Cisco NCS 1020 Datapath Configuration Guide, IOS XR Release 24.3.x

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CONTENTS

C H A P T E R 1

NCS 1020 Datapath Orchestration

This chapter gives a brief overview of the datapath orchestration that is required for NCS 1020.

Document Objective

Cisco Network Convergence System (NCS) 1020 platform has the following configuration guides.

- The *Cisco NCS 1020 System Setup and Software Installation Guide* describes how to bring up the NCS 1020 system and perform the required software installation.

- The *Cisco NCS 1020 Datapath Configuration Guide* describes how to configure various datapaths on NCS 1020.

- The *Cisco NCS 1020 Optical Applications Configuration Guide* describes multiple optical applications on NCS 1020, that help to bring up the link and maintain traffic on the link.

Document Organization - Data Path Guide

This document is organized into the following chapters:

Chapter	Description
Configure Controllers, on page 3	Describes the tasks to configure and view the parameters of the OTS, OTS-OCH, OSC, OCH, and OMS controller types.
Monitor Performance, on page 49	Describes the setting and retrieval of PM counters for the OTS, OTS-OCH, OSC, OCH, and OMS controllers in flex-bin, 30-second, 15-minute, or 24-hour intervals.
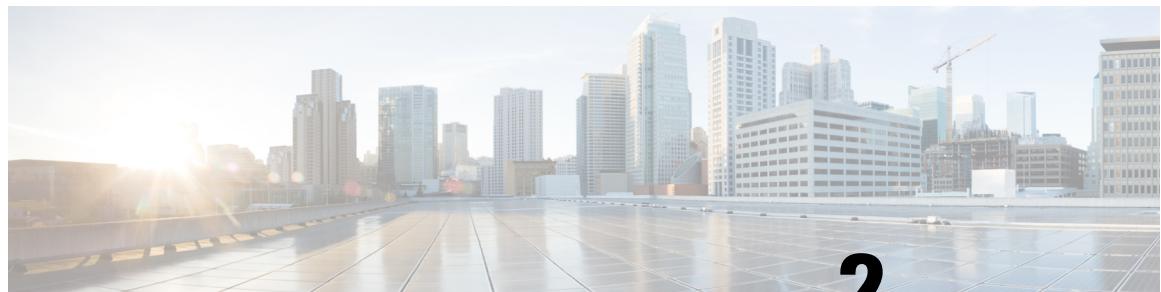
CHAPTER 2

Configure Controllers

There are six types of controllers for Cisco NCS 1020. The controllers are the OTS, OTS-OCH, OSC, OCH, and OMS controllers. This chapter describes the tasks that are used to configure and view these controllers.

Table 1: Controllers

Controller Types	Description
Optical Transport Section (OTS)	The OTS controller holds all the optical parameters for the OTS optical interfaces.
OTS-OCH	The OTS-OCH controller is created on the LINE side of the OLT nodes using the `hw-module` command in Flex-Grid configuration. OTS-OCH controller supports optical cross-connection between the LINE side and ADD/DROP side of the OLT nodes only. The channel IDs must be the same for both LINE side and COM side OTS-OCH controllers.
Optical Service Channel (OSC)	The OSC controller represents the optical layer of the OSC channel. Line ports host the OSC controller.
Optical Channel (OCH)	By default, the OCH controllers are automatically configured when Mux/Demux panels and breakout panels are brought up. These controllers are on the CCMD cards.
Optical Multiplex Section (OMS)	By default, the OMS controllers are automatically configured when Mux/Demux panels and breakout panels are brought up. These controllers are on the CCMD cards.

OTS Controllers

OLT Controller Model

When the NCS1K-E-OLT-C and NCS1K-OLT-C cards are brought up, 34 OTS controllers are created by default.

- LINE 0 port: ots 0/0/0/0 (C band line OTS controller)

- L-BAND 1 port: ots 0/0/0/1 (L band line OTS controller)

- LC port: ots 0/0/0/2 (Add1 Rx/Drop1 Tx OTS controller)

- LC port: ots 0/0/0/3 (Add2 Rx/Drop2 Tx OTS controller)

- MPO ports: ots 0/0/0/4 to ots 0/0/0/11

- MPO ports: ots 0/0/0/12 to ots 0/0/0/19

- MPO ports: ots 0/0/0/20 to ots 0/0/0/27

- MPO ports: ots 0/0/0/28 to ots 0/0/0/33

For the NCS1K-E-OLT-Cvariant, the following lists the Add/Drop ports that are mapped to the OTS controllers:

- LINE 0 port: ots 0/0/0/0 (C band line OTS controller)

- L-BAND 1 port: ots 0/0/0/1 (L band line OTS controller)

- LC port: ots 0/0/0/2…17 (Add1…16 Rx/Drop1…16 Tx OTS controller)

- MPO ports: ots 0/0/0/18 to ots 0/0/0/25

- MPO ports: ots 0/0/0/26 to ots 0/0/0/33

The following figures and tables show the OLT card variants and the mapping between physical ports and controllers:

Figure 1: NCS1K-OLT-C
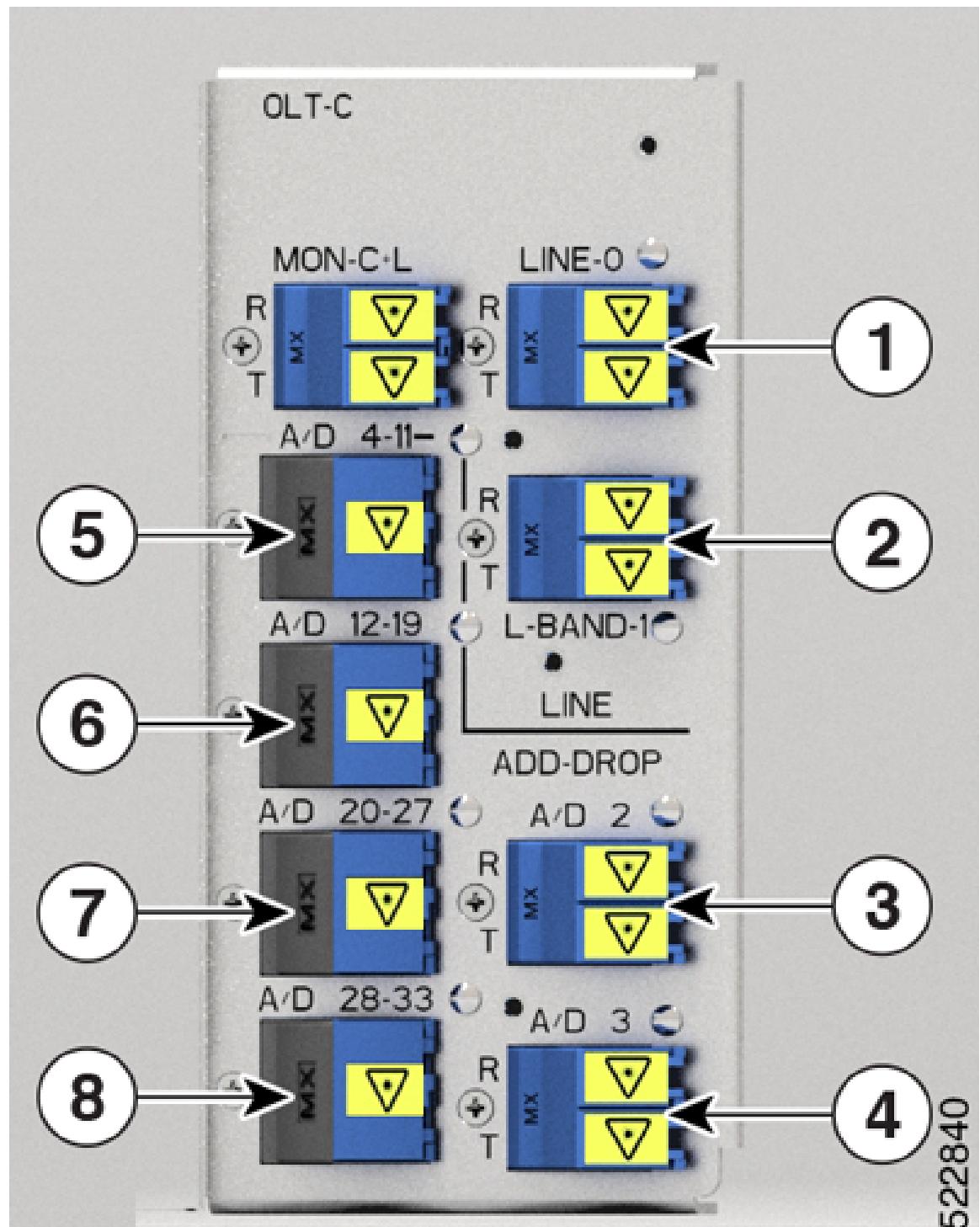
Table 2: NCS1K-OLT-C Port Mapping

1	Parent Controller: OTS0/0/0/0
	Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2
	Child Controller: COM OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3
	Child Controller: COM OTS-OCH 0/0/0/3/x
5	Parent Controller: OTS0/0/0/4-11
	Child Controller: COM OTS-OCH 0/0/0/4-11/x
6	Parent Controller: OTS0/0/0/12-19
	Child Controller: COM OTS-OCH 0/0/0/12-19/x
7	Parent Controller: OTS0/0/0/20-27
	Child Controller: COM OTS-OCH 0/0/0/20-27/x
8	Parent Controller: OTS0/0/0/28-33
	Child Controller: COM OTS-OCH 0/0/0/28-33/x

Figure 2: NCS1K-E-OLT-C
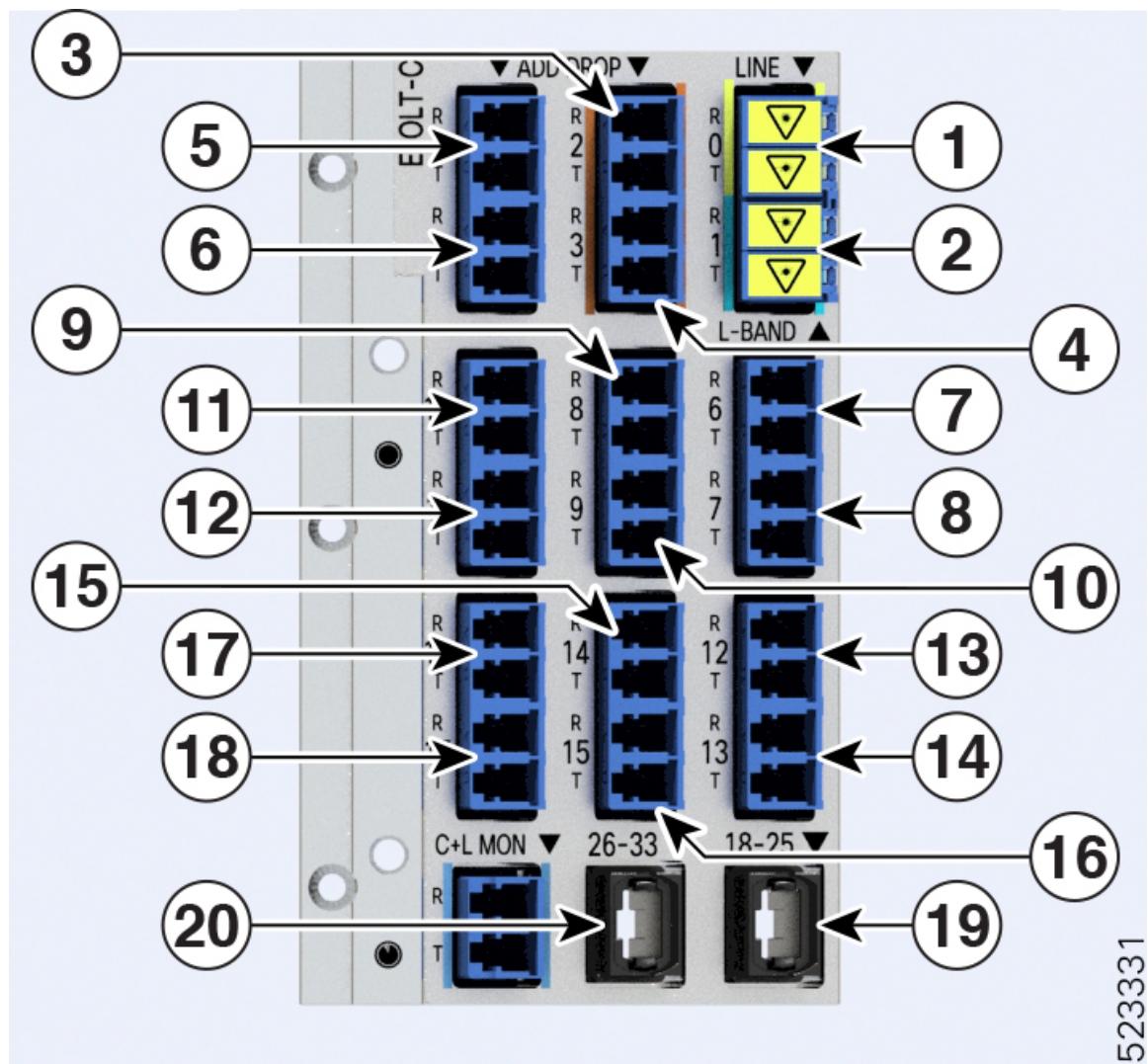
Table 3: NCS1K-E-OLT-C Port Mapping

1	Parent Controller: OTS0/0/0/0
	Child Controller: OSC0/0/0/0, Line OTS-OCH 0/0/0/0/x
2	Parent Controller: OTS0/0/0/1
3	Parent Controller: OTS0/0/0/2
	Child Controller: COM OTS-OCH 0/0/0/2/x
4	Parent Controller: OTS0/0/0/3
	Child Controller: COM OTS-OCH 0/0/0/3/x

