100	25
loss-sensitivity (in 0.1dB)	Limit under which the loss is not considered as a real loss.	+4 to +50	6
measure-time (in sec)	Time required to perform the complete optical scan.	0 to 360	180
pulse-width (in ns)	Pulse duration during the measurement.	8 to 100000	1000
reflection-sensitivity (in 0.1dB)	Limit under which the reflection is not considered as a real reflection.	-400 to -140	-300
span-length (in km)	Length of span.	0 to 150	100

Start OTDR Measurement in Expert Mode

hw-module slot *slot-number* **otdr port** *port-number* **direction** *direction* **scan expert**

Example

The following example starts the OTDR measurement in expert mode in TX direction.

```
hw-module slot 3 otdr port 1 direction tx scan expert
```

The user receives a message as "Otdr action will continue in the background". To see the status of OTDR measurement, use the **show hw-module slot slot-number otdr status** command.

Display List of OTDR Measurements

show hw-module slot *slot-number* **otdr scan**

Example

The following example shows the list of OTDR measurements.

```
show hw-module slot 3 otdr scan


  #| otdr#| Rx/Tx|Mode|  Date/Time    |       SOR filename
-----+------+------+-------+-------------------+----------------------
  0|   1  |  Tx  |AUTO|20180504-092810|ncs1001_slot3_otdr1_TX.20180504-092810.sor
  1|   1  |  Tx  |AUTO|20180504-114239|ncs1001_slot3_otdr1_TX.20180504-114239.sor
```

The following table describes the significant fields shown in the above example.

Field	Description
#	Number of OTDR measurements.
otdr#	Port where OTDR measurement is done.
Rx/Tx	Direction of OTDR measurement.
Mode	Type of scan (auto or expert).
Date/Time	Date and time of OTDR measurement.
SOR filename	Number of files with measurement data.

The following example shows data for OTDR measurement stored in position number 0.

```
show hw-module slot 3 otdr scan 0


Measurement on: 20180504-151351

OTDR device number: 1
Scan direction: Tx
Scan mode: Auto
Directory location: /harddisk:/otdr
File name: ncs1001_slot3_otdr1_TX.20180504-151351.sor

Total ORL: 29.86 dB
Distance (estimate): 38.996 km

Total number of event detected: 3

Event# |       TYPE           | LOCATION(km) | ACCURACY(m) | MAGNITUDE(dB) | TH-CROSSING
-------+--------------------+--------------+-------------+---------------+------------
   0   |      LOSS            |    0.000     |    5.62     |    -1.09      |    NO
   1   |      LOSS            |    23.840    |    114.06   |    -0.44      |    NO
   2   |    END OF FIBER      |    38.996    |    249.00   |               |    NO
```

The following table describes the significant fields shown in the above example.

Field	Description
OTDR device number	Port number.
Scan direction	Direction of scan.
Scan mode	Mode of scan (auto or expert).
Directory location	Location where the SOR file is stored.
File name	Name of SOR file.
Total ORL	Optical return loss in dB.
Distance (estimate)	Distance in km.
Total number of event detected	Event detected during OTDR measurement.
Event#	Number of events.
TYPE	Type of event if the event is a LOSS or END of Fiber.
LOCATION(km)	Location where the event is into the span.
ACCURACY(m)	Accuracy where the event is into the span.
MAGNITUDE(dB)	Magnitude LOSS of event.
TH-CROSSING	loss-abs-threshold value.

Stop OTDR Measurement

Use this command to stop the OTDR measurement in automatic and expert modes.

hw-module slot *slot-number* **otdr port** *port-number* **scan abort**

Example

The following command displays the status of OTDR measurement in automatic mode after the cancel operation.

show hw-module slot 3 otdr status

```
Port |   Rx/Tx |      Date/Time     |     Training  |   OTDR Measurement|Next scan (min)
-------+-------+--------------------+-------------------+---------------------+--------
   1   |  Tx   |   20190927-102727  |     ABORTED   |      UNKNOWN      |    0
```

The following command displays the status of OTDR measurement in expert mode after the cancel operation.

show hw-module slot 3 otdr status

```
Port | Rx/Tx |      Date/Time        |     Training     |   OTDR Measurement
     -------+-------+--------------------+-------------------+-------------------

   1   |   Tx  |   20180503-181159   | UNKNOWN          |      ABORTED
```

View the Logical Ports and the Photodiode Power Levels

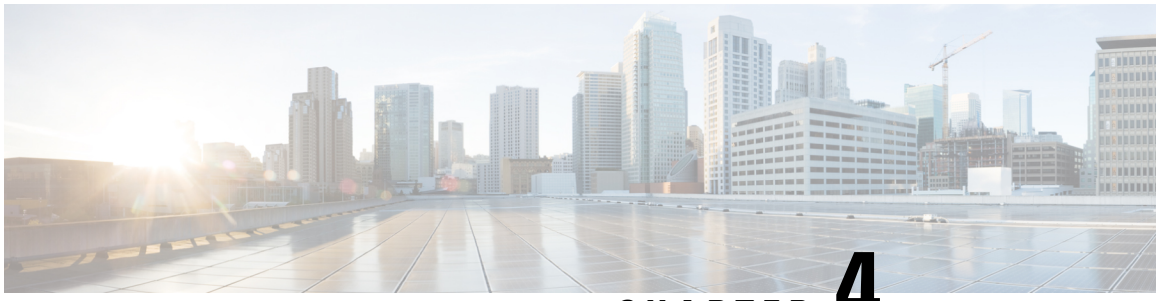
Use the command **show controllers otssummary** to display the power values of the photodiodes and the logical ports associated with the physical ports of the OTDR module.

