



## **Configuration Guide for Cisco NCS 1014, IOS XR Release 24.3.x**

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# CHAPTER 1

## Cisco NCS 1014 Advanced Multihaul Optical Platform - An Overview

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This chapter provides an overview for Cisco NCS 1014 Advanced Multihaul Optical Platform.

- [Cisco NCS 1014 Chassis and Line Cards, on page 1](#)
- [Document Objective, on page 5](#)
- [Document Organization, on page 5](#)

### Cisco NCS 1014 Chassis and Line Cards

The Cisco NCS 1014 chassis is an advanced multihaul optical platform supporting transponders and line system cards. It is a 2RU chassis that delivers a universal transponder solution which provides excellent performance for metro, long-haul and submarine applications.

Cisco NCS 1014 chassis has the following modules:

- Removable controller
- Removable backup solid state drive (SSD)
- Two replaceable power supply units (PSU)
- Three replaceable fan modules
- Four line cards

In Release 7.11.1, the Cisco NCS 1014 chassis supports the line cards:

- [2.4T Line Card](#)—2.4T DWDM Transponder Card
- [CCMD-16 Line Card](#)—16-port Colorless Mux/Demux Optical Line Card
- [1.2T Card](#)—1.2T DWDM Transponder Card

From Release 24.1.1, the Cisco NCS 1014 chassis supports the line cards:

- [NCS1K14-2.4T-X-K9](#)—2.4T-X DWDM Transponder/Muxponder Card
- [QXP-K9 Line Card](#)—3.2T QXP Transponder Card

## 1.2T Card

The 1.2T DWDM line card is a transponder that has 12 client ports to deliver 100GE and OTU4 client traffic. This line card has two trunks that operate at any rate between 100G and 600G in 50G increments. It uses Advanced Encryption Standard with a 256-bit key length (AES256)-based Layer-1 encryption to encrypt client-side data for 100GE and OTU4. The NCS1K4-1.2T-K9 line card is a single-slot unit that supports C-band traffic.

## 2.4T Line Card

The 2.4T line card is a coherent optics Transponder and Muxponder for the Cisco NCS 1014 chassis. It is a single-slot card that supports C-band traffic at trunk ports. This line card delivers 400GE, 100GE, and OTU4 client traffic over two trunk ports operating at speeds ranging from 400G to 1.2T each.

## CCMD-16 Line Card

The CCMD-16 optical line card has:

- Two line ports to transmit and receive using the same LC connectors.
- 16 ports for add/drop with LC connector-based interfaces

There are two variants of the optical line card:

- **NCS1K14-CCMD-16-C**

The NCS1K14-CCMD-16-C line card is a C-band, 16-port Colorless Direct attach optical line card with EDFA. It can host up to 16 channels. It supports any signal distribution between 191250 and 196200 GHz, for example, the 64 channels grid with 75-GHz spacing.

- **NCS1K14-CCMD-16-L**

The NCS1K14-CCMD-16-L line card is an L-band, 16-port Colorless Direct attach optical line card with EDFA. It can host up to 16 channels. It supports any signal distribution between 186025 and 191000 GHz, for example, the 64 channels grid with 75-GHz spacing.



## 2.4TX Line Card

*Table 1: Feature History*

Feature Name	Release Information	Feature Description
NCS1K14-2.4T-X-K9 Line Card	Cisco IOS XR Release 24.1.1	<p>The new <b>NCS1K14-2.4T-X-K9 line card</b> is a single-slot Transponder and Muxponder card that delivers up to 1.2T C-band traffic at each trunk port. It has six QDD client ports that support 400GE and 4x100GE traffic on each port. This card provides two trunk ports that support 1.2T traffic on each port. The <b>mxponder-slice</b> and <b>mxponder</b> keywords in the <b>hw-module</b> command enable this card to operate in the following modes.</p> <ul style="list-style-type: none"> <li>• <b>Muxponder Slice Mode</b>—The card virtually splits into two slices in this mode. It is possible to configure both trunks to carry different data rates. The supported trunk rates are 400G, 500G, 600G, 800G, 1000G, and 1200G.</li> <li>• <b>Muxponder Mode</b>—The card acts as one unit in this mode, configuring both trunks to the same data rate. The supported trunk rates are 600G and 1000G. Additionally, the capacity of a specific shared client port is consumed by two trunk ports.</li> </ul>

The 2.4TX line card is a coherent optics Transponder and Muxponder for the Cisco NCS 1014 chassis. It is a single-slot card that supports C-band traffic at trunk ports. This card delivers 400GE and 100GE client traffic over two trunk ports operating at speeds ranging from 400G to 1.2T each. This card operates in two card modes, namely, the muxponder mode and the muxponder slice mode. In muxponder mode, the client traffic splits between the two trunk ports for 600G and 1000G payloads on port 2 and 3 respectively. In this mode, both trunk ports always carry the same data rate. In muxponder slice mode, both trunk ports act independently, carrying different data rates in each trunk.



**Note** In Release 24.1.1, the 2.4TX line card supports only 400, 500, 600, 800, 1000, and 1200G trunk payloads.

For more information about the 2.4TX card, see [datasheet](#).

In the 2.4TX card, the client and trunk ports support the pluggable form factor and data rates as shown in the following table.