5	Parent Controller: OTS0/0/0/4
	Child Controller: COM OTS-OCH 0/0/0/4/x
6	Parent Controller: OTS0/0/0/5
	Child Controller: COM OTS-OCH 0/0/0/5/x
7	Parent Controller: OTS0/0/0/6
	Child Controller: COM OTS-OCH 0/0/0/6/x
8	Parent Controller: OTS0/0/0/7
	Child Controller: COM OTS-OCH 0/0/0/7/x
9	Parent Controller: OTS0/0/0/8
	Child Controller: COM OTS-OCH 0/0/0/8/x
10	Parent Controller: OTS0/0/0/9
	Child Controller: COM OTS-OCH 0/0/0/9/x
11	Parent Controller: OTS0/0/0/10
	Child Controller: COM OTS-OCH 0/0/0/10/x
12	Parent Controller: OTS0/0/0/11
	Child Controller: COM OTS-OCH 0/0/0/11/x
13	Parent Controller: OTS0/0/0/12
	Child Controller: COM OTS-OCH 0/0/0/12/x
14	Parent Controller: OTS0/0/0/13
	Child Controller: COM OTS-OCH 0/0/0/13/x
15	Parent Controller: OTS0/0/0/14
	Child Controller: COM OTS-OCH 0/0/0/14/x
16	Parent Controller: OTS0/0/0/15
	Child Controller: COM OTS-OCH 0/0/0/15/x
17	Parent Controller: OTS0/0/0/16
	Child Controller: COM OTS-OCH 0/0/0/16/x
18	Parent Controller: OTS0/0/0/17
	Child Controller: COM OTS-OCH 0/0/0/17/x
19	Parent Controller: OTS0/0/0/18-25
	Child Controller: COM OTS-OCH 0/0/0/18-25/x

| 20 | Parent Controller: OTS0/0/0/26-33 |
| | Child Controller: COM OTS-OCH 0/0/0/26-33/x |

To view the platform information, use the following command:

```
RP/0/RP0/CPU0:ios#show platform
```

The following output highlights the *NCS1K-OLT-C* card type for the OLT controller model.

```
Tue Apr 30 12:02:48.807 IST
Node            Type                   State                   Config state
--------------------------------------------------------------------------------
0/RP0/CPU0      NCS1010-CTR2-B-K9(Active) IOS XR RUN              NSHUT,NMON
0/FT0           NCS1010-FAN            OPERATIONAL             NSHUT,NMON
0/FT1           NCS1010-FAN            OPERATIONAL             NSHUT,NMON
0/FT4           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT5           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT6           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT7           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/0/NXR0        NCS1K-OLT-C            OPERATIONAL             NSHUT,NMON
0/1/NXR0        NCS1010-FLR-P          PRESENT                 NSHUT,NMON
0/2/NXR0        NCS1K14-CCMD-16-C      OPERATIONAL             NSHUT,NMON
0/PM0           NCS1K4-AC-PSU-2        OPERATIONAL             NSHUT,NMON
0/PM1           NCS1K4-AC-PSU-2        OPERATIONAL             NSHUT,NMON
```

The following output highlights the *NCS1K-E-OLT-C* card type for the OLT controller model.

```
Fri Jun  9 07:04:19.710 UTC
Node            Type                   State                   Config state
--------------------------------------------------------------------------------
0/RP0/CPU0      NCS1010-CTR2-B-K9(Active) IOS XR RUN              NSHUT,NMON
0/FT0           NCS1010-FAN            OPERATIONAL             NSHUT,NMON
0/FT1           NCS1010-FAN            OPERATIONAL             NSHUT,NMON
0/FT4           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT5           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT6           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/FT7           NCS1020-FAN            OPERATIONAL             NSHUT,NMON
0/0/NXR0        NCS1K-E-OLT-C          OPERATIONAL             NSHUT,NMON
0/1/NXR0        NCS1010-FLR-P          PRESENT                 NSHUT,NMON
0/2/NXR0        NCS1K14-CCMD-16-C      OPERATIONAL             NSHUT,NMON
0/PM0           NCS1K4-AC-PSU-2        OPERATIONAL             NSHUT,NMON
0/PM1           NCS1K4-AC-PSU-2        OPERATIONAL             NSHUT,NMON
```

To view the OTS controller status on the NCS1K-OLT-C line card, use the `show controller description` command.

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output highlights the status of the OTS controller interfaces (*ots0/0/0/0...ots0/0/0/33*) on the OLT cards

```
Wed Jun 29 16:03:59.914 UTC

Interface               Status       Description
--------------------------------------------------------------------------------
Osc0/0/0/0              up
Ots0/0/0/0              up
Ots0/0/0/1              up
Ots0/0/0/2              up
.
.
Output snipped
.
.
```

```
Ots0/0/0/30                      up
Ots0/0/0/31                      up
Ots0/0/0/32                      up
Ots0/0/0/33                      up
.
.
```
Output snipped

To view the parameters of the LINE 0 OTS controller, use the following command:

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

The following output displays the parameters of the LINE 0 OTS controller *ots 0/0/0/0*.

```
Tue May 21 18:45:55.382 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Green

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 0
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
        EGRESS-AUTO-LASER-SHUT = 0
        EGRESS-AUTO-POW-RED = 0
        EGRESS-AMPLI-GAIN-LOW = 0
        EGRESS-AMPLI-GAIN-HIGH = 0
        HIGH-TX-BR-PWR = 0
        HIGH-RX-BR-PWR = 0
        SPAN-TOO-SHORT-TX = 0
        SPAN-TOO-SHORT-RX = 0

        Parameter Statistics:
        ---------------------
        Total Rx Power(C+L) = -10.00 dBm
        Total Tx Power(C+L) = 20.00 dBm
        Total Rx Power = 20.01 dBm
        Total Tx Power = 20.02 dBm
        Rx Signal Power = 20.00 dBm
        Tx Signal Power = 20.00 dBm
        Tx Voa Attenuation = 15.0 dB
        Ingress Ampli Mode = Gain
        Ingress Ampli Gain = 12.0 dB
        Ingress Ampli Tilt = 0.0 dB
        Ingress Ampli Gain Range = Normal
        Ingress Ampli Safety Control mode = auto
        Ingress Ampli OSRI = OFF
        Ingress Ampli Force Apr = OFF
        Egress Ampli Mode = Gain
        Egress Ampli Gain = 16.0 dB
        Egress Ampli Tilt = 0.0 dB
        Egress Ampli Safety Control mode = auto
```

```
Egress Ampli OSRI = OFF
Egress Ampli Force APR = OFF
Egress Ampli BR = ENABLE
Egress Ampli BR Power = -30.00 dBm
Egress Ampli BR Ratio = -20.00 dB



Configured Parameters:
-------------
Tx Voa Attenuation = 15.0 dB
Ingress Ampli Mode = Gain
Ingress Ampli Gain = 12.0 dB
Ingress Ampli Power = -1.0 dBm
Ingress Ampli Tilt = 0.0 dB
Ingress Ampli Gain Range = Normal
Ingress Ampli Safety Control mode = auto
Ingress Ampli OSRI = OFF
Ingress Ampli Force Apr = OFF
Egress Ampli Mode = Gain
Egress Ampli Gain = 16.0 dB
Egress Ampli Power = 5.0 dBm
Egress Ampli Tilt = 0.0 dB
Egress Ampli Safety Control mode = auto
Egress Ampli OSRI = OFF
Egress Ampli Force APR = OFF
Egress Ampli BR = ENABLE
BR High Threshold = -17.0 dBm
```

To view the parameters on OTS port 2 or 3, use the following command:

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

The following output displays the parameters of the OTS port 2 controller *ots 0/0/0/2*.

```
Tue May 21 19:01:02.675 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Green

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 0
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
        EGRESS-AUTO-LASER-SHUT = 0
        EGRESS-AUTO-POW-RED = 0
        EGRESS-AMPLI-GAIN-LOW = 0
        EGRESS-AMPLI-GAIN-HIGH = 0
        HIGH-TX-BR-PWR = 0
        HIGH-RX-BR-PWR = 0
        SPAN-TOO-SHORT-TX = 0
        SPAN-TOO-SHORT-RX = 0
```

```
        Parameter Statistics:
        ---------------------
        Total Rx Power = 10.00 dBm
        Total Tx Power = -10.49 dBm
        Ingress Ampli Mode = Gain
        Ingress Ampli Gain = 16.0 dB
        Ingress Ampli Tilt = 0.0 dB




        Configured Parameters:
        -------------
        Ingress Ampli Gain = 16.0 dB
        Ingress Ampli Tilt = 0.0 dB
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/1
Wed Mar 23 06:17:57.475 UTC

 Controller State: Down

 Transport Admin State: In Service

 LED State: Red

        Alarm Status:
        -------------
        Detected Alarms:
                RX-LOS-P
                TX-POWER-FAIL-LOW

        Alarm Statistics:
        -----------------
        LOW-TX-PWR = 0
        RX-LOS-P = 1
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 1
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
        EGRESS-AUTO-LASER-SHUT = 0
        EGRESS-AUTO-POW-RED = 0
        EGRESS-AMPLI-GAIN-LOW = 0
        EGRESS-AMPLI-GAIN-HIGH = 0
        HIGH-TX-BR-PWR = 0
        HIGH-RX-BR-PWR = 0
        SPAN-TOO-SHORT-TX = 0
        SPAN-TOO-SHORT-RX = 0

        Parameter Statistics:
        ---------------------



        Configured Parameters:
        -------------
RP/0/RP0/CPU0:OLT-C-14#sh controllers ots 0/0/0/1
Mon Feb 27 20:34:00.257 UTC

Controller State: Up

Transport Admin State: In Service
```

```
LED State: Green

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


Alarm Statistics:
-----------------
RX-LOS-P = 1
RX-LOC = 0
TX-POWER-FAIL-LOW = 2
INGRESS-AUTO-LASER-SHUT = 0
INGRESS-AUTO-POW-RED = 0
INGRESS-AMPLI-GAIN-LOW = 0
INGRESS-AMPLI-GAIN-HIGH = 0
EGRESS-AUTO-LASER-SHUT = 0
EGRESS-AUTO-POW-RED = 0
EGRESS-AMPLI-GAIN-LOW = 0
EGRESS-AMPLI-GAIN-HIGH = 0
HIGH-TX-BR-PWR = 0
HIGH-RX-BR-PWR = 0
SPAN-TOO-SHORT-TX = 0
SPAN-TOO-SHORT-RX = 0

Parameter Statistics:
---------------------
Total Rx Power = 19.39 dBm
Total Tx Power = 3.99 dBm



Configured Parameters:
-------------

RP/0/RP0/CPU0:OLT-C-14#
```

To view the parameters on the MPO port, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/33
```

The following output displays the paramters for the MPO port *ots 0/0/0/33*.

```
Sun Apr 10 14:04:40.513 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Green

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        RX-LOC = 0
        TX-POWER-FAIL-LOW = 0
        INGRESS-AUTO-LASER-SHUT = 0
        INGRESS-AUTO-POW-RED = 0
        INGRESS-AMPLI-GAIN-LOW = 0
        INGRESS-AMPLI-GAIN-HIGH = 0
```

```
            EGRESS-AUTO-LASER-SHUT = 0
            EGRESS-AUTO-POW-RED = 0
            EGRESS-AMPLI-GAIN-LOW = 0
            EGRESS-AMPLI-GAIN-HIGH = 0
            HIGH-TX-BR-PWR = 0
            HIGH-RX-BR-PWR = 0
            SPAN-TOO-SHORT-TX = 0
            SPAN-TOO-SHORT-RX = 0

            Parameter Statistics:
            ---------------------
            Total RX Power = -5.00 dBm
            Total TX Power = -10.50 dBm



            Configured Parameters:
            -------------
```

Configure OTS Controllers

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.

There are multiple parameters for the OTS controllers. You can configure the parameters that are required for the different configuration for an OTS controller on an OLT node by using the following commands in the Ots controller configuration mode:

- **tx-voa-attenuation** *value*
- **egress-ampli-gain** *value*
- **egress-ampli-tilt** *value*
- **egress-ampli-osri** {**on** | **off**}
- **egress-ampli-safety-control-mode** {**auto** | **disabled**}
- **egress-ampli-force-apr** {**on** | **off**}
- **egress-channel-slice** *channel-slice* **attn** *attenuation-value*
- **ingress-ampli-gain-range** {**normal** | **extended**}
- **ingress-ampli-gain** *value*
- **ingress-ampli-tilt** *value*
- **ingress-ampli-osri** {**on** | **off**}
- **ingress-ampli-safety-control-mode** {**auto** | **disabled**}
- **ingress-ampli-force-apr** {**on** | **off**}
- **ingress-channel-slice** *channel-slice* **attn** *attenuation-value*

OTS Controller Configuration Parameters

Table 4: OTS Controller Configuration Parameters

Parameter	Description	Hardware Capability	Range	Default	Notes
tx-voa-attenuation	TX VOA attenuation set point	VOA	• 0–20 dB	0.0	—
ampli-~~safety-control-mode~~ (ingress/egress)	Amplifier control mode	Amplifier	auto and disabled	automatic	—

Parameter	Description	Hardware Capability	Range	Default	Notes
ampli-gain-range (ingress/egress)	Amplifier gain range	Amplifier	normal and extended	normal	

Parameter	Description	Hardware Capability	Range	Default	Notes

					If you change the gain range from Normal to Extended or the opposite way, without updating the proper gain value for the new gain range, then the following may happen:
					
					• The EDFA switches to the preconfigured or default value of the gain causing a mismatch between the operational and configured gain.
					
					• The gain configuration is lost during the reload of software or line card, as the configured gain mismatches with the latest gain-range. This may result in traffic interruption during these reload operations.
					
					Hence, we recommend that you explicitly configure the gain range mode as normal or extended, and the corresponding gain values for each mode to get the expected results.
					
					The following are a few example scenarios that may not work as expected:
					
					• Scenario 1:
					
					Current running config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range extended`
					`egress-ampli-gain <gain value in extended mode>`
					
					New applied config:
					
					`controller Ots R/S/I/P`
					`no egress-ampli-gain-range extended`
					`commit`
					
					• Scenario 2:
					
					Current running config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range extended`
					`egress-ampli-gain <gain value in extended mode>`
					
					New applied config:
					
					`controller Ots R/S/I/P`
					`egress-ampli-gain-range Normal`
					`commit`

Parameter	Description	Hardware Capability	Range	Default	Notes

					• Scenario 3:
					
					Current running config:
					
					```controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode>```
					
					New applied config:
					
					```controller Ots R/S/I/P egress-ampli-gain-range extended commit```
					
					The following is another example scenario that involves commit-replace command where you replace the existing gain configuration that does not have explicitly configured gain-range, with new gain-range and gain value.
					
					Scenario 4:
					
					Current running config:
					
					```controller Ots R/S/I/P egress-ampli-gain <gain value in normal mode>```
					
					New applied config:
					
					```…………..```
					```controller Ots R/S/I/P egress-ampli-gain-range extended egress-ampli-gain <gain value in extended mode> commit replace```

ampli-gain (ingress/egress)	Amplifier gain set point	Amplifier	80–380	ingress: 12, egress: 16	The actual range of amplifier gain set point depends on amplifier gain range.
ampli-tilt (ingress/egress)	Amplifier tilt	Amplifier	–5 to +5	0.0	—
osri (ingress/egress)	Optical safety remote interlock	Amplifier	on and off	off	When **osri** is on, the EDFA is in shut state and vice versa.
ampli-force-apr (ingress/egress)	—	Amplifier	on and off	off	When **ampli-force-apr** is set to *on*, the EDFA output power is clamped to 8 dBm.

Parameter	Description	Hardware Capability	Range	Default	Notes
channel-slice *channel-slice* attn *attenuation* (ingress/egress)	Channel slice attenuation set point	—	1–1548 (channel slice) OLT: 0–250 (attenuation value in 0.1 dB)	0.0	—

Channel Slice Attenuation

The attenuation for the channel slices is automatically configured by APC.

To view the channel slice attenuation information, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 channel-slice-attenuation-info
```