Example:

```
RP/0/RP0/CPU0:IOS#show controllers ots 0/2/0/*  summary
Tue Jan 23 13:49:41.604 CET

Port         Type   Status   TX Power   TX Total Power  RX Power  RX Total Power  RX Voa
Attenuation   TX Voa Attenuation   Ampli Gain     Ampli Tilt
                                (dBm)     (dBm)            (dBm)     (dBm)               (dBm)
            (dBm)
 ----                 ----    ------     -----------      --------   ----------
---------------   ------------------     -------------   ----------
Ots0_2_0_0   Com    N/A      -40.00     Unavailable      -40.00    Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
Ots0_2_0_1   Com    N/A       0.60      Unavailable      -16.60    Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
Ots0_2_0_2   Osc    N/A      -17.60     Unavailable       1.30     Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
Ots0_2_0_3   Com    N/A      -40.00     Unavailable      -40.00    Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
Ots0_2_0_4   Com    N/A       0.20      Unavailable      -22.20    Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
Ots0_2_0_5   Osc    N/A      -23.60     Unavailable       1.30     Unavailable
Unavailable         Unavailable         Unavailable    Unavailable
```

Note The parameters such as Status, RX Total power, TX Total power, RX Attenuation, TX Attenuation, Amplifier Gain, and Amplifier Tilt on each of the corresponding OTS controller are not available for the OTDR card.



CHAPTER 4

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
```

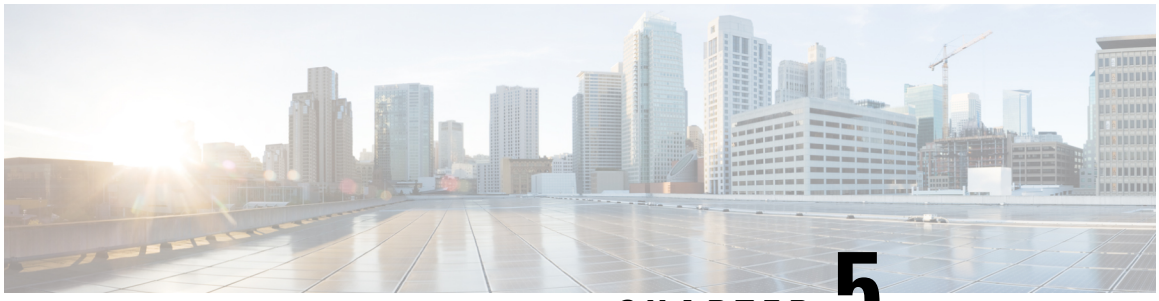
Displays the current performance monitoring parameters of the Optics controller in 15 minute intervals related to bucket 5.

```
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
```



CHAPTER 5

USB Automount

This chapter describes USB Automount configuration on NCS 1000.

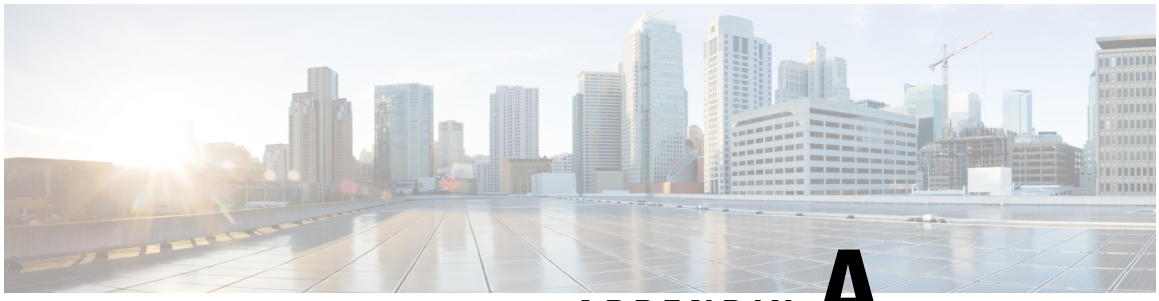
USB Automount

The USB automount feature allows the user to read from or write files and folders onto the USB device without explicitly mounting it. The mounted USB device can be accessed as disk2: file system.

In NCS 1001, the USB device is automatically mounted in both sysadmin-vm and XR.

The user must unmount the USB device from sysadmin-vm or XR before it is removed from NCS 1000. If the USB device must be mounted again after the device is unmounted but before removing the device, it can be done using the **mount** command.

USB Automount



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