*Table 2: NCS1K14-2.4T-X-K9 Interfaces and Data Rates*

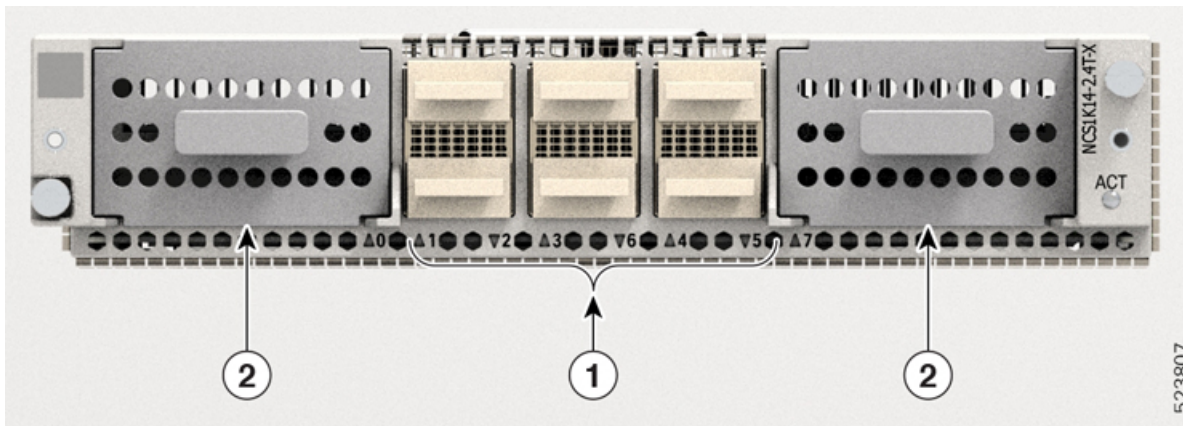
Interfaces	Form Factor	Ports	Data Rates
Client	QSFP-DD56	1, 2, 3, 4, 5, 6	400G
	QSFP-DD112	2, 5	400, 800G
Trunk	Coherent Interface Module 8 (CIM8)	0, 7	up to 1.2T in each port



**Note** In Release 24.1.1, the ports 2 and 5 support only up to 400G data rates.

The 2.4TX card has two trunk ports and six client ports as shown in the following figure.

**Figure 1: 2.4TX Line Card Front View**



**Table 3: 2.4TX Line Card Interfaces**

Callout	Interface
1	Client port
2	Trunk port

The following figure shows the mapping between the client and trunk ports.

**Figure 2: 2.4TX Card Client and Trunk Mapping**

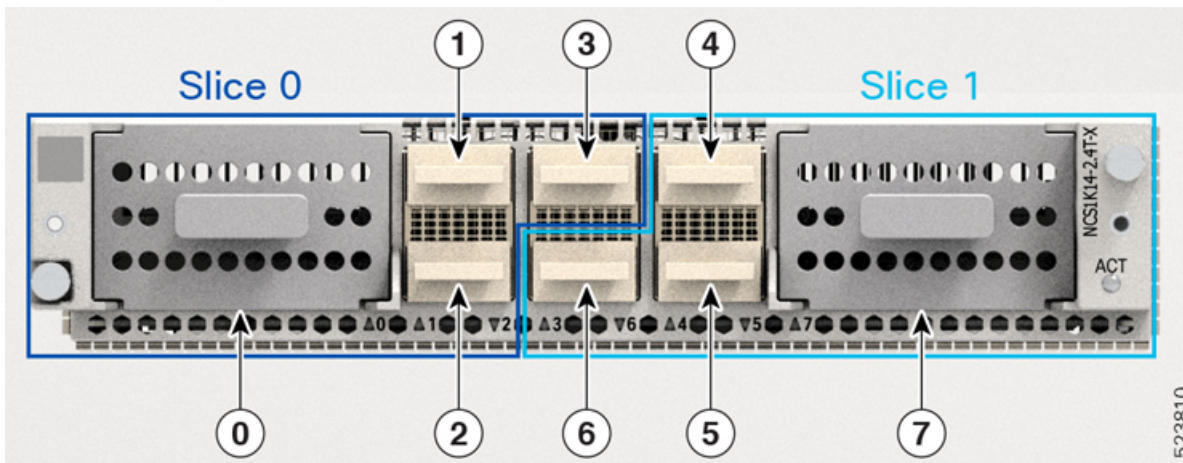


Table 4: Client-to-Trunk Port Mapping

Trunk Port	Client Ports
0	1, 2, 3
7	4, 5, 6



**Note** This client-to-trunk port mapping is only applicable for the mxponder-slice mode.

## QXP-K9 Line Card

The QXP-K9 line card is a high-density QSFP-DD transponder that has eight client ports (QSFP-DD) and eight trunk ports (QSFP-DD ZR+). It is a single-slot card that supports 3.2T traffic through its eight QSFP-DD trunk ports. Each trunk port operates at speed up to 400G in a 50G increment. Each client port supports 400GE, 4x100GE, and 100GE without FEC client rates.

## Document Objective

The Cisco NCS 1014 Configuration Guide describes how to configure various card modes for the line cards that are supported in the Cisco NCS 1014 chassis.

## Document Organization

This document is organized into the following chapters:

Chapter	Description
<a href="#">Configuring the Card Mode</a>	Describes different card mode configurations and supported data rates for the 1.2T, 2.4T and 2.4T-X line cards.
<a href="#">Performance Monitoring</a>	Describes the configuration and retrieval of PM counters for the optics, Ethernet, coherent DSP, OCH, and OMS controller types in flex-bin, 30-second, 15-minute, or 24-hour intervals.





## CHAPTER 2

# Configuring the Card Mode

This chapter lists the supported configurations and the procedures to configure the card mode on the line cards.



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**Note** Unless otherwise specified, “line cards” refers to 1.2T and 1.2TL line cards.

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- [1.2T Line Card, on page 7](#)
- [QXP Card, on page 22](#)
- [2.4T and 2.4TX Card Modes Overview, on page 28](#)

## 1.2T Line Card

The following section describes the supported configurations and procedures to configure the card modes on the line card.

### Card Modes

The line cards support module and slice configurations.

The line cards have two trunk ports (0 and 1) and 12 client ports (2 through 13) each. You can configure the line card in two modes:

- **Muxponder**—In this mode, both trunk ports are configured with the same trunk rate. The client-to-trunk mapping is in a sequence.
- **Muxponder slice**—In this mode, each trunk port is configured independent of the other with different trunk rates. The client-to-trunk mapping is fixed. For Trunk 0, the client ports are 2 through 7. For Trunk 1, the client ports are 8 through 13.