The following sample output shows the channel slice attenuation information:

```
Sun Mar 27 15:27:27.600 UTC

Attenuation Slices spacing    :          3.125 GHz
Attenuation Slices Range      :          1 - 1548
Slice start wavelength        :          1566.82 nm
Slice start frequency         :          191337.50 GHz

Sub Channel Attenuation information :
Ingress Channel Slice Attenuation :
--------------------------------------------------------------------------------
spectrum-slice num                 Attenuation values (dB)
--------------------------------------------------------------------------------
  1 - 12     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
 13 - 24     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
 25 - 36     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
 37 - 48     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
 49 - 60     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
 61 - 72     25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
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 .
 .
1501 - 1512  25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
1513 - 1524  25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
1525 - 1536  25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
1537 - 1548  25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0    25.0
 25.0
--------------------------------------------------------------------------------
```

```
Egress Channel Slice Attenuation :
--------------------------------------------------------------------------------
spectrum-slice num                      Attenuation values (dB)
--------------------------------------------------------------------------------
  1 - 12     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 13 - 24     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 25 - 36     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 37 - 48     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 49 - 60     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 61 - 72     25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 .
 .
 output snipped
 .
 .
1501 - 1512  25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1513 - 1524  25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1525 - 1536  25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1537 - 1548  25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
```

To modify the attenuation values manually, APC must be disabled first using the following commands:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#optical-line-control controller ots 0/0/0/0 apc disable
RP/0/RP0/CPU0:ios(config)#commit
```

For more information on APC commands, see the section, "Configure APC".

To modify the attenuation value for an egress channel slice, use the following commands:

Note The OTS controller commands do not support decimal inputs. The OTS controller commands consider the inputs to one decimal place for the parameter values. In the following example, the *attn* value for the *egress-channel-slice 10* is provided as *100* to configure the *attn* value for the *egress-channel-slice 10* to *10.0 dB*.

```
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 egress-channel-slice 10 attn 100
RP/0/RP0/CPU0:ios(config)#commit
Sun Apr 10 14:47:37.849 UTC
RP/0/RP0/CPU0:ios(config)#end
```

To view the modified attenuation value for egress channel slice 10, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 channel-slice-attenuation-info
```

The following output highlights the modified attenuation value for *egress channel slice 10* that is set to *10.0 dB*.

```
Sun Apr 10 14:47:47.050 UTC

Attenuation Slices spacing    :         3.125 GHz
Attenuation Slices Range      :         1 - 1548
Slice start wavelength        :         1566.82 nm
```

```
Slice start frequency         :            191337.50 GHz

Sub Channel Attenuation information :
Ingress Channel Slice Attenuation :
--------------------------------------------------------------------------------
spectrum-slice num                  Attenuation values (dB)
--------------------------------------------------------------------------------
  1 -   12    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 13 -   24    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 25 -   36    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 37 -   48    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 49 -   60    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 61 -   72    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
  .
  .
 output snipped
  .
  .
1501 - 1512   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1513 - 1524   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1525 - 1536   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1537 - 1548   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
--------------------------------------------------------------------------------
Egress Channel Slice Attenuation :
--------------------------------------------------------------------------------
spectrum-slice num                  Attenuation values (dB)
--------------------------------------------------------------------------------
  1 -   12    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   10.0   25.0
 25.0
 13 -   24    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 25 -   36    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 37 -   48    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 49 -   60    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
 61 -   72    25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
  .
  .
 output snipped
  .
  .
1501 - 1512   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1513 - 1524   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1525 - 1536   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
1537 - 1548   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0   25.0
 25.0
RP/0/RP0/CPU0:ios#
```

Examples

In the following example, the tx-voa-attenuation is set to 10 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#tx-voa-attenuation 100
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-gain is set to 20 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 200
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-tilt is set to 2.5 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-tilt 25
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following examples, the egress-ampli-gain-range is set to extended and Normal.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain-range extended
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 360
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain-range normal
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-gain 150
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-safety-control-mode is set to auto.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-safety-control-mode auto
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-osri is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-osri on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-ampli-force-apr is set to on.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-ampli-force-apr on
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, the egress-channel-slice attenuation is set to 20 dB.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#egress-channel-slice 1 attn 200
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

In the following example, to establish connection using the existing GRPC framework.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#optical-line-control
```

```
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#partner-band-port ipv4 address 10.10.1.2
RP/0/RP0/CPU0:ios(config-Ots)#controller Ots0/0/0/0
RP/0/RP0/CPU0:ios(config-Ots)#commit
```

OTS-OCH Controllers

The OTS-OCH controllers are not created by default when the cards are brought up. The LINE OTS-OCH controllers can be created using the **hw-module** command.

Optical Cross Connections

Optical Cross Connections can be configured only on OLT nodes. In these nodes, the OTS-OCH controller is not created automatically on the Add/Drop ports (COM side). The optical cross connect configuration defines the line side OTS-OCH channel as the source and creates an OTS-OCH controller on the Add/Drop port to which the cross connection is made. The channel ID must be the same for both the LINE side and COM side OTS-OCH controllers.

Flex Grid Validation

The following validations are performed before the **hw-module** configurations are committed:

- The channel ID is any value 1–194.

- The center frequency must be within the C-band spectrum , for the OLT-C cards. The frequency range is 191.3375-196.1750 THz.

- The supported channel width range is 25.000GHz to 4837.500 GHz. Overlap of channels is permitted as Nyquist channels are supported. See ASE Loading, on page 34.

- You can set the channel centre frequency and width with 1MHz resolution.

Create OTS-OCH Controllers

To create the OTS-OCH controller on the LINE side of the OLT-C node, use the following commands in the configuration mode:

- **hw-module location** *location* **terminal-ampli grid-mode** *mode*

- **channel-id** *channel-id* **centre-freq** *frequency* **width** *channel-width*

To configure the optical cross-connect, use the following command in the configuration mode:

controller ots-och *Rack/Slot/Instance/Port/Channel-id-number* **add-drop-channel ots-och** *Rack/Slot/Instance/Port/Channel-id-number*

To create the OTS-OCH controller on the LINE side of an OLT-C node, use the following commands:

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/nxr0 terminal-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#commit
```

To view the OTS-OCH controller that is created on the LINE side, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och ?
```

The following output highlights the OTS-OCH controller that is created on the LINE side.

```
  0/0/0/0/1              Ots-Och Interface Instance
  R/S/I/P/B or R/S/I/P  Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format
```

To configure the optical cross-connect, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
Mon Apr  4 14:54:32.834 UTC
RP/0/RP0/CPU0:ios(config)#controller ots-och 0/0/0/0/1 add-drop-channel ots-och 0/0/0/33/1
RP/0/RP0/CPU0:ios(config)#commit
```

The OTS-OCH controller is created on the Add/Drop port to which the cross-connection is made on the COM side. To view the OTS-OCH controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller ots-och ?
```

The following output highlights the OTS-OCH controller that is created on the Add/Drop port to which the cross-connection is made on the COM side.

```
  0/0/0/0/1              Ots-Och Interface Instance
  0/0/0/33/1             Ots-Och Interface Instance
  R/S/I/P/B or R/S/I/P  Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format
```

To view the OTS-OCH controllers, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots-och ?
```

The following output displays the OTS-OCH controller interfaces:

```
  0/0/0/0/1              Ots-Och Interface Instance
  0/0/0/0/10             Ots-Och Interface Instance
  .
  .
  output snipped
  .
  .
  0/0/0/0/29             Ots-Och Interface Instance
  0/0/0/0/3              Ots-Och Interface Instance
  0/0/0/0/49             Ots-Och Interface Instance
  0/0/0/0/5              Ots-Och Interface Instance
  .
  .
  output snipped
  .
  .
  0/0/0/0/64             Ots-Och Interface Instance
  0/0/0/0/7              Ots-Och Interface Instance
  0/0/0/0/8              Ots-Och Interface Instance
  0/0/0/0/9              Ots-Och Interface Instance
  R/S/I/P/B or R/S/I/P  Forward interface in Rack/Slot/Instance/Port/Breakout format or
R/S/I/P format
```

To view the flex grid information on the OLT node, use the following command:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0/NXR0 terminal-ampli
```

The following output displays the flex grid information on the OLT node.

```
Tue May 21 19:39:43.303 UTC

Legend:
NXC     - Channel not cross-connected
ACTIVE - Channel cross-connected to data port
ASE      - Channel filled with ASE
FAILED - Data channel failed, pending transition to ASE
```

```
Location:              0/0/NXR0

Status:                Provisioned

Flex Grid Info

Channel Number     Centre Frequency(THz)     Channel Width(GHz)     Channel Status
Overlapping Channels
1                  191.375000                75.000                 NXC
- ,    -
2                  191.450000                75.000                 NXC
- ,    -
3                  191.525000                75.000                 NXC
- ,    -
4                  191.600000                75.000                 NXC
- ,    -
5                  191.675000                75.000                 NXC
- ,    -
6                  191.750000                75.000                 NXC
- ,    -
7                  191.825000                75.000                 NXC
- ,    -
8                  191.900000                75.000                 NXC
- ,    -
9                  191.975000                75.000                 NXC
- ,    -
10                 192.050000                75.000                 NXC
- ,    -
11                 192.125000                75.000                 NXC
- ,    -
12                 192.200000                75.000                 NXC
- ,    -
13                 192.275000                75.000                 NXC
- ,    -
14                 192.350000                75.000                 NXC
- ,    -
15                 192.425000                75.000                 NXC
- ,    -
16                 192.500000                75.000                 NXC
- ,    -
17                 192.575000                75.000                 NXC
- ,    -
18                 192.650000                75.000                 NXC
- ,    -
19                 192.725000                75.000                 NXC
- ,    -
20                 192.800000                75.000                 NXC
- ,    -
21                 192.875000                75.000                 NXC
- ,    -
22                 192.950000                75.000                 NXC
- ,    -
23                 193.025000                75.000                 NXC
- ,    -
24                 193.100000                75.000                 NXC
- ,    -
25                 193.175000                75.000                 NXC
- ,    -
26                 193.250000                75.000                 NXC
- ,    -
27                 193.325000                75.000                 NXC
- ,    -
28                 193.400000                75.000                 NXC
```

- , -			
29	193.475000	75.000	NXC
- , -			
30	193.550000	75.000	NXC
- , -			
31	193.625000	75.000	NXC
- , -			
32	193.700000	75.000	NXC
- , -			
33	193.775000	75.000	NXC
- , -			
34	193.850000	75.000	NXC
- , -			
35	193.925000	75.000	NXC
- , -			
36	194.000000	75.000	NXC
- , -			
37	194.075000	75.000	NXC
- , -			
38	194.150000	75.000	NXC
- , -			
39	194.225000	75.000	NXC
- , -			
40	194.300000	75.000	NXC
- , -			
41	194.375000	75.000	NXC
- , -			
42	194.450000	75.000	NXC
- , -			
43	194.525000	75.000	NXC
- , -			
44	194.600000	75.000	NXC
- , -			
45	194.675000	75.000	NXC
- , -			
46	194.750000	75.000	NXC
- , -			
47	194.825000	75.000	NXC
- , -			
48	194.900000	75.000	NXC
- , -			
49	194.975000	75.000	NXC
- , -			
50	195.050000	75.000	NXC
- , -			
51	195.125000	75.000	NXC
- , -			
52	195.200000	75.000	NXC
- , -			
53	195.275000	75.000	NXC
- , -			
54	195.350000	75.000	NXC
- , -			
55	195.425000	75.000	NXC
- , -			
56	195.500000	75.000	NXC
- , -			
57	195.575000	75.000	NXC
- , -			
58	195.650000	75.000	NXC
- , -			
59	195.725000	75.000	NXC
- , -			
60	195.800000	75.000	NXC

```
- ,    -
61                    195.875000                  75.000                  NXC
- ,    -
62                    195.950000                  75.000                  NXC
- ,    -
63                    196.025000                  75.000                  NXC
- ,    -
64                    196.100000                  75.000                  NXC
- ,    -
```

Note The legend provides information about the channel's status. By default, the channels are brought up with NXC channel status.

The channel's status is preserved after HA events.

To view the parameters of the OTS-OCH controller (LINE side), use the following command:

`RP/0/RP0/CPU0:ios#`**`show controllers ots-och 0/0/0/0/1`**

The following output displays the parameters of the OTS-OCH controller on the LINE side.

```
Tue Apr  5 06:32:29.696 UTC

 Controller State: Up

 Transport Admin State: In Service

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        TX-POWER-FAIL-LOW = 0

        Parameter Statistics:
        ---------------------
        Total RX Power = -10.50 dBm
        Total TX Power = -10.50 dBm


        Cross Connect Info:
        --------------------
        Add-Drop Channel  = Ots-Och0/0/0/33/1



        Configured Parameters:
        -------------
```

Note The Add/Drop channel that is cross-connected to the line port, 0/0/0/0/1 is displayed in the output.

To view the parameters of the OTS-OCH controller, use the following command:

`RP/0/RP0/CPU0:ios#`**`show controllers ots-och 0/0/0/0/1`**

OSC Controllers

The Optical Service Channel (OSC) controller is used to represent the optical capabilities, configuration, and monitoring of the OSC laser. The corresponding Gigabit Ethernet interface is the child interface that represents Ethernet capabilities, configuration, and monitoring.

OSC provides a communication channel for traffic coming from a UDC port. OSC serves as a channel probe to check fiber continuity between two nodes. OSC provides remote node management functionality. OSC is generated and terminated on each line side. OSC-C operates at a frequency of 198.50 THz and OSC-L operates at a frequency of 184.450 THz.

Nodes with NCS1K-OLT-C cards have one OSC controller. To view the status of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controller description
```

The following output highlights the status of the OSC controller for the NCS1K-OLT-C cards.

```
Tue Apr 12 17:17:51.306 UTC

Interface                 Status        Description
--------------------------------------------------------------------------------
Osc0/0/0/0                up
Ots0/0/0/0                up
Ots0/0/0/1                up
Ots0/0/0/2                up
 .
 .
 output snipped
 .
 .
Ots0/0/0/31               up
Ots0/0/0/32               up
Ots0/0/0/33               up
```

To view the parameters of the LINE 0 OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output shows the parameters of the LINE 0 OSC controller.

```
Wed Mar 23 06:04:18.565 UTC

 Controller State: Down

 Transport Admin State: In Service

 Laser State: Off

        Alarm Status:
        -------------
        Detected Alarms:
                RX-LOS-P

        Alarm Statistics:
        -----------------
        RX-LOS-P = 369
        TX-POWER-FAIL-LOW = 0

        Parameter Statistics:
        ---------------------
        Total TX Power = -50.00 dBm
```

```
          Total RX Power = -50.00 dBm



          Configured Parameters:
          -------------
```

Configure OSC Controllers

There are multiple parameters for the OSC controllers. You can configure the parameters that are required for the different configuration for an OSC controller on an OLT node by using the following commands in the configuration mode:

- **transmit-power** *value*

- **sec-admin-state** {**normal** | **maintenance**}

- **tx-low-threshold**

- **shutdown**

Examples

In the following example, the transmit-power is set to 2 dBm. The OSC Tx power can be changed by configuring the OSC transmit power attribute. This attribute internally regulates the OSC Tx VOA.

Note The OSC controller commands do not support decimal inputs. The OSC controller commands consider the inputs to one decimal place for the parameter values. In this example, the transmit-power parameter is provided as *20* to configure the transmit-power parameter to *2 dBm*.

```
RP/0/RP0/CPU0:ios(config)#controller osc 0/0/0/0 transmit-power 20
Fri May 13 11:26:53.445 UTC
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config)#commit
Fri May 13 11:26:55.127 UTC
RP/0/RP0/CPU0:ios(config)#end
```

To view the parameters of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output shows the parameters of the OSC controller.

```
Fri May 13 11:26:59.542 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

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


Alarm Statistics:
----------------
```

```
RX-LOS-P = 0
TX-POWER-FAIL-LOW = 0

Parameter Statistics:
---------------------
Total TX Power = 1.89 dBm
Total RX Power = -17.30 dBm



Configured Parameters:
-------------
```

In the following example, the *sec-admin-state* is set to *maintenance*.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/0/0/0 sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the parameters of the OSC controller, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output highlights the *Transport Admin State* of the OSC controller that is set to *Maintenance*.

```
Fri Apr 22 15:55:36.324 UTC

 Controller State: Up

 Transport Admin State: Maintenance

 Laser State: On

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        TX-POWER-FAIL-LOW = 0

        Parameter Statistics:
        ---------------------
        Total TX Power = -10.00 dBm
        Total RX Power = -30.00 dBm



        Configured Parameters:
        -------------
```

In the following example, the OSC controller is *shut down*.

```
P/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller osc 0/0/0/0 shutdown
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the parameters of the OSC controller that is *shut down*, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers osc 0/0/0/0
```

The following output highlights the *Controller State*, *Transport Admin State*, and *Laser State* of the OSC controller that is *shut down*.

```
Tue Apr 12 17:33:12.998 UTC

 Controller State: Administratively Down

 Transport Admin State: Out Of Service

 Laser State: Off

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


        Alarm Statistics:
        -----------------
        RX-LOS-P = 0
        TX-POWER-FAIL-LOW = 0

        Parameter Statistics:
        ---------------------
        Total TX Power = -50.00 dBm
        Total RX Power = -30.00 dBm



        Configured Parameters:
        -------------
```

Gigabit Ethernet Interfaces

A Gigabit Ethernet interface represents the packet layer of an OSC channel.

To view the parameters of a Gigabit Ethernet interface, use the following command:

RP/0/RP0/CPU0:ios#**show interfaces gigabitEthernet 0/0/0/0**

The following output shows the parameters of a Gigabit Ethernet interface.

```
Tue Apr 19 10:57:18.251 UTC
GigabitEthernet0/0/0/0 is up, line protocol is up
  Interface state transitions: 1
  Hardware is GigabitEthernet, address is 38fd.f866.096c (bia 38fd.f866.096c)  - IP of the
 OSC controller
  Internet address is 10.7.1.1/24
  MTU 1514 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
     reliability 255/255, txload 0/255, rxload 0/255
  Encapsulation ARPA,
  Full-duplex, 1000Mb/s, unknown, link type is force-up
  output flow control is off, input flow control is off
  loopback not set,
  Last link flapped 01:14:28
  ARP type ARPA, ARP timeout 04:00:00
  Last input Unknown, output Unknown
  Last clearing of "show interface" counters Unknown
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
```

To view the IPv4 address of a Gigabit Ethernet interface, use the following command:

RP/0/RP0/CPU0:ios#**show ipv4 interface brief**

The following output highlights the interface, IPv4 address (*IP-Address*), status, operational status of the routing protocol (*Protocol*), VPN routing and forwarding (VRF) instance name (*Vrf-Name*) of the Gigabit Ethernet interface.

```
Tue Apr 19 10:58:02.951 UTC

Interface                      IP-Address      Status          Protocol Vrf-Name
Loopback0                      10.3.3.11       Up              Up       default
Loopback3                      10.1.1.1        Up              Up       default
GigabitEthernet0/0/0/0         10.7.1.1        Up              Up       default
MgmtEth0/RP0/CPU0/0            10.33.0.61      Up              Up       default
PTP0/RP0/CPU0/0                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/1            unassigned      Shutdown        Down     default
PTP0/RP0/CPU0/1                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/2            unassigned      Shutdown        Down     default
```

The Gigabit Ethernet interface must be in *Up* state for the OSC laser to turn up. When the node comes up, the Gigabit Ethernet interface turns to *Down* state. Run the following commands on the Gigabit Ethernet interface to bring it up.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#no interface gigabitEthernet 0/0/0/0 shutdown
RP/0/RP0/CPU0:ios(config)#commit
```

The UDC ports on the OLT nodes carry 100 Mbps traffic. To see the port parameters, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers switch summary
```

The following output highlights the *UDC0* and *UDC1* ports values including their 100 Mbps traffic speed.

```
Mon May  9 07:30:03.726 UTC

Rack  Card  Switch   Rack Serial Number
----------------------------------------
  0   RP0   RP-SW    FCB2546B08L

         Phys      Admin     Port        Protocol    Forward
Port     State     State     Speed       State       State        Connects To
--------------------------------------------------------------------------------
0         Up        Up       10-Gbps        -        Forwarding   CPU0
1         Up        Up       10-Gbps        -        Forwarding   CPU1
2        Down      Down       1-Gbps        -        Forwarding   DEWEY
3        Down      Down      Unknown        -        Forwarding   UnUsed
4         Up        Up        1-Gbps        -        Forwarding   MGMT0
5        Down       Up        1-Gbps        -        Forwarding   MGMT1
6        Down       Up        1-Gbps        -        Forwarding   MGMT2
7        Down      Down       1-Gbps        -        Forwarding   UnUsed
8        Down       Up        1-Gbps        -        Forwarding   PTP0
9        Down       Up        1-Gbps        -        Forwarding   PTP1
10        Up        Up       100-Mbps       -        Forwarding   UDC0
11        Up        Up       100-Mbps       -        Forwarding   UDC1
12        Up        Up       100-Mbps       -        Forwarding   OSC0
13        Up        Up       100-Mbps       -        Forwarding   OSC1
14       Down      Down      10-Mbps        -        Forwarding   UnUsed
15       Down      Down      Unknown        -        Forwarding   UnUsed
```

The Tx and Rx drops counters do not increment on the node when the fiber is removed from the UDC0 or UDC1 port of the neighboring node. To view the statistics, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers switch statistics
```

The following output highlights the Tx and Rx drops counters on the node when the fiber is removed from the *UDC0* and *UDC1* ports.