### Sub 50G Configuration

You can configure the sub 50G or coupled mode on the line card only in the muxponder mode. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T	0, 1	-	2	-
150G	300G	1.2T	0, 1	2	3	4
350G	700G	1.2T	0, 1	2, 3, 4	5	6, 7, 8
450G	900G	1.2T	0, 1	2, 3, 4, 5	6	7, 8, 9, 10
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12

1.2T line card supports an alternate port configuration for Sub 50G (split client port mapping) that you configure using CLI. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T	0, 1	-	7	-
150G	300G	1.2T	0, 1	2	7	8
250G	500G	1.2T	0, 1	2, 3	7	8, 9
350G	700G	1.2T	0, 1	2, 3, 4	7	8, 9, 10
450G	900G	1.2T	0, 1	2, 3, 4, 5	7	8, 9, 10, 11
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12



**Note** In all x50G configurations, client traffic on the middle port is affected with ODUK-BDI and LF alarms after the **power cycle or link flap** on the trunk side. This issue is raised when the two network lanes work in coupled mode and move from low to high power. To solve this issue, create a new frame either at the near-end or far-end by performing **shut** or **no shut** of the trunk ports.

### Coupled Mode Restrictions

The following restrictions apply to the coupled mode configuration:

- Both trunk ports must be configured with the same bits-per-symbol or baud rate and must be sent over same fiber and direction.
- The chromatic dispersion must be configured to the same value for both trunk ports.
- When trunk internal loopback is configured, it must be done for both trunk ports. Configuring internal loopback on only one trunk results in traffic loss.

- Fault on a trunk port of a coupled pair may cause errors on all clients including those running only on the unaffected trunk port.

## Configure Split Client Port Mapping

You can configure the trunk port to client port mapping for sub 50G data rates in the default mode or in the split client port mapping mode.

To configure the split client port mapping, use the following commands.

**configure**

**hw-module location** *location* **mxponder**

**split-client-port-mapping**

**commit**

The following is a sample in which split-client-port-mapping is configured with a 450G trunk payload.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

To remove the split client port-mapping configuration and configure default client port mapping, use the following commands.

**configure**

**hw-module location** *location* **mxponder**

**no split-client-port-mapping**

**commit**

The following is a sample in which split client port-mapping configuration is removed.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#no split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

### Verifying the Port Mapping Configuration

The following is a sample output of the split client port-mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder

Location:                0/1/NXR0
Client Bitrate:          100GE
Trunk Bitrate:           450G
Status:                  Provisioning In Progress
LLDP Drop Enabled:       FALSE
ARP Snoop Enabled:       FALSE
Client Port              Mapper/Trunk Port          CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                        Traffic Split Percentage
HundredGigECtrlr0/1/0/2  ODU40/1/0/0/1          100
0
HundredGigECtrlr0/1/0/3  ODU40/1/0/0/2          100
```

```

0
HundredGigECtrlr0/1/0/4      ODU40/1/0/0/3      100
0
HundredGigECtrlr0/1/0/5      ODU40/1/0/0/4      100
0
HundredGigECtrlr0/1/0/7      ODU40/1/0/0/5      50
50
HundredGigECtrlr0/1/0/8      ODU40/1/0/1/1      0
100
HundredGigECtrlr0/1/0/9      ODU40/1/0/1/2      0
100
HundredGigECtrlr0/1/0/10     ODU40/1/0/1/3      0
100
HundredGigECtrlr0/1/0/11     ODU40/1/0/1/4      0
100

```

The following is a sample output of the default client port mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder
```

```

Location:          0/1/NXR0
Client Bitrate:    100GE
Trunk Bitrate:     450G
Status:            Provisioning In Progress
LLDP Drop Enabled: FALSE
ARP Snoop Enabled: FALSE
Client Port                               Mapper/Trunk Port      CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                                     Traffic Split Percentage

HundredGigECtrlr0/1/0/2      ODU40/1/0/0/1      100
0
HundredGigECtrlr0/1/0/3      ODU40/1/0/0/2      100
0
HundredGigECtrlr0/1/0/4      ODU40/1/0/0/3      100
0
HundredGigECtrlr0/1/0/5      ODU40/1/0/0/4      100
0
HundredGigECtrlr0/1/0/6      ODU40/1/0/0/5      50
50
HundredGigECtrlr0/1/0/7      ODU40/1/0/1/1      0
100
HundredGigECtrlr0/1/0/8      ODU40/1/0/1/2      0
100
HundredGigECtrlr0/1/0/9      ODU40/1/0/1/3      0
100
HundredGigECtrlr0/1/0/10     ODU40/1/0/1/4      0
100

```

## Supported Data Rates

The following data rates are supported on the line card.

The following table displays the client and trunk ports that are enabled for the muxponder configuration.

Trunk Data Rate	Card Support	Client Data Rate (100GE, OTU4)	Trunk Ports	Client Ports
100	1.2T	100GE, OTU4	0	2
200	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5



Trunk Data Rate	Card Support	Client Data Rate (100GE, OTU4)	Trunk Ports	Client Ports
300	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7
400	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9
500	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11
600	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

The following table displays the client and trunk ports that are enabled for the muxponder slice 0 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T	100, OTU4	0	2
200	1.2T	100, OTU4	0	2, 3
300	1.2T	100, OTU4	0	2, 3, 4
400	1.2T	100, OTU4	0	2, 3, 4, 5
500	1.2T	100, OTU4	0	2, 3, 4, 5, 6
600	1.2T	100, OTU4	0	2, 3, 4, 5, 6, 7

The following table displays the client and trunk ports that are enabled for the muxponder slice 1 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T	100, OTU4	1	8
200	1.2T	100, OTU4	1	8, 9
300	1.2T	100, OTU4	1	8, 9, 10
400	1.2T	100, OTU4	1	8, 9, 10, 11
500	1.2T	100, OTU4	1	8, 9, 10, 11, 12
600	1.2T	100, OTU4	1	8, 9, 10, 11, 12, 13

All configurations can be accomplished by using appropriate values for client bitrate and trunk bitrate parameters of the **hw-module** command.

The following table displays the trunk parameter ranges for the 1.2T card.