```
Mon May  9 07:30:10.164 UTC

Rack  Card  Switch   Rack Serial Number
----------------------------------------
 0    RP0   RP-SW    FCB2546B08L
```

Port	Phys State	State Changes	Tx Packets	Rx Packets	Tx Drops/ Errors	Rx Drops/ Errors
0 Connects To	Up	1	8250025	3171592	0	0
CPU0						
1	Up	1	6380049	10790031	0	0
CPU1						
2	Down	0	0	0	0	0
DEWEY						
3	Down	0	0	0	0	0
UnUsed						
4	Up	2	3171749	8319773	49	0
MGMT0						
5	Down	0	0	0	0	0
MGMT1						
6	Down	0	0	0	0	0
MGMT2						
7	Down	0	0	0	0	0
UnUsed						
8	Down	2	0	0	0	0
PTP0						
9	Down	2	0	0	0	0
PTP1						
10	**Up**	**0**	**0**	**0**	**0**	**0**
UDC0						
11	**Up**	**0**	**497065830**	**3937555205**	**0**	**0**
UDC1						
12	Up	0	0	0	0	0
OSC0						
13	Up	0	508219613	503446049	3440127611	1218
OSC1						
14	Down	0	0	0	0	0
UnUsed						
15	Down	0	0	0	0	0
UnUsed						

Headless Mode

The headless mode of operation allows Cisco NCS 1020 to operate errorless during software upgrades and when the controller card is either physically absent or in a failed state. For example, NCS 1020 operates in headless mode for up to 72 hours, during process restarts, controller reload, line card warm reload, line card FPD upgrade, or removal of the controller (Online Insertion and Removal (OIR)). During this time, traffic is not impacted, although the control plane is not up and running. However, you cannot provision anything nor view operational data with a nonfunctional controller. Performance monitoring data based on 15 minutes and 24-hour intervals are not supported with a nonfunctional controller.

OIR is done during the upgrade or replacement of controller cards. When you initiate an OIR, you cannot reach the NCS 1020 through any medium. When the OIR completes, the NCS 1020 becomes reachable.

You can initiate OIR on the controller unit for the following scenarios:

• FPD upgrade failure

- Software image update failure

- Bootup failure

ASE Loading

The OLT card includes a Noise Loader (NL) EDFA, which acts as an Amplified Spontaneous Emission (ASE) or noise source. The NL connected to the 2x33 ports Wavelength Selective Switch (WSS) loads optical noise. The optical noise fills the Line-TX optical spectrum, when the provisioned optical channels are not available on the ADD- 1 RX, ADD- 2 RX, or COM (OTS0/0/0/2 - OTS0/0/0/33) ports. For more details about the ports, see OLT Functional Layout.

The CHANNEL-NOISE-LOADED alarm is raised when an OTS-OCH controller channel fails and the missing carrier power in the channel is replaced with internally generated ASE noise. The alarm is cleared automatically when the original traffic channel is restored and the temporary ASE noise is removed. For more details about the alarm, see CHANNEL-NOISE-LOADED.

Benefits of ASE Loading:

- Completely populates the transmission spectrum at LINE-TX independent of the actual system traffic load, thereby easing the system regulation starting from the Day-1 of the installation.

- The same channel load is maintained during channel failures or channel deletion, which makes the system tolerant to power transients.

- System performances can be verified efficiently because the ASE pattern emulates the full spectrum load also for the nonlinear interaction in the fibers, such as Four Wave Mixing (FWM), Cross Phase Modulations (XPM), and Stimulated Raman Scattering (SRS). Also, gradual fiber degradation that affects utilization of full-fiber capacity can be tracked.

- Keeps the system running the full-channel configuration, which makes the system be intrinsically stable and provide optimal performance.

Nyquist Channels

Nyquist Channels

Nyquist channels are supported on OLT-C cards. The Nyquist channels can overlap on each other.

The following image depicts a sample of four normal channels and four Nyquist (overlapping) channels:

Figure 3: Normal Channels and Nyquist Channels
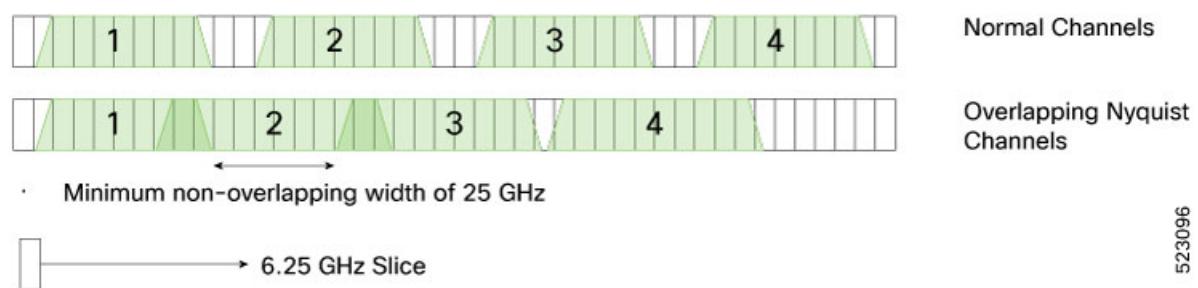
While creating the overlapping channels, consider the following conditions.

- If two channels share at least one slice, then it is considered as overlap.

- For the Nyquist overlapped channels, the channels must be cross connected to the same A/D port of the OLT card. If tried to cross-connect to a different port, the NCS 1020 software rejects the configuration with an error message.

- The center frequency of a channel must be outside the spectral range of any other channel.

- The Nyquist channels must have a minimum width of 25GHz of nonoverlapping region.

How ASE Operates

The following is the list of operations that are performed as part of the ASE loading:

1. The NL emits a total power of 16 dBm, and generates a power-spectral density (PSD) that is approximately equal to –10 dBm/12.5 GHz at the WSS input port. The OCM7 port monitors profile of the generated ASE channel. A Variable Optical Attenuator (VOA) available between the NL and the WSS input port regulates the ASE channel level properly.

2. The controller sets a predefined value for the VOA so that the ASE channels that are obtained at the COM TX-1 port are equalized to the actual traffic channels to fill out the spectrum at the input of the fixed gain amplifier.

3. When the controller detects a missing channel, for example any failure on the ADD/ EXP ports, it sends an updated attenuation value to the OLT. The OLT applies this value as a new attenuation setpoint and executes the transition from ADDs/EXPs path to ASE in the impacted wavelengths, thus ensuring fast recovery of the initial total optical power on the LINE-TX port.

4. When the optical power is restored, the controller sends a restoration command to the OLT. The OLT executes the transition from ASE to ADDs/EXPs in the impacted wavelengths ensuring minimal total optical power disturbance on the LINE-TX port, thus allowing a smooth fade-out of the ASE.

How ASE Is Managed

The default target ASE Load Spectral Density (AL_SD) is set to 81% for the OLT-C card. This default AL_SD is defined based on the frequency grid at 75 GHz with the first channel centered at 191.375 THz. The spectrum is allocated through logical bins with 3.125-GHz width such that each physical slice is associated to two bins. Based on the above, the first ASE channel for the OLT-C card has:

- Bins 1 and 2 blocked (frequency range 191.33750 – 191.34375 THz)

- Bins 3–22 opened (frequency range 191.34375 to 191.40625 THz)

- Bins 23 and 24 blocked (frequency range 191.40625 – 191.4125 THz)

All the other ASE channels are defined similarly by shifting all the settings by 75 GHz (24 bins).

Note The ASE channels on the bins 1537–1548 and 1-12 are retained as blocked for Automatic VOA Shutdown (AVS). In this AVS mode, the VOA is set at maximum attenuation value, when the channel is not provisioned to ensure the system reliability in case power is accidentally inserted.

Static ASE—At the system startup, without any channel provisioned, the complete ASE Load pattern is forwarded to the OLT LINE-TX port.

Figure 4: Static ASE
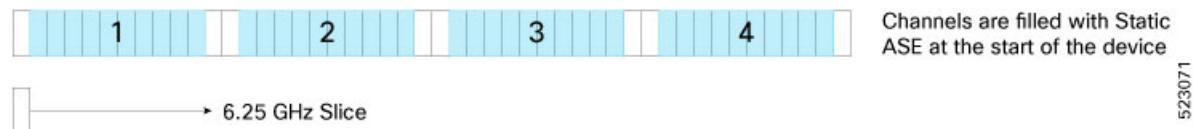
Dynamic ASE—When a traffic channel fails (for example, the PSD within the set of slices that are dedicated to the traffic channel is below a given threshold) an equivalent temporary ASE channel is inserted to maintain the spectral density on the line port. This dynamic ASE channel fills the original traffic channel with only a single slice guard band, at the beginning and the end. When the original traffic channel is restored, the temporary ASE channel is removed, and the original routing on the WSS is reestablished.

Dynamic ASE—With the Nyquist channels, dynamic ASE has the following behavior changes:

- A minimum guard band of 6.25GHz is maintained between the active channel and the dynamic ASE, so the guard band of dynamic ASE will be 6.25 GHz + unused portion of the next user channel.

- When there are two channels, and if channel 1 has failed and channel 2 overlaps channel 1, the dynamic ASE is filled in the slices other than the overlapping slices while leaving at least one slice as guard band.

- If both channel 1 and channel 2 are overlapping and both have failed, dynamic ASE fills both the channels without leaving any guardband.

- Static ASE and Dynamic ASE cannot overlap.

Figure 5: Dynamic ASE with Nyquist Channels
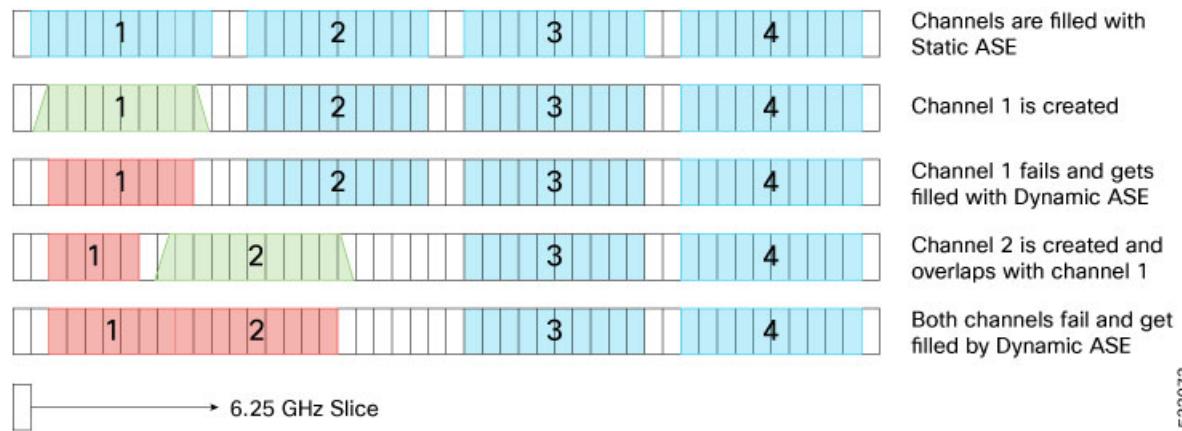
Optical Channel Monitoring

The Optical Channel Monitor (OCM) blocks in the OLT cards provide per-channel optical power monitoring.

The OLT-C card has a single OCM device with 37 OCM measuring points (OCM1 - OCM37). You can read the OCM data for the all the OCM blocks through the IOS-XR commands, except OCM1, OCM4, and OCM7.

The measuring points in the OLT-C card are:

- LINE-TX

- LINE-RX

- 2x33 ports of WSS in the multiplexer section of the OLT-C card

See OLT Functional Layout for details of the ports.

Table 5: Optical Specifications for OCM in OLT-C

Parameter	Unit	Minimum	Typical	Maximum	Note
Dynamic ranges	dBm/12.5GHz	−10		10	Ports: LINE-TX, COM-RX-1 and internal Noise Loader port
		−30		0	Port LINE-RX
		−35		0	Ports: ADD-RX-1 and ADD-RX-2
		−35		5	Ports ADD/DROP-i (i=3..32) (on DROP ports OCM is virtual)
Accuracy	dB	± 0.5		± 2	Depending on the adjacent channel relative power
Frequency range	THz	191.175 191.150		196.175	Out-of-band channel frequency 191.150 - 191.3375 THz are available only as row-data values.
Frequency accuracy (absolute)	GHz			± 5	
Frequency accuracy (relative)	GHz			+/-3	
Resolution Bandwidth	GHz		12.5		
Frequency step	GHz	3.125			
Scan Time	ms			250	Single port

View OCM Data

You can view the raw OCM data (slice level channel power) using the following commands:

```
RP/0/RP0/CPU0:ios#sh controllers ots 0/0/0/0 spectrum-info
Fri Feb 4 13:12:49.841UTC
Spectrum Slices spacing         :            3.125 GHz
Spectrum Slices Range           :            1 - 1548
Slice start wavelength          :            1566.82 nm
Slice start frequency           :            191337.50 GHz
Spectrum power information :
Rx power :
---------------------------------------------------------------------------------
spectrum-slice num                       Rx-power values (dBm)
---------------------------------------------------------------------------------
   1 - 12              -88.8  -88.8  -88.8  -88.8     -88.8  -88.8  -88.8  -88.8
-88.8  -88.8  -88.8  -88.8
  13 - 24              -88.8  -88.8  -88.8  -88.8     -88.8  -88.8  -88.8  -88.8
-88.8  -88.8  -88.8  -88.8
…....
…....
…....
1537 - 1548            -88.8  -88.8  -88.8  -88.8     -88.8  -88.8  -88.8  -88.8
-88.8  -88.8  -88.8  -88.8
---------------------------------------------------------------------------------
Tx power :
---------------------------------------------------------------------------------
spectrum-slice num                       Tx-power values (dBm)
---------------------------------------------------------------------------------
1 - 12                 -9.5   -7.3   -6.0   -5.2     -4.9   -4.8   -4.6   -4.4       -4.4
   -4.4   -4.4   -4.4
13 - 24                -4.4   -4.5   -4.6   -4.8     -5.1   -5.5   -6.4   -7.7       -9.6
 -12.0  -13.2  -11.4
25 - 36                -9.2   -7.7   -6.7   -6.2     -6.0   -5.9   -5.7   -5.6       -5.6
   -5.5   -5.4   -5.4
37 - 48                -5.3   -5.3   -5.4   -5.5     -5.8   -6.1   -6.6   -7.3       -8.6
 -10.4  -12.2  -11.8
…...
…...
…...
1525 - 1536            -2.4   -2.4   -2.4   -2.4     -2.4   -2.3   -2.3   -3.0
-4.2   -6.5  -10.3  -14.9
1537 - 1548           -19.3  -22.6  -24.3  -25.3    -26.1  -26.6  -27.1  -27.6
-27.9  -28.2  -28.4  -28.6
```

The preceding sample displays the Rx-power values (OCM3 raw data) and Tx-power values (OCM2 raw data) at the line sides. Similarly, you can view the OCM raw data for the COM side controllers OTS0/0/0/2 to 0/0/0/33.

You can also view the grid OCM data (per channel power level) for a particular channel in the OLT-C cards. By default, the channels are not created. Create a channel using the following commands:

configure

hw-module location *location* **terminal-ampli grid-mode** *mode*

channel-id *channel id* **centre-freq** *frequency* **width** *channel-width*

commit

The following is a sample to configure the channel on an OLT-C card:

```
RP/0/RP0/CPU0:ios#config
Fri Feb 4 13:14:49.841 UTC
```

```
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0 terminal-ampli grid-mode flex
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#channel-id 1 centre-freq 196.1 width 75
RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)# commit
Fri Feb 4 13:15:12.841 UTC

RP/0/RP0/CPU0:ios(config-hwmod-olt-flexi)#end
```

The following sample shows the OTS OCH controller channel parameters such as Total Rx power and Total Tx power.

```
RP/0/RP0/CPU0:ios#sh controllers ots-och 0/0/0/0/1
Fri Feb 4 13:15:59.125 UTC
Controller State: Up
Transport Admin State: In Service
LED State: Yellow
Parameter Statistics:
---------------------
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm
Configured Parameters:
-------------
RP/0/RP0/CPU0:ios#
```

The following sample shows the OTS OCH controller channel parameters such as Total Rx power and Total Tx power.

```
RP/0/RP0/CPU0:ios#sh controllers ots-och 0/0/0/2/1
Fri Feb 4 13:15:59.125 UTC
Controller State: Up
Transport Admin State: In Service
Alarm Status:
-------------
Detected Alarms: None
Alarm Statistics:
-----------------
RX-LOS-P = 0
TX-POWER-FAIL-LOW = 0
Parameter Statistics:
---------------------
Total RX Power = -10.50 dBm
Total TX Power = -10.50 dBm
Configured Parameters:
-------------
RP/0/RP0/CPU0:ios#
```

CCMD-16 Controllers

The NCS1K14-CCMD-16-C cards have two types of controllers. The controllers are OMS and OCH controllers. When the NCS1K14-CCMD-16-C cards become operational, both the OMS and OCH controllers are automatically created by default.

To view the OCH controllers, run the following command:

Command

```
RP/0/RP0/CPU0:ios#show controllers och 0/2/0/0
```

The following output shows the active OCH controllers in *Slot 2* from *port 1 to 16*.

Output Example

```
0/2/0/1              Och Interface Instance
 0/2/0/10             Och Interface Instance
 0/2/0/11             Och Interface Instance
 0/2/0/12             Och Interface Instance
 0/2/0/13             Och Interface Instance
 0/2/0/14             Och Interface Instance
 0/2/0/15             Och Interface Instance
 0/2/0/16             Och Interface Instance
 0/2/0/2              Och Interface Instance
 0/2/0/3              Och Interface Instance
 0/2/0/4              Och Interface Instance
 0/2/0/5              Och Interface Instance
 0/2/0/6              Och Interface Instance
 0/2/0/7              Och Interface Instance
 0/2/0/8              Och Interface Instance
 0/2/0/9              Och Interface Instance
```

To view the OMS controllers, run the following command:

Command

```
RP/0/RP0/CPU0:ios#show controllers oms 0/2/0/0
```

The following output shows the active OMS controller in *Slot 0*.

Output Example

```
0/2/0/0              Oms Interface Instance
```

OCH Controller

When you bring up the nodes with NCS1K14-CCMD-16-C cards, the OCH controllers are automatically created by default. The OCH controllers for the NCS1K14-CCMD-16-C cards are:

Table 6: Supported Interfaces

Card	Port Type	OCH Ports	Interfaces
NCS1K14-CCMD-16-C	LC Ports	16	och R/S/I/1 to och R/S/I/16

Note   R/S/I/P stands for Rack/Slot/Instance/Port.

To view the parameters of an OCH controller, use the following command:

Command Example

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/1
```

The following output shows the parameters of the OCH controller.