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
50G	15%	1	1.3125	24.0207911	31.5272884
50G	27%	1	1.4453125	24.0207911	34.7175497

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	1.7578125	5.25	24.0207911	71.7420962
200G	27%	2	4.40625	31.51	69.43
250G	15%	2.1953125	6	26.2727403	71.8059237
250G	27%	2.4140625	6	28.9312914	71.9068991
300G	15%	2.6328125	6	31.5272884	71.8485385
300G	27%	2.8984375	6	34.7175497	71.8681352
350G	15%	3.0703125	6	36.7818364	71.8790086
350G	27%	3.3828125	6	40.503808	71.8404724
400G	15%	3.5078125	6	42.0363845	71.9018782
400G	27%	3.8671875	6	46.2900663	71.8197392
450G	15%	3.9453125	6	47.2909326	71.9196757
450G	27%	4.34375	6	52.0763245	71.9327648
500G	15%	4.3828125	6	52.5454806	71.93392
500G	27%	4.8281250	6	57.8625828	71.9068991
550G	15%	4.8203125	6	57.8000287	71.9455787
550G	27%	5.3125	6	63.6488411	71.88575
600G	15%	5.2578125	-	-	71.9552971

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	2	4	31.5272884	63.0545768

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
200G	27%	2	4.40625	31.51664088	69.43509943
250G	15%	2.1953125	4.5	35.0303204	71.8059237
250G	27%	2.4140625	4.5	38.5750552	71.9068991
300G	15%	2.6328125	4.5	42.0363845	71.8485385
300G	27%	2.8984375	4.5	46.2900662857142	71.86813526
350G	15%	3.0703125	4.5	49.0424486	71.8790086
350G	27%	3.3828125	4.5	54.0050773	71.8404724
400G	15%	3.5078125	4.5	56.0485127	71.9018782
400G	27%	3.8671875	4.5	61.72008838	71.81973921

## Configuring the Card Mode

You can configure the line card in the module (muxponder) or slice configuration (muxponder slice).

To configure the card in the muxponder mode, use the following commands.

### configure

**hw-module location** *location* **mxponder client-rate** {100GE | OTU4}

**hw-module location** *location* **mxponder trunk-rate** {50G | 100G150G | 200G | 250G | 300G | 350G | 400G | 450G | 500G | 550G | 600G }

### commit

To configure the card in the muxponder slice mode, use the following commands. **configure hw-module location** *location* **mxponder-slice** *mxponder-slice-number* **client-rate** { 100GE|OTU4}

**hw-module location** *location* **mxponder-slice trunk-rate** { 100G | 200G | 300G | 400G | 500G | 600G }

### commit

### Examples

The following is a sample in which the card is configured in the muxponder mode with a 550G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Tue Oct 15 01:24:56.355 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder trunk-rate 550G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Sun Feb 24 14:09:33.989 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2/NXR0 mxponder client-rate OTU4
```

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2/NXR0 mxponder trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 0 mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 1 mode with a 400G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured with mixed client rates in the muxponder slice mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 23 06:10:22.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 0 client-rate OTU4
trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0 mxponder-slice 1 client-rate 100GE
trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

### Verifying the Card Configuration

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2/NXR0 mxponder
Fri Mar 15 11:48:48.344 IST
```

```
Location:                0/2/NXR0
Client Bitrate:          100GE
Trunk Bitrate:           500G
Status:                  Provisioned
LLDP Drop Enabled:       FALSE
Client Port              Mapper/Trunk Port   CoherentDSP0/2/0/0   CoherentDSP0/2/0/1
                        Traffic Split Percentage
```

```
HundredGigECtrlr0/2/0/2 ODU40/2/0/0/1      100      0
HundredGigECtrlr0/2/0/3 ODU40/2/0/0/2      100      0
HundredGigECtrlr0/2/0/4 ODU40/2/0/0/3      100      0
HundredGigECtrlr0/2/0/5 ODU40/2/0/0/4      100      0
HundredGigECtrlr0/2/0/6 ODU40/2/0/0/5      100      0
HundredGigECtrlr0/2/0/7 ODU40/2/0/1/1       0        100
HundredGigECtrlr0/2/0/8 ODU40/2/0/1/2       0        100
HundredGigECtrlr0/2/0/9 ODU40/2/0/1/3       0        100
HundredGigECtrlr0/2/0/10 ODU40/2/0/1/4      0        100
HundredGigECtrlr0/2/0/11 ODU40/2/0/1/5      0        100
```

The following is a sample output of the coupled mode configuration where the shared client port is highlighted.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder
Tue Oct 15 01:25:57.358 UTC
```

```
Location:                0/1/NXR0
Client Bitrate:          100GE
Trunk Bitrate:           550G
```

```

Status:                Provisioned
LLDP Drop Enabled:    FALSE
Client Port           Mapper/Trunk Port   CoherentDSP0/1/0/0 CoherentDSP0/1/0/1
                    Traffic Split Percentage

HundredGigEctrler0/1/0/2   ODU40/1/0/0/1           100           0
HundredGigEctrler0/1/0/3   ODU40/1/0/0/2           100           0
HundredGigEctrler0/1/0/4   ODU40/1/0/0/3           100           0
HundredGigEctrler0/1/0/5   ODU40/1/0/0/4           100           0
HundredGigEctrler0/1/0/6   ODU40/1/0/0/5           100           0
HundredGigEctrler0/1/0/7   ODU40/1/0/0/6           50            50
HundredGigEctrler0/1/0/8   ODU40/1/0/1/1           0             100
HundredGigEctrler0/1/0/9   ODU40/1/0/1/2           0             100
HundredGigEctrler0/1/0/10  ODU40/1/0/1/3           0             100
HundredGigEctrler0/1/0/11  ODU40/1/0/1/4           0             100
HundredGigEctrler0/1/0/12  ODU40/1/0/1/5           0             100
    
```

The following is a sample output of all the muxponder slice 0 configurations.

```

RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 0
Fri Mar 15 06:04:18.348 UTC

Location:                0/1/NXR0
Slice ID:                 0
Client Bitrate:          100GE
Trunk Bitrate:           500G
Status:                  Provisioned
LLDP Drop Enabled:      FALSE
Client Port              Mapper/Trunk Port   CoherentDSP0/1/0/0
                    Traffic Split Percentage

HundredGigEctrler0/1/0/2   ODU40/1/0/0/1           100
HundredGigEctrler0/1/0/3   ODU40/1/0/0/2           100
HundredGigEctrler0/1/0/4   ODU40/1/0/0/3           100
HundredGigEctrler0/1/0/5   ODU40/1/0/0/4           100
HundredGigEctrler0/1/0/6   ODU40/1/0/0/5           100
    
```

The following is a sample output of all the muxponder slice 1 configurations.