Output Example

```
Thu Oct 12 09:26:38.555 UTC

 Controller State: Up

 Transport Admin State: In Service
```

```
        LED State: Green

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


                Alarm Statistics:
                -----------------
                RX-LOS-P = 0
                TX-POWER-FAIL-LOW = 0

                Parameter Statistics:
                ---------------------
                Tx Power = -2.30 dBm
                Rx Power = -0.70 dBm
```

OMS Controller

When you bring up the nodes with NCS1K14-CCMD-16-C cards, the OMS controllers are automatically created by default. The OMS controllers for the NCS1K14-CCMD-16-C cards are:

Table 7: Supported Interfaces

Card	Port Type	OMS Ports	Interfaces
NCS1K14-CCMD-16-C	LC Ports	1	oms R/S/I/0

Note R/S/I/P stands for Rack/Slot/Instance/Port.

To view the parameters of an OMS controller, use the following command:

Command Example

```
RP/0/RP0/CPU0:ios#show controllers oms 0/1/0/0
```

The following output shows the parameters of an OMS controller.

Output Example

```
Thu Oct 12 09:23:35.297 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Red

        Alarm Status:
        -------------
        Detected Alarms:
                HI-TX-BR-PWR

        Alarm Statistics:
        -----------------
        RX-LOS-P = 3
        TX-POWER-FAIL-LOW = 0
        INGRESS-AMPLI-GAIN-LOW = 0
```

```
                  INGRESS-AMPLI-GAIN-HIGH = 0
                  EGRESS-AUTO-LASER-SHUT = 0
                  EGRESS-AMPLI-GAIN-LOW = 0
                  EGRESS-AMPLI-GAIN-HIGH = 0
                  HI-TX-BR-PWR = 2


                  Parameter Statistics:
                  --------------------
                  Tx Power = -3.40 dBm
                  Rx Power = -2.30 dBm
                  Rx Voa Attenuation = 5.0 dB
                  Tx Voa Attenuation = 5.0 dB
                  Ingress Ampli Mode = Gain
                  Ingress Ampli Gain = 5.0 dB
                  Ingress Ampli Tilt = 0.0 dB
                  Ingress Ampli OSRI = OFF
                  Egress Ampli Mode = Gain
                  Egress Ampli Gain = 2.0 dB
                  Egress Ampli Tilt = 0.0 dB
                  Egress Ampli Gain Range = Normal
                  Egress Ampli OSRI = OFF
                  Egress Ampli BR Power = -12.90 dBm
                  Egress Ampli BR Ratio = -9.39 dB


                  Configured Parameters:
                  -------------
                  Rx Voa Attenuation = 5.0 dB
                  Tx Voa Attenuation = 5.0 dB
                  Ingress Ampli Mode = Gain
                  Ingress Ampli Gain = 5.0 dB
                  Ingress Ampli Power = -9.0 dBm
                  Ingress Ampli OSRI = OFF
                  Egress Ampli Mode = Gain
                  Egress Ampli Gain = 2.0 dB
                  Egress Ampli Power = 0.0 dBm
                  Egress Ampli Gain Range = Normal
                  Egress Ampli OSRI = OFF
                  BR High Threshold = -17.0 dBm
```

Configure Controller Parameters for NCS1K14-CCMD-16-C Card

This chapter describes the controller configuration using EDFA, VoA, optical safety, and photodiode parameters which are supported on NCS1K14-CCMD-16-C line cards.

Table 8: Basic Controller Configuration Parameters

Parameter	CLI	Description
EDFA-ADD Control Mode	`controller Oms R/S/I/P` `egress-ampli-mode power-control`	Here the default mode is gain-control. Use this command to change the mode to power-control mode. You can delete this configuration to revert to gain-control mode.

EDFA-ADD Power	`controller Oms R/S/I/P`
	
	`egress-ampli-power <val in 0.1 dBm>`
		This is the target output power configuration for the EDFA located on COM-Tx. If the output power is not configured, then a default value is used by the system. You can find the applied target output power by using the **show controller oms** output.

EDFA-ADD Gain Range	`controller Oms R/S/I/P`
	
	`egress-ampli-gain-range <normal | extended>`	

If you change the gain range from Normal to Extended or the opposite way, without updating the proper gain value for the new gain range, then the following may happen:

- The EDFA switches to the preconfigured or default value of the gain causing a mismatch between the operational and configured gain.

- The gain configuration is lost during the reload of software or line card, as the configured gain mismatches with the latest gain-range. This may result in traffic interruption during these reload operations.

Hence, we recommend that you explicitly configure the gain range mode as normal or extended, and the corresponding gain values for each mode to get the expected results.

The following are a few example scenarios that may not work as expected:

- Scenario 1:

  Current running config:

  ```
  controller Oms R/S/I/P
   egress-ampli-gain-range extended
   egress-ampli-gain <gain value in
  extended mode>
  ```

  New applied config:

  ```
  controller Oms R/S/I/P
   no egress-ampli-gain-range extended
   commit
  ```

- Scenario 2:

  Current running config:

  ```
  controller Oms R/S/I/P
   egress-ampli-gain-range extended
   egress-ampli-gain <gain value in
  extended mode>
  ```

  New applied config:

  ```
  controller Oms R/S/I/P
   egress-ampli-gain-range Normal
   commit
  ```

- Scenario 3:

  Current running config:

  ```
  controller Oms R/S/I/P
   egress-ampli-gain <gain value in normal
   mode>
  ```

		New applied config:
| | | ```
controller Oms R/S/I/P
egress-ampli-gain-range extended
commit
``` |
		The following is another example scenario that involves commit-replace command where you replace the existing gain configuration that does not have explicitly configured gain-range, with new gain-range and gain value.
		Scenario 4:
		Current running config:
| | | ```
controller Oms R/S/I/P
egress-ampli-gain <gain value in normal mode>
``` |
| | | New applied config: |
| | | ```
…………..
controller Oms R/S/I/P
egress-ampli-gain-range extended
egress-ampli-gain <gain value in extended mode>
commit replace
``` |
| EDFA-ADD Gain | ```
controller Oms R/S/I/P
egress-ampli-gain <val in 0.1 dB>
``` | This is used for configuring gain for the EDFA located on the COM-Tx port. If the gain is not configured, then a default value is used by the system. The **show controller oms** output can be used for finding the applied gain. |
| EDFA-DROP Control Mode | ```
controller Oms R/S/I/P
ingress-ampli-mode power-control
``` | The default mode is gain-control. Use this command to change the mode to power-control mode. You can delete this configuration to revert to gain-control mode. |
| EDFA-DROP Power | ```
controller Oms R/S/I/P
ingress-ampli-power <vale in 0.1 dBm>
``` | This is the target output power configuration for the EDFA located on COM-Rx. If the output power is not configured, then a default value is used by the system. You can find the applied target output power by using the **show controller oms** output. |
| EDFA-DROP Gain | ```
controller Oms R/S/I/P
ingress-ampli-gain <val in 0.1 dB>
``` | This is used for configuring gain for the EDFA located on the COM-Rx port. If the gain is not configured, then a default value is used by the system. The **show controller oms** output can be used for finding the applied gain. |

VoA Attenuation	`controller Oms R/S/I/P`
	`tx-voa-attenuation <val in 0.1 dB>`
	`rx-voa-attenuation <val in 01. dB>`
		This is used to configure VoA attenuation for COM-Tx and COM-Rx ports. The system picks a default value if the gain is not configured. The **show controller oms** output can be used for finding the applied attenuation.

Shutdown (COM Port)	`controller Oms R/S/I/P` `shutdown`	COM-Tx and Rx ports are put in Out of Service (OOS) when this command is executed. This turns off the EDFA devices on both COM-Tx and COM-Rx ports and the respective alarms are masked. Here the default value is 'unshut'.
Shutdown (Ch Ports)	`controller Och R/S/I/P` `shutdown`	The channel port will be marked as out-of-service.

Configure Operational Parameters

The different operational parameters supported are given below.

Table 9: Operational Parameters

Parameter	CLI	Description
Photo Diodes (COM Port)	**OMS Controller** `Tx Power and Rx Power`	Rx Power = Inband power + OOB Tx Power = Inband power + OOB It reports the power transmitted and received on the OMS port. The OOB power received on COM-Rx is looped back to COM-Tx with some loss due to the insertion-loss on the loop back path.
Photo Diodes (CH Ports)	**OCH Controller** `Tx Power and Rx Power`	It reports the power transmitted and received on the channel ports.

Amplifier Parameters	**OMS Controller**
	`Ingress Ampli Mode`
	`Ingress Ampli Gain`
	`Ingress Ampli Tilt`
	`Ingress Ampli OSRI`
	`Egress Ampli Mode`
	`Egress Ampli Gain`
	`Egress Ampli Tilt`
	`Egress Ampli Gain Range`
	`Egress Ampli OSRI`
	`Egress Ampli BR Power`
	`Egress Ampli BR Ratio`
		Egress and ingress amplifier parameters.

| VoA Parameters | **OMS Controller**

`Tx VoA Attenuation and Rx VoA Attenuation` | VoA attenuation parameters. |

Configure Optical Safety Parameters

Use the following parameters for configuring optical safety.

Table 10: Optical Safety Parameters

Parameter	**CLI**	**Description**

OSRI	`controller Oms R/S/I/P`
	
	`egress-ampli-osri`
	
	`ingress-ampli-osri`
		Use this configuration to enable or Disable Optical Safety Remote Interlock (OSRI) on the amplifiers located on COM-Tx and COM-Rx ports. The default value is 'Off'. The **show controller oms** output can be used for finding the OSRI configuration and status.

Monitor Performance

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds for, and report performance data for early detection of network issues. You can configure and retrieve PM counters for the various controllers in flex-bin, 30-second, 15-minute, or 24-hour intervals. These parameters simplify troubleshooting operations and enhance data that can be collected directly from the equipment.

Monitor Performance

You can set and retrieve PM counters for the OTS, OTS-OCH, OSC, OCH, and OMS controllers for various intervals.

PM Parameters for Controllers table lists the PM parameters, their descriptions, and precision levels.

Table 11: PM Parameters for Controllers

PM Parameter (Unit of Measure)	Description	Resolution
SLR(C+L) [dB]	Rx Span Loss	1/100
SLT(C+L) [dB]	Tx Span Loss	1/100
SLR(S) [dB]	Rx Signal Span Loss	1/100
SLT(S) [dB]	Tx Signal Span Loss	1/100
OPT [dBM]	Total Tx(C+OSC) power	1/100
OPR [dBM]	Total Rx(C+OSC) power	1/100
OPT(C+L) [dBM]	Total Tx(C+L+OSC) power	1/100
OPR(C+L) [dBM]	Total Rx(C+L+OSC) power	1/100
OPR(S) [dBM]	C Band Received Signal Power	1/100
OPT(S) [dBM]	C Band Transmitted Signal Power	1/100
OPBR [dBM]	Back Reflection Power	1/100

EAGN [dB]	Egress Amplifier Gain	1/100
EATL [dB]	Egress Amplifier Tilt	1/100
IAGN [dB]	Ingress Amplifier Gain	1/100
IATL [dB]	Ingress Amplifier Tilt	1/100

The PM Thresholds for OLT OTS Controller tables list the maximum and minimum thresholds that can be set for the PM parameters for OLT nodes.

Table 12: PM Thresholds for OLT OTS Controller (0/0/0/0)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−2000	4000
OPR	−3000	1800
OPT(C+L)	−2000	6085
OPR(C+L)	−3000	3600
OPR(S)	−3000	1800
OPT(S)	−500	2800
OPBR	−3000	−1400
EAGN	1390	3100
EATL	−500	500
IAGN	1030	3800
IATL	−500	500

Table 13: PM Thresholds for OLT OTS Controller (0/0/0/2 and 0/0/0/3)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	1500
OPR	−2500	1800
IAGN	1300	1900
IATL	−500	500

Table 14: PM Thresholds for OLT OTS Controller (0/0/0/4 to 0/0/0/33)

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	1500

| OPR | −1500 | 1000 |

Table 15: PM Thresholds for OLT OTS-OCH Controller

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−3000	1500
OPR	−3000	1500

Table 16: PM Thresholds for OLT OSC Controller (0/0/0/0)

Parameter	Threshold Min	Threshold Max
OPT	−2000	1200
OPR	−3000	0

PM Thresholds for OCH Controllers table lists the maximum and minimum thresholds that are set for the PM parameters for OCH controllers.

Table 17: PM Thresholds for OCH Controllers

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−30	15
OPR	−30	15

PM Thresholds for OMS Controllers table lists the maximum and minimum thresholds that are set for the PM parameters for OMS controllers.

Table 18: PM Thresholds for OMS Controllers

PM Parameter	Minimum Threshold	Maximum Threshold
OPT	−30	15
OPR	−30	15

Configure and View PM Parameters

You can configure the performance monitoring parameters for the controllers. To configure PM parameters, use the following commands in the configuration mode:

controller *controllertype R/S/I/P* { **pm** { **15-min** | **24-hour** | **30-sec** | **flex-bin** } { **optics** | **ots** } { **report** | **threshold** } { **opr** | **opt** | **eagn** | **eatl** | **iagn** | **iatl** | **slr-cl** | **slt-cl** | **opbr** | **opr** | **opr-cl** | **opr-s** | **opt** | **opt-cl** | **opt-s** } { **max-tca** | **min-tca** } {**enable** | *value* }

Examples

The following example enables the maximum and minimum Threshold Crossing Alert (TCA) reporting on the OTS controller for a 15 minute interval. The sample also configures the maximum and minimum Rx span loss threshold to 36db and 33db respectively. These values are compared against the current maximum span loss value to determine if a TCA should be generated.

```
RP/O/RPO/CPUO:ios#config
RP/O/RPO/CPUO:ios(config)#controller ots 0/0/0/0 pm 15-min ots report slr-cl max-tca enable
RP/O/RPO/CPUO:ios(config)#controller ots 0/0/0/0 pm 15-min ots threshold slr-cl max 3600
RP/O/RPO/CPUO:ios(config)#controller ots 0/0/0/0 pm 15-min ots report slr-cl min-tca enable
RP/O/RPO/CPUO:ios(config)#controller ots 0/0/0/0 pm 15-min ots threshold slr-cl min 3300
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

The following example shows the TOT-SPAN-LOSS-TX-CL-MAX alert is triggered when the current TX span loss value exceeds the maximum TX span loss threshold:

```
RP/0/RP0/CPU0:P1D_DT_04#show alarms brief system conditions | include SPAN
Thu Oct  5 04:49:21.462 UTC
0/0            NotAlarmed    Controller      10/05/2023 04:49:00 UTC   Ots0/0/0/0 -
Threshold Crossing Alert For TOT-SPAN-LOSS-TX-CL-MAX In 30 Second Bucket
```

The following example sets the reporting status to maximum TCA for the eagn parameter of the OTS controller for a 15-minute interval.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 pm 15-min ots report eagn max-tca enable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

The following example configures the maximum threshold for the eagn parameter of the OTS controller to 20 dB.

✎

Note   The OTS controller commands accept PM parameter values in two decimal places. In this example, the *eagn* parameter is entered as *2000* to configure the *eagn* parameter to *20 dB*.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller ots 0/0/0/0 pm 15-min ots threshold eagn max 2000
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

To view the current PM parameters on an OTS controller for a 15-minute interval, use the following command:

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

The following output shows the current PM parameters on an OTS controller for a 15-minute interval and highlights the *maximum threshold* set for the *eagn* parameter that is configured for *20 dB*.

```
Tue May 17 06:37:00.529 UTC

Optics in the current interval [06:30:00 - 06:37:00 Tue May 17 2022]

Optics current bucket type : Valid
             MIN       AVG       MAX    Operational  Configured   TCA    Operational
Configured   TCA
                                        Threshold(min)Threshold(min(min)
Threshold(max)Threshold(max(max)
OPT[dBm]   : 20.00     20.00     20.00    -20.00      NA          NO   40.00        NA
```

```
                 NO
OPR[dBm]      : 20.00      20.00      20.00     -30.00     NA           NO   18.00           NA
                 NO
OPT(C+L)[dBm]: 20.00      20.00      20.00     -20.00     NA           NO   60.85           NA
                 NO
OPR(C+L)[dBm]: -10.00    -10.00     -10.00     -30.00     NA           NO   36.00           NA
                 NO
OPT(S)[dBm]   : 20.00      20.00      20.00      -5.00     NA           NO   28.00           NA
                 NO
OPR(S)[dBm]   : 20.00      20.00      20.00     -30.00     NA           NO   18.00           NA
                 NO
OPBR[dBm]     : -30.00    -30.00     -30.00     -30.00     NA           NO  -14.09           NA
                 NO
SLR(C+L)[dB]     : 0.00       0.00       0.00      0.00              NA        NO   42.00
              NA                NO
SLT(C+L)[dB]     : 0.00       0.00       0.00      0.00              NA        NO   42.00
              NA                NO
SLR(S)[dB]       : 0.00       0.00       0.00      0.00              NA        NO   42.00
              NA                NO
SLT(S)[dB]       : 0.00       0.00       0.00      0.00              NA        NO   42.00
              NA                NO
EAGN[dB]      : 30.00      30.00      30.00      16.00     NA           NO   20.00           20.00
         YES
EATL[dB]      : -4.80      -4.80      -4.80      -5.00     NA           NO   5.00            NA
                 NO
IAGN[dB]      : 25.00      25.00      25.00      12.00     NA           NO   25.00           NA
                 NO
IATL[dB]      : -2.40      -2.40      -2.40      -5.00     NA           NO   5.00            NA
                 NO

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

To view the historical PM parameters on an OTS controller for a 15-minute interval, use the following command:

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

The following output shows the historical PM parameters on an OTS controller for a 15-minute interval.

```
Tue Sep  3 12:26:53.739 IST

Optics in interval 1 [12:00:00 - 12:15:00 Tue Sep 3 2024]

Optics history bucket type : Valid
               MIN        AVG        MAX
OPT[dBm]    : 15.02      15.08      15.12
OPR[dBm]    : -1.94      -1.94      -1.94
OPT(C+L)[dBm]   : 15.00      15.06      15.10
OPR(C+L)[dBm]   : -1.90      -1.90      -1.90
OPT(S)[dBm]   : 14.90      14.96      15.00
OPR(S)[dBm]   : -2.00      -2.00      -2.00
OPBR[dBm]   : -25.70     -25.63     -25.50
OPBRR[dB]   : -40.59     -40.59     -40.50
EAGN[dB]    : 17.00      17.00      17.00
EATL[dB]    : 0.00       0.00       0.00
SLR(C+L)[dB]   : 21.90      21.92      21.98
SLT(C+L)[dB]   : 9.68       9.71       9.75
SLR(S)[dB]   : 21.90      21.92      21.98
SLT(S)[dB]   : 9.68       9.71       9.75
```

To view the current PM parameters on an OTS-OCH controller for a 15-minute interval, use the following command:

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

The following output shows the current PM parameters on an OTS-OCH controller for a 15-minute interval.

```
Tue May 17 10:27:20.387 UTC

Optics in the current interval [10:15:00 - 10:27:20 Tue May 17 2022]

Optics current bucket type : Valid
          MIN  AVG   MAX Operational    Configured     TCA     Operational    Configured
     TCA
                            Threshold(min)  Threshold(min) (min)  Threshold(max)
Threshold(max) (max)
OPT[dBm] : 1.20 1.30   1.30     -30.00          NA          NO        15.00
NA    NO
OPR[dBm] :-12.31-12.25-12.20    -30.00          NA          NO        15.00
NA    NO
Last clearing of "show controllers OPTICS" counters never
```

To view the current PM parameters on an OSC controller for a 15-minute interval, use the following command:

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

The following output shows the current PM parameters on an OSC controller for a 15-minute interval.

```
Tue May 17 08:24:32.642 UTC

Optics in the current interval [08:15:00 - 08:24:32 Tue May 17 2022]

Optics current bucket type : Valid
           MIN       AVG       MAX      Operational     Configured     TCA    Operational
 Configured     TCA
                            Threshold(min)   Threshold(min) (min)
Threshold(max)Threshold(max)(max)
OPT[dBm]    : -10.00    -10.00    -10.00   -20.00          NA          NO   12.00
     NA          NO
OPR[dBm]    : -30.00    -30.00    -30.00   -30.00          NA          NO   0.00
     NA          NO

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

To view the current PM parameters for an OCH controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers och 0/1/0/0 pm current 30-sec optics 1
```

The following output shows the current PM parameters for an OCH controller for a 30-second interval.

```
Tue May 10 11:28:29.896 UTC

Optics in the current interval [11:28:00 - 11:28:29 Tue May 10 2022]

Optics current bucket type : Valid
           MIN       AVG       MAX      Operational     Configured     TCA    Operational
     Configured     TCA
                            Threshold(min)   Threshold(min) (min) Threshold(max)
  Threshold(max) (max)
OPT[dBm]    : -50.00    -50.00    -50.00   -30.00          NA             NO   15.00
     NA             NO
OPR[dBm]    : -50.00    -50.00    -50.00   -30.00          NA             NO   15.00
     NA             NO

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

To view the current PM parameters for an OTS controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers ots 0/0/0/0 pm current 30-sec optics 1
```

The following output shows the current PM parameters on an OTS controller for a 30-second interval.

```
Optics in the current interval [19:39:30 - 19:39:40 Fri Jun 14 2024]

Optics current bucket type : Valid
             MIN        AVG        MAX     Operational      Configured      TCA    Operational
        Configured      TCA
                                          Threshold(min)  Threshold(min)  (min)  Threshold(max)
      Threshold(max)  (max)
OPT[dBm]      : 22.72     22.77      22.82    -28.00           NA             NO    40.00
           NA                NO
OPR[dBm]      : -19.35    -19.35     -19.35   -30.00           NA             NO    20.00
           NA                NO
OPT(C+L)[dBm] : 22.70     22.75      22.80    -28.00           NA             NO    80.00
           NA                NO
OPR(C+L)[dBm] : -19.40    -19.40     -19.40   -30.00           NA             NO    40.00
           NA                NO
OPT(S)[dBm]   : 22.70     22.75      22.80    -28.00           NA             NO    28.00
           NA                NO
OPR(S)[dBm]   : -34.20    -34.13     -34.09   -30.00           NA             NO    20.00
           NA                NO
SLR(C+L)[dB]  : 0.00       0.00       0.00     0.00            NA             NO    42.00
           NA                NO
SLT(C+L)[dB]  : 0.00       0.00       0.00     0.00            NA             NO    42.00
           NA                NO
SLR(S)[dB]    : 0.00       0.00       0.00     0.00            NA             NO    42.00
           NA                NO
SLT(S)[dB]    : 0.00       0.00       0.00     0.00            NA             NO    42.00
           NA                NO
OPBR[dBm]     : 3.10       3.15       3.20    -30.00           NA             NO    -14.00
           NA                NO
OPBRR[dB]     : -19.60    -19.60     -19.60   -50.00           NA             NO    0.00
           NA                NO
EAGN[dB]      : 23.90     23.94      24.00     8.00            NA             NO    36.00
           NA                NO
EATL[dB]      : 4.00       4.05       4.10    -5.00            NA             NO    5.00
           NA                NO
```

To view the historical PM parameters on an OCH controller for a 30-second interval, use the following command:

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

The following output shows the historical PM parameters on an OCH controller for a 30-second interval.

```
Mon Jul 25 05:35:52.176 UTC

Optics in interval 1 [05:35:00 - 05:35:30 Mon Jul 25 2022]

Optics history bucket type : Valid
             MIN        AVG        MAX
OPT[dBm]   : -50.00    -50.00     -50.00
OPR[dBm]   : -50.00    -50.00     -50.00

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

To view the current PM parameters for an OCH controller for a 15-minute interval, use the following command:

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

The following output shows the current PM parameters for an OCH controller for a 15-minute interval.

```
Tue May 10 11:28:50.952 UTC

Optics in the current interval [11:15:00 - 11:28:50 Tue May 10 2022]

Optics current bucket type : Valid
             MIN        AVG        MAX     Operational      Configured      TCA    Operational
```

```
        Configured      TCA
                                    Threshold(min)    Threshold(min)  (min)  Threshold(max)
    Threshold(max) (max)
OPT[dBm]    : -50.00     -50.00    -50.00   -30.00            NA                NO    15.00
        NA              NO
OPR[dBm]    : -50.00     -50.00    -50.00   -30.00            NA                NO    15.00
        NA              NO

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

To view the historical PM parameters for an OCH controller for a 15-minute interval, use the following command:

`RP/0/RP0/CPU0:ios#`**`show controllers och 0/1/0/0 pm history 15-min optics 1 bucket 1`**

The following output shoes the historical PM parameters for an OCH controller for a 15-minute interval.

```
Mon Jul 25 05:36:12.167 UTC

Optics in interval 1 [05:15:00 - 05:30:00 Mon Jul 25 2022]

Optics history bucket type : Valid
            MIN       AVG       MAX
OPT[dBm]   : -50.00   -50.00   -50.00
OPR[dBm]   : -50.00   -50.00   -50.00

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

To view the current PM parameters on an OCH controller for a 24-hour interval, use the following command:

`RP/0/RP0/CPU0:ios#`**`show controllers och 0/1/0/0 pm current 24-hour optics 1`**

The following output shoes the current PM parameters on an OCH controller for a 24-hour interval.

```
Tue May 10 11:29:09.270 UTC

Optics in the current interval [00:00:00 - 11:29:09 Tue May 10 2022]

Optics current bucket type : Invalid
            MIN       AVG       MAX     Operational      Configured      TCA    Operational
        Configured      TCA
                                    Threshold(min)    Threshold(min)  (min)  Threshold(max)
    Threshold(max) (max)
OPT[dBm]    : -50.00     -50.00    -50.00   -30.00            NA                NO    15.00
        NA              NO
OPR[dBm]    : -50.00     -50.00    -50.00   -30.00            NA                NO    15.00
        NA              NO

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

To view the historical PM parameters on an OCH controller for a 24-hour interval, use the following command:

`RP/0/RP0/CPU0:ios#`**`show controllers och 0/1/0/0 pm history 24-hour optics 1`**

he following output shows the historical PM parameters on an OCH controller for a 24-hour interval.

```
Mon Jul 25 05:36:35.165 UTC

Optics in interval 1 [00:00:00 - 24:00:00 Sun Jul 24 2022]

Optics history bucket type : Valid
            MIN       AVG       MAX
OPT[dBm]   : -50.00   -50.00   -50.00
OPR[dBm]   : -50.00   -50.00   -50.00

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

To view the current PM parameters for an OMS controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8 pm current 30-sec optics 1
```

The following output shows the current PM parameters for an OMS controller for a 30-second interval.