```

RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 1
Fri Mar 15 06:11:50.020 UTC

Location:                0/1/NXR0
Slice ID:                 1
Client Bitrate:          100GE
Trunk Bitrate:           400G
Status:                  Provisioned
LLDP Drop Enabled:      TRUE
Client Port              Mapper/Trunk Port   CoherentDSP0/1/0/1
                    Traffic Split Percentage

HundredGigEctrler0/1/0/8   ODU40/1/0/1/1           100
HundredGigEctrler0/1/0/9   ODU40/1/0/1/2           100
HundredGigEctrler0/1/0/10  ODU40/1/0/1/3           100
HundredGigEctrler0/1/0/11  ODU40/1/0/1/4           100
    
```

The following is a sample output of the muxponder slice 1 configuration with client configured as OTU4.

```

RP/0/RP0/CPU0:ios#sh hw-module location 0/0/NXR0 mxponder-slice 1

Wed Mar 11 13:59:11.073 UTC

Location:                0/0/NXR0
Slice ID:                 1
    
```

```

Client Bitrate:      OTU4
Trunk Bitrate:      200G
Status:              Provisioned
Client Port          Peer/Trunk Port          CoherentDSP0/0/0/1
                    Traffic Split Percentage
OTU40/0/0/8         ODU40/0/0/1/1          100
OTU40/0/0/9         ODU40/0/0/1/2          100

```

The following is a sample to verify the mixed client rate configuration in the muxponder slice mode.

```

RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder
Mon Mar 23 06:20:22.227 UTC

```

```

Location:            0/1/NXR0
Slice ID:            0
Client Bitrate:      OTU4
Trunk Bitrate:      500G
Status:              Provisioned
Client Port          Peer/Trunk Port          CoherentDSP0/1/0/0
                    Traffic Split Percentage
OTU40/1/0/2         ODU40/1/0/0/1          100
OTU40/1/0/3         ODU40/1/0/0/2          100
OTU40/1/0/4         ODU40/1/0/0/3          100
OTU40/1/0/5         ODU40/1/0/0/4          100
OTU40/1/0/6         ODU40/1/0/0/5          100

```

```

Location:            0/1/NXR0
Slice ID:            1
Client Bitrate:      100GE
Trunk Bitrate:      500G
Status:              Provisioned
LLDP Drop Enabled:  FALSE
ARP Snoop Enabled:  FALSE
Client Port          Mapper/Trunk Port      CoherentDSP0/1/0/1
                    Traffic Split Percentage
HundredGigECtrlr0/1/0/8  ODU40/1/0/1/1          100
HundredGigECtrlr0/1/0/9  ODU40/1/0/1/2          100
HundredGigECtrlr0/1/0/10 ODU40/1/0/1/3          100
HundredGigECtrlr0/1/0/11 ODU40/1/0/1/4          100
HundredGigECtrlr0/1/0/12 ODU40/1/0/1/5          100

```

Use the following command to clear alarm statistics on the optics or coherent DSP controller.

**clear counters controller** *controllertype R/S/I/P*

The following is a sample in which the alarm statistics are cleared on the coherent DSP controller.

```

RP/0/RP0/CPU0:ios#show controller coherentDSP 0/1/0/0
Tue Jun 11 05:15:12.540 UTC

```

```

Port                : CoherentDSP 0/1/0/0
Controller State    : Up
Inherited Secondary State : Normal
Configured Secondary State : Normal
Derived State       : In Service
Loopback mode       : None
BER Thresholds      : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring : Enable

```

Alarm Information:

```

LOS = 1 LOF = 1 LOM = 0
OOF = 1 OOM = 1 AIS = 0
IAE = 0 BIAE = 0          SF_BER = 0
SD_BER = 2      BDI = 2 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                : None

Bit Error Rate Information
  PREFEC BER                    : 8.8E-03
  POSTFEC BER                   : 0.0E+00

TTI :
  Remote hostname               : P2B8
  Remote interface              : CoherentDSP 0/1/0/0
  Remote IP addr                : 0.0.0.0

FEC mode                        : Soft-Decision 15

AINS Soak                      : None
AINS Timer                     : 0h, 0m
AINS remaining time            : 0 seconds
RP/0/RP0/CPU0:ios#clear counters controller coherentDSP 0/1/0/0
Tue Jun 11 05:17:07.271 UTC
All counters are cleared
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/1
Tue Jun 11 05:20:55.199 UTC

Port                            : CoherentDSP 0/1/0/1
Controller State                : Up
Inherited Secondary State       : Normal
Configured Secondary State      : Normal
Derived State                   : In Service
Loopback mode                   : None
BER Thresholds                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring          : Enable

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0          SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                : None

Bit Error Rate Information
  PREFEC BER                    : 1.2E-02
  POSTFEC BER                   : 0.0E+00

TTI :
  Remote hostname               : P2B8
  Remote interface              : CoherentDSP 0/1/0/1
  Remote IP addr                : 0.0.0.0

FEC mode                        : Soft-Decision 15

AINS Soak                      : None
AINS Timer                     : 0h, 0m
AINS remaining time            : 0 seconds

```

## Regeneration Mode

In an optical transmission system, 3R regeneration helps extend the reach of the optical communication links by reamplifying, reshaping, and retiming the data pulses. Regeneration helps to correct any distortion of optical signals by converting it to an electrical signal, processing that electrical signal, and then retransmitting it again as an optical signal.

In Regeneration (Regen) mode, the OTN signal is received on a trunk port and the regenerated OTN signal is sent on the other trunk port of the line card and the other way round. In this mode, only the trunk optics controller and coherentDSP controllers are created.

### Configuring the Card in Regen Mode

The supported trunk rates for 1.2T card is 100G to 600G in multiples of 100G.

To configure regen mode on 1.2T, use the following commands:

```
configure
hw-module location location
regen
trunk-rate trunk-rate
commit
exit
```

#### Example

The following is a sample to configure the regen mode on 1.2T line card with the trunk-rate 300.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0/NXR0
RP/0/RP0/CPU0:ios(config-hwmod)#regen
RP/0/RP0/CPU0:ios(config-regen)#trunk-rate 300
RP/0/RP0/CPU0:ios(config-regen)#commit
RP/0/RP0/CPU0:ios(config-regen)#exit
```

### Verifying the Regen Mode

The following is a sample to verify the regen mode.

```
show hw-module location location regen

RP/0/RP0/CPU0:ios#show hw-module location 0/0 regen
Mon Mar 25 09:50:42.936 UTC

Location:                0/0/NXR0
Trunk Bitrate:           400G
Status:                  Provisioned
East Port                 West Port
CoherentDSP0/0/0/0      CoherentDSP0/0/0/1
```

The terms, East Port and West Port are used to represent OTN signal regeneration at the same layer.



## Configuring the BPS

You can configure the Bits per Symbol (BPS) to 3.4375 to support 300G trunk configurations on 75 GHz networks using the following commands:

```
configure
controller optics R/S/I/P bits-per-symbol value
commit
```

The following is a sample in which the BPS is configured to 3.4375.

```
RP/0/RP0/CPU0:ios#configure
Wed Mar 27 14:12:49.932 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/3/0/0 bits-per-symbol 3.4375
RP/0/RP0/CPU0:ios(config)#commit
```

### Supported Baud Rates

**Table 5: Supported Baud Rates**

Traffic Rate	Minimum Baud Rate	Maximum Baud Rate
400	43.34518	130.4647
600	59.53435	148.0555
800	79.37913	148.0555
1000	99.22392	148.0555

### Viewing BPS and Baud Rate Ranges

To view the the BPS for a specific range use the following command:

```
show controller optics R/S/I/P bps-range bps-range | include data-rate | include fec-type
```

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 bps-range 3 3.05 | include 300G | include
SD27
Thu Mar 28 03:01:39.751 UTC
300G          SD27          3.0000000    69.4350994
300G          SD27          3.0078125    69.2547485
300G          SD27          3.0156250    69.0753320
300G          SD27          3.0234375    68.8968428
300G          SD27          3.0312500    68.7192736
300G          SD27          3.0390625    68.5426174
300G          SD27          3.0468750    68.3668671
```

To view the baud for a specific range use the following command:

```
show controller optics R/S/I/P baud-rate-range baud-range | include data-rate | include fec-type
```

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 baud-rate-range 43 43.4 | include 300G |
include SD27
Thu Mar 28 03:12:36.521 UTC
300G          SD27          4.8046875    43.3545986
300G          SD27          4.8125000    43.2842178
300G          SD27          4.8203125    43.2140651
300G          SD27          4.8281250    43.1441394
```

300G	SD27	4.8359375	43.0744397
300G	SD27	4.8437500	43.0049648

## Configuring the Trunk Rate for BPSK

You can configure trunk rates of 50G, 100G, and 150G to support Binary Phase-Shift Keying (BPSK) modulation. The BPSK modulation enables information to be carried over radio signals more efficiently.

You can configure trunk rates for BPSK using CLI, NetConf YANG, and OC models.

The following table list the 50G, 100G, and 150G trunk rates with the supported BPSK modulation:

Trunk Rate	BPSK Modulation
50G	1 to 1.4453125
100G	1 to 2.890625
150G	1.453125 to 4.3359375

To configure the trunk rate for BPSK modulation, enter the following commands:

**configure**

**hw-module location** *location* **mxponder**

**trunk-rate** {50G | 100G | 150G}

**commit**

The following example shows how to configure trunk rate to 50G:

```
RP/0/RP0/CPU0:(config)#hw-module location 0/0/NXR0 mxponder
RP/0/RP0/CPU0:(config-hwmod-mxp)#trunk-rate 50G
RP/0/RP0/CPU0:(config-hwmod-mxp)#commit
```

## Viewing the BPSK Trunk Rate Ranges

To view the trunk rate configured for the BPSK modulation, use the following **show** commands:

```
RP/0/RP0/CPU0:ios(hwmod-mxp)#show hw-module location 0/0/NXR0 mxponder
```

```
Tue Feb 25 11:13:41.934 UTC
```

```
Location:                0/0/NXR0
Client Bitrate:          100GE
Trunk Bitrate:           50G
Status:                  Provisioned
LLDP Drop Enabled:       FALSE
ARP Snoop Enabled:       FALSE
Client Port              Mapper/Trunk Port          CoherentDSP0/0/0/0
CoherentDSP0/0/0/1
                          Traffic Split Percentage

HundredGigECtrlr0/0/0/2  ODU40/0/0/0          50
50
```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/0  
 Thu Mar 5 07:12:55.681 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Green

Optics Status

Optics Type: DWDM optics  
 DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,  
 Wavelength=1552.524nm

Alarm Status:

-----  
 Detected Alarms: None

LOS/LOL/Fault Status:

Alarm Statistics:

-----  
 HIGH-RX-PWR = 0                      LOW-RX-PWR = 2  
 HIGH-TX-PWR = 0                      LOW-TX-PWR = 0  
 HIGH-LBC = 0                         HIGH-DGD = 0  
 OOR-CD = 0                            OSNR = 0  
 WVL-OOL = 0                         MEA = 0  
 IMPROPER-REM = 0  
 TX-POWER-PROV-MISMATCH = 0  
 Laser Bias Current = 0.0 %  
 Actual TX Power = 1.97 dBm  
 RX Power = 1.58 dBm  
 RX Signal Power = 0.60 dBm  
 Frequency Offset = 386 MHz

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	4.9	-12.0	0.0	0.0
Tx Power Threshold(dBm)	3.5	-10.1	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

Configured Tx Power = 2.00 dBm  
 Configured CD High Threshold = 180000 ps/nm  
 Configured CD lower Threshold = -180000 ps/nm  
 Configured OSNR lower Threshold = 0.00 dB  
 Configured DGD Higher Threshold = 180.00 ps  
 Baud Rate = 34.7175521851 GBd  
 Bits per Symbol = 1.0000000000 bits/symbol  
 Modulation Type: BPSK  
 Chromatic Dispersion -9 ps/nm  
 Configured CD-MIN -180000 ps/nm CD-MAX 180000 ps/nm  
 Polarization Mode Dispersion = 0.0 ps  
 Second Order Polarization Mode Dispersion = 125.00 ps^2

```

Optical Signal to Noise Ratio = 34.60 dB
SNR = 20.30 dB
Polarization Dependent Loss = 0.20 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 2.00 ps
Filter Roll Off Factor : 0.100
Rx VOA Fixed Ratio : 15.00 dB
Enhanced Colorless Mode : 0
Enhanced SOP Tolerance Mode : 0
NLEQ Compensation Mode : 0
Cross Polarization Gain Mode : 0
Cross Polarization Weight Mode : 0
Carrier Phase Recovery Window : 0
Carrier Phase Recovery Extended Window : 0

```

```

AINS Soak           : None
AINS Timer          : 0h, 0m
AINS remaining time : 0 seconds

```

## QXP Card

**Table 6: Feature History**

Feature Name	Release Information	Description
NCS1K4-QXP-K9 Line Card Support on NCS 1014	Cisco IOS XR Release 24.1.1	NCS1K4-QXP-K9 line card delivers low cost 100G and 400G DWDM transmission with ZR+ optics on a router. This line card can be used in both traditional Optical Networking solution and in Routed Optical Networking solution. This line card has 16 pluggable ports with eight QSFP-DD client ports and eight QSFP-DD trunk ports.  For more information about the NCS1K4-QXP-K9 card, see the <a href="#">datasheet</a> .

The NCS1K4-QXP-K9 3.2T QSFP-DD DCO Transponder Line Card has eight client ports (QSFP-DD) and eight trunk ports (QSFP-DD ZR+). Each line card supports up to 3.2 Tbps traffic. The client rates that are supported are 400GE, 4x100GE, and 100GE Ethernet only. The modulation formats supported are 16 QAM for 400GE Txp/4x100GE Mxp.

The QXP line card provides up to 16 QSFP-DD ports (eight QSFP-DD client ports and eight QSFP-DD trunk ports). The supported operating modes are:

- 400GE-TXP
- 4X100GE MXP
- 2x100GE MXP

The QXP card has 8 slices. Each slice consists of one client and one trunk port with a slice capacity of 400G. The total capacity is 3.2T.

**Table 7: Slice and Port Mapping on the QXP Card**

Slice	Trunk Port	Client Port
0	0	1
1	2	3
2	4	5
3	6	7
4	8	9
5	10	11
6	12	13
7	14	15



**Note**

- When you use OPENROADM trunk mode by configuring the **trunk-mode OR** command, use only alternate slices on the QXP card. Either use slices 0, 2, 4, 6 or 1, 3, 5, 7.
- QDD-400G-ZR-S pluggable module supports FEC mode CFEC only.
- QDD-400G-ZR-S pluggable module operates only as an Ethernet transponder.

**Supported Data Rates for QXP Card**

The following table displays the client and trunk ports that are enabled for transponder and muxponder modes.

Operating mode	Card Support	Client Data Rate	Client Optics	Trunk Ports	Client Ports
400GE-TXP	QXP Card	400G	<ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-400G-FR4-S</li> <li>• QDD-400-AOCxM</li> </ul>	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
4X100GE MXP	QXP Card	4X100G Break out	<ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-4X100G-LR-S</li> </ul>	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
2X100GE MXP	QXP Card	2X100G Break out	<ul style="list-style-type: none"> <li>• QDD-400G-DR4-S</li> <li>• QDD-4X100G-LR-S</li> </ul>	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15

**Configure 400G Transponder Mode**

Use the following commands to configure and provision 400G TXP.

**hw-module location** *location*

**mxponder-slice** *slice-number*

**trunk-rate** 400G

**trunk-mode** [ZR | OR]

**client-port-rate** *port-number***client-type** 400GE

The following is a sample configuration of configuring a 400G TXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 400GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 400G Transponder Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0 mxponder-slice 0
Sat Jun 25 21:32:58.799 UTC

Location:                0/0
Slice ID:                 0
Client Bitrate:          400GE
Trunk Bitrate:           400G
Status:                  Provisioned
LLDP Drop Enabled:       FALSE
ARP Snoop Enabled:       FALSE
Client Port              Mapper/Trunk Port      CoherentDSP0/0/0/0
                        Traffic Split Percentage
FourHundredGigECtrlr0/0/0/1      -                100
```




---

**Note** The **trunk-mode** command allows you to choose between OTN and ethernet traffic on the trunk port.

---

**Configure 400G Muxponder Mode**

Use the following commands to configure and provision 400G MXP.

**hw-module location** *location*

**mxponder-slice** *slice-number*

**trunk-rate** 400G

**client-port-rate** *port-number* **lane** *lane-number***client-type** 100GE

The following is a sample configuration of configuring a 400G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
```

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 100GE
```

The following is a sample output of **show hw-module location location mxponder-slice slice-number** when configured in 400G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:                0/3
Slice ID:                 1
Client Bitrate:          100GE
Trunk Bitrate:           400G
Status:                   Provisioned
LLDP Drop Enabled:       FALSE
ARP Snoop Enabled:       FALSE
Client Port                Mapper/Trunk Port          CoherentDSP0/3/0/2
                          Traffic Split Percentage

HundredGigEctr0/3/0/3/1  -                               100
HundredGigEctr0/3/0/3/2  -                               100
HundredGigEctr0/3/0/3/3  -                               100
HundredGigEctr0/3/0/3/4  -                               100
```

### Configure 2x100G Muxponder Mode

Use the following commands to configure and provision 2x100G MXP.

**hw-module location location**

**mxponder-slice slice-number**

**trunk-rate 200G**

**client-port-rate port-number lane lane-number client-type 100GE**

The following is a sample configuration of configuring a 2x100G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
```

The following is a sample output of **show hw-module location location mxponder-slice slice-number** when configured in 2x100G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:                0/3
Slice ID:                 1
Client Bitrate:          100GE
Trunk Bitrate:           200G
Status:                   Provisioned
LLDP Drop Enabled:       FALSE
ARP Snoop Enabled:       FALSE
Client Port                Mapper/Trunk Port          CoherentDSP0/3/0/2
                          Traffic Split Percentage

HundredGigEctr0/3/0/3/1  -                               100
HundredGigEctr0/3/0/3/2  -                               100
```

### DAC Supported Modes for NCS1K4-QXP-K9 Card

DAC support is enabled on the NCS1K4-QXP-K9 card for 2x100G, 4x100G, and 400G operating modes. The following table provides the details of the respective DAC rates for the different trunk rates for NCS1K4-QXP-K9 card.

**Table 8: DAC Supported Data Rates for NCS1K4-QXP-K9 Card**

Trunk Rate	Modulation Format	Default Value	Modified DAC Supported
200G	QPSK	1x1	1x1.50
200G	8QAM	1x1.25	N/A
200G	16-QAM	1x1.25	N/A
400G	16-QAM	1x1	1x1.50

The following example changes the DAC rate to 1x1.5 on an optics controller.

```
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/0
RP/0/RP0/CPU0:ios(config-Optics)#dac-Rate 1x1.50
RP/0/RP0/CPU0:ios(config-Optics)#commit
```



- 
- Note**
- Changing the DAC turns the laser Off and then back on for the optics. This is a traffic impacting operation.
  - The DAC rate configuration must match on both ends of a connection.
- 

### Cisco 400G QSFP-DD High-Power (Bright ZR+) Optical Module Support on QXP Card

QXP card supports Cisco 400G QSFP-DD High-Power (Bright) Optical Modules. DP04QSDD-HK9 operates as Ethernet or OTN transponder. DP04QSDD-HE0 operates only as an Ethernet transponder.

Use the following commands to configure OTN data path on the Bright ZR+ pluggable optical modules. The **trunk-mode OR** refers to OpenROADM.

**hw-module location** *location*

**mxponder-slice 1** *slice-number*

**trunk-mode OR**

**trunk-rate** *rate*

Use the following commands to configure Ethernet data path on the Bright ZR+ pluggable optical modules.

**hw-module location** *location*

**mxponder-slice 1** *slice-number*

**trunk-mode ZR**

**trunk-rate** *rate*





**Note** DP04QSDD-HK9 operates as Ethernet or OTN transponder. DP04QSDD-HE0 operates only as an Ethernet transponder. DP04QSDD-HE0 supports only trunk-mode ZR. Configuring trunk-mode OR on the DP04QSDD-HE0 pluggable raises the MEA alarm.

The following is a sample configuration of configuring a 4x100G OTN trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode OR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)# client-port-rate 9 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)# client-port-rate 9 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)# client-port-rate 9 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)# client-port-rate 9 lane 4 client-type 100GE
```

The following is a sample configuration of configuring Ethernet trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode ZR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
```

The following is a sample configuration of setting 0dBm transmit power on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/2
RP/0/RP0/CPU0:ios(config-Optics)#transmit-power 0
Thu Mar 9 13:02:30.662 UTC
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config-Optics)#commit
Thu Mar 9 13:02:31.566 UTC
```

The following is a sample output of the **show controllers optics** command, with the transmit power set to 0 dBm.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/8
Thu Apr 13 13:54:33.163 UTC
Controller State: Up
Transport Admin State: In Service
Laser State: On
LED State: Green
Optics Status
  Optics Type: QSFP-DD DWDM
  DWDM carrier Info: C BAND, MSA ITU Channel=49, Frequency=193.70THz,
  Wavelength=1547.715nm
  Alarm Status:
  -----
  Detected Alarms: None
  LOS/LOL/Fault Status:
  Alarm Statistics:
  -----
  HIGH-RX-PWR = 0          LOW-RX-PWR = 4
  HIGH-TX-PWR = 0          LOW-TX-PWR = 1
  HIGH-LBC = 0            HIGH-DGD = 0
  OOR-CD = 0              OSNR = 4
  WV-L-OOL = 0            MEA = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0
```

```

Laser Bias Current = 0.0 %
Actual TX Power = 0.00 dBm
RX Power = -10.50 dBm
RX Signal Power = -10.35 dBm
Frequency Offset = 199 MHz

```

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	3.0	-24.5	0.0	0.0
Tx Power Threshold(dBm)	0.0	-16.0	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

```

LBC High Threshold = 90 %
Configured Tx Power = 0.00 dBm
Configured CD High Threshold = 52000 ps/nm
Configured CD lower Threshold = -52000 ps/nm
Configured OSNR lower Threshold = 21.10 dB
Configured DGD Higher Threshold = 67.00 ps

```

**Table 9: Operating Modes Supported for Bright ZR+ Pluggable Modules on QXP Card**

Operating mode	Modulation	FEC
4x100GE MXP	16-QAM	CFEC
4x100GE MXP	16-QAM	OFEC
2x100GE MXP	QPSK	OFEC
400GE TXP	16-QAM	CFEC
400GE TXP	16-QAM	OFEC

## 2.4T and 2.4TX Card Modes Overview

This section helps you familiarize with the different card modes available in the 2.4T and 2.4TX cards, their corresponding data rates, baud rate of each data rate, and the step-by-step procedure to configure line card in muxponder modes with the QDD-4x100GE and QDD-400GE pluggables.

### Available Card Modes

The 2.4T and 2.4TX line cards have two trunk ports (0 and 7) and six client ports (from 1 to 6) each. You can configure the line card in:

- **Muxponder slice**—You can configure each trunk port independent of the other with different trunk rates. The client-to-trunk mapping is fixed. For Trunk 0, the client ports are 1 to 3. For Trunk 7, the client ports are 4 to 6.
- **Muxponder**—You can configure both trunk ports with the same trunk rate. The client-to-trunk mapping is fixed.




---

**Note** The muxponder mode is supported on the 2.4TX card only.

---

## 2.4T and 2.4TX Card Trunk Pluggables and Datarates

### Coherent Interconnect Module 8

The 2.4T and 2.4TX cards support Coherent Interconnect Module 8 (CIM8) pluggables as trunk pluggables.

The Coherent