```
Mon Jul 25 07:24:38.319 UTC

Optics in the current interval [07:24:30 - 07:24:38 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

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

To view the historical PM parameters on an OMS controller for a 30-second interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8  pm history 30-sec optics 1 bucket 1
```

The following shows the historical PM parameters on an OMS controller for a 30-second interval.

```
Mon Jul 25 07:13:51.228 UTC

Optics in interval 1 [07:13:00 - 07:13:30 Mon Jul 25 2022]

Optics history bucket type : Valid
             MIN        AVG        MAX
OPT[dBm]   : -50.00    -50.00    -50.00
OPR[dBm]   : -50.00    -50.00    -50.00

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

To view the current PM parameters for an OMS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8 pm current 15-min optics 1
```

The following output shows the current PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:25:00.183 UTC

Optics in the current interval [07:15:00 - 07:25:00 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

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

To view the historical PM parameters for an OMS controller for a 15-minute interval, use the following command:

```
RP/0/RP0/CPU0:ios#show controllers oms 0/3/0/8  pm history 15-min optics 1 bucket 1
```

The following output shows the historical PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:14:03.090 UTC

Optics in interval 1 [06:45:00 - 07:00:00 Mon Jul 25 2022]

Optics history bucket type : Valid
             MIN        AVG        MAX
```

```
OPT[dBm]   : -50.00    -50.00    -50.00
OPR[dBm]   : -50.00    -50.00    -50.00

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

To view the current PM parameters on an OMS controller for a 24-hour interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers oms 0/3/0/8 pm current 24-hour optics 1**

The following output shows the historical PM parameters for an OMS controller for a 15-minute interval.

```
Mon Jul 25 07:26:09.817 UTC

Optics in the current interval [00:00:00 - 07:26:09 Mon Jul 25 2022]

Optics current bucket type : Valid
MIN AVG MAX Operational Configured TCA Operational Configured TCA
Threshold(min) Threshold(min) (min) Threshold(max) Threshold(max) (max)
OPT[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO
OPR[dBm] : -50.00 -50.00 -50.00 -30.00 NA NO 15.00 NA NO

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

To view the historical PM parameters on an OMS controller for a 24-hour interval, use the following command:

RP/0/RP0/CPU0:ios#**show controllers oms 0/3/0/8 pm history 24-hour optics 1**

The following output shows the historical PM parameters on an OMS controller for a 24-hour interval.

```
Mon Jul 25 07:18:13.532 UTC

Optics in interval 1 [00:00:00 - 24:00:00 Sun Jul 24 2022]

Optics history bucket type : Valid
            MIN        AVG        MAX
OPT[dBm]   : -50.00    -50.00    -50.00
OPR[dBm]   : -50.00    -50.00    -50.00

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

PM History Persistence

PM history parameters are retained even after a line card cold reload, line card warm reload, rack reload, RP reload, power cycle, or upgrade of the NCS 1020 chassis.

After a software upgrade to the latest release, you can view the history performance monitoring parameters from the previous release. The PM history persistence is supported for 30-second, 15-minute, and 24-hour bucket types. After a software upgrade to a higher version, if new PM parameters are available in the new version, the following error is displayed while fetching PM data.

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/0/0/8 pm history 15-min ether 5
Tue Apr  5 22:05:56.750 UTC
pm_display_int_15min_ether_index: bag_decode failed ('bag' detected the 'fatal' condition
'An irresolvable version conflict prevented the specified bag from being decoded')
```

However, the following list describes the time that is required to fill all historical buckets of each bucket type, later while fetching PM historical data, no error appears.

- For 30-second bucket type, 15 minutes is required to fill 30 historical buckets.

- For 15-minute bucket type, 8 hours is required to fill 32 historical buckets.

- For 24-hour bucket type, 24 hours is required to fill 7 historical bucket.

PM counters are updated continuously in current bucket for all bucket types (flex, 30-second, 15-minute, and 24-hour). After the timer expires for the respective bucket type, the current PM data is moved to the historical PM bucket. This process of moving PM data to the historical bucket is called Rollover. After rollover, you can access the current PM data as historical PM data.

In case of deletion or removal of the controller, the PM data is persistent for 3 hours. Unless the controller is brought up within 3 hours, the PM data is cleared because the controller is considered to be not in use.

Limitations

If NCS 1020 reload or software upgrade happens during the rollover time, one of the following scenarios occurs:

- The complete PM bucket is missing and the next PM bucket is marked as *Invalid*.

- PM bucket expiry message appears as follows:

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/3/0/2 pm history 30-sec ether 29
Fri Apr  1 01:32:20.646 UTC
History data is empty, Verify at least one collection period is expired
```

- PM bucket interval is marked as *Invalid* and counters are updated as zero.

- PM bucket interval is marked as *Invalid* and counters are updated as nonzero.

Cisco NCS 1020 Topologies

This appendix describes multidegree support on NCS 1020 and has examples of a few NCS 1020 topologies.

Configuring SNMP

The following MIBs are supported in NCS 1020.

SNMP MIB Name	OID
CISCO-FLASH-MIB	1.3.6.1.4.1.9.9.10
CISCO-ENHANCED-MEMPOOL-MIB	1.3.6.1.4.1.9.9.221
ENTITY-MIB	1.3.6.1.2.1.47
CISCO-ENTITY-FRU-CONTROL-MIB	1.3.6.1.4.1.9.9.117
CISCO-ENTITY-SENSOR-MIB	1.3.6.1.4.1.9.9.91
CISCO-IF-EXTENSION-MIB	1.3.6.1.4.1.9.9.27
CISCO-ENTITY-ASSET-MIB	1.3.6.1.4.1.9.9.92
CISCO-PROCESS-MIB	1.3.6.1.4.1.9.9.109
CISCO-CONFIG-MAN-MIB	1.3.6.1.4.1.9.9.43
CISCO-ENTITY-REDUNDANCY-MIB	1.3.6.1.4.1.9.9.498
CISCO-SYSTEM-MIB	1.3.6.1.4.1.9.9.131
CISCO-SYSLOG-MIB	1.3.6.1.4.1.9.9.41
RMON-MIB	1.3.6.1.2.1.16.0
CISCO-ALARM-MIB	1.3.6.1.4.1.9.9.869
EVENT-MIB	1.3.6.1.2.1.88
DISMAN-EXPRESSION-MIB	1.3.6.1.2.1.90
CISCO-FTP-CLIENT-MIB	1.3.6.1.4.1.9.9.80
NOTIFICATION-LOG-MIB	1.3.6.1.2.1.92
CISCO-RF-MIB	1.3.6.1.4.1.9.9.176

SNMP MIB Name	OID
UDP-MIB	1.3.6.1.2.1.7
CISCO-OPTICAL-MIB	1.3.6.1.4.1.9.9.828.0.1
CISCO-OPTICAL-OTS-MIB	1.3.6.1.4.1.9.9.834

For more information regarding SNMP MIBs refer to cfnng.cisco.com.

NCS 1020 SNMP OTS MIB Support

SNMP MIBS in the NCS 1020 platform support many controllers and parameters of different operational types which help in interacting with the rest of the system.

SNMP Traps

An SNMP trap refers to a type of SNMP Protocol Data Unit (PDU). An agent is able to send an unrequested message to the manager to notify about any important event with an SNMP trap, unlike other PDU types.

- Traps can be sent on SNMP version-2 (V2) or version-3 (V3) authentication.

- In version-2 (V2C) of SNMP, community public and UDP port are defined by default as 162.

- In version-3 (V3), user, group authentication methods like md5 and des56 are used and the UDP port needs to be mentioned.

Configuration on nodes is listed below.

- **Configuration of traps server as receiver**: A trap server listens only to both the protocols SNMP V3 and SNMP V2. For V3 traps, server IP, userid and UDP port are needed as in the example given below.

  - snmp-server host 10.65.41.209 traps version 3 priv nocUser1 udp-port 163

  For V2 traps, server IP, protocol 2c , community public and UDP ports are needed, as in the the example given below.

  - snmp-server host 64.104.134.47 traps version 2c public udp-port 12217

- **Configuration of user for SNMP V3 authentication**: Configure username with ID like nocUser1 and groups like nocGroup1 etc, followed by the authentication methods like md5 and privileged protocols like des56 followed by user and owner types as in the example given below.

  - snmp-server user nocUser1 nocGroup1 v3 auth md5 encrypted 0505090C145F4B1B48 priv des56 encrypted 082F434D3C0A000543 SystemOwner

- **Configuration for SNMP V3 View**: View includes the MIB starting point like given in the example below.

  - snmp-server view nocView1 1.3 included

- **Configuration for Community String**: Community string is public with read, write permission and system owner privileges like given in the example below.

  - snmp-server community public RW SystemOwner

- **Configuration for SNMP V3 Group**: Defines the group as name nocGroup1 with V3 protocol and privileges, notify view and view name as nocView1 and includes read and write operations similarly. The example is as given below.

  - snmp-server group nocGroup1 v3 priv notify nocView1 read nocView1 write nocView1

- **Configuration for Traps Requireing Customers Check**: Syslog as traps is enabled as given below.

  - snmp-server traps syslog

- **Configuration for Inventory**: For insert and remove and other control operations as given in the example below.

  - snmp-server traps fru-ctrl

- **Configuration for Traps**: For config change request use as the example given below.

  - snmp-server traps config

- **Configuration for Entity Related Update**: Use as given in the example below.

  - snmp-server traps entity

- **Configuration for System Up/Down Related Traps**: Use as per the example given below.

  - snmp-server traps system

- **Configuration for Preserving the Ifindex Over Reload**: Use as per the example given below.

  - snmp-server ifindex persist

A few examples of SNMP traps are added below.

```
Received SNMPv2c Trap:
Community: public
From: 10.127.60.241
sysUpTimeInstance = 00:07:05.93
snmpTrapOID.0 = cefcFanTrayStatusChange
cefcFanTrayOperStatus.4097 = up(2)
entPhysicalDescr.4097 = NCS1010 - Shelf Fan
entPhysicalName.4097 = 0/FT0

Received SNMPv2c Trap:
Community: public
From: 10.127.60.241
sysUpTimeInstance = 00:07:05.86
snmpTrapOID.0 = clogMessageGenerated
clogHistFacility.1 = MGBL-exec
clogHistSeverity.1 = error(4)
clogHistMsgName.1 = LOGIN_AUTHEN
clogHistMsgText.1 = Login Authentication failed. Exiting...
clogHistTimestamp.1 = 00:50:36.81
Received
```

Supporting Controllers of SNMP MIBs in NCS 1020

The following controllers support the various operational parameters of the NCS 1020 SNMP MIBs.

Table 19: Supporting Controllers of SNMP MIBs in NCS 1020

SNMP MIB	Controllers
CISCO-OPTICAL-OTS-MIB	• OTS • OTS-OCH • OMS • OCH • DFB • OSC

NCS 1020 SNMP MIB Controller Parameters

The controller specific parameters for NCS 1020 controllers are given below.

Table 20: NCS 1020 SNMP MIB Controller Parameters

SNMP MIB	Controller Parameters
CISCO-OPTICAL-OTS-MIB	• RxSpanLoss
	• TxSpanLoss
	• TxSignalPower
	• RxSignalPower
	• TxVoaAttenuation
	• ControllerState
	• TransportAdminState
	• TotalTxPower
	• TotalRxPower
	• IngressAmpliGain
	• IngressAmpliTilt
	• IngressAmpliGainRange
	• EgressAmpliGain
	• EgressAmpliTilt
	• EgressAmpliGainRange
	• IngressAmpliOsri
	• EgressAmpliOsri
	• IngressAmpliSafetyControlMode
	• EgressAmpliSafetyControlMode
	• TotalLCTxPower
	• TotalLCRxPower
	• IngressAmpliForceApr
	• EgressAmpliForceApr
	• BrPower
	• LedState
	• SpectrumInfo
	• OtsControllerPortType
	• LineTxBrRatio

NCS 1020 SNMP MIB Performance Monitoring Parameters

The NCS 1020 SNMP MIB performance monitoring parameters are given below.

Table 21: NCS 1020 SNMP MIB Performance Monitoring Parameters

SNMP MIB	Performance Monitoring Parameters
CISCO-OPTICAL-OTS-MIB	• Tx Power(min, max, avg) • Rx Power(min, max, avg) • Ingress Ampli Gain(min, max, avg) • Ingress Ampli Tilt(min, max, avg) • Egress Ampli Gain(min, max, avg) • Egress Ampli Tilt(min, max, avg) • Tx Power(C+L)(min, max, avg) • Rx Power(C+L)(min, max, avg) • Tx Power[S](min, max, avg) • Rx Power[S](min, max, avg) • Opbr (min, max, avg)

NCS 1020 SNMP MIB Raman Parameters

The NCS 1020 OTS raman parameters are given below.

Table 22: NCS 1020 SNMP MIB Raman Parameters

SNMP MIB	Raman Parameters
CISCO-OPTICAL-OTS-MIB	• Raman-1 Power • Raman-1 Wavelength • Raman-2 Power • Raman-2 Wavelength • Raman-3 Power • Raman-3 Wavelength • Raman-4 Power • Raman-4 Wavelength • Raman-5 Power • Raman-5 Wavelength • Raman Osri • Raman Safety Control Mode • Raman Force Apr • Raman Br Power • Composite Raman Power • Raman Br Ratio

NCS 1020 SNMP MIB Supported Operations

NCS 1020 SNMP MIB Supported Operations are given below.

Table 23: NCS 1020 SNMP MIB Supported Operations

SNMP MIB	SNMP Operation
CISCO-OPTICAL-OTS-MIB	• snmpwalk • Get Exact • Get One • Get Many

Note
- Both version-2 (V2) and version-3 (V3) SNMP operations are supported in NCS 1020.
- The transmit VOA attenuation value is measured in 1/100 dB and 1/10 dB on line systems devices in NCS 1020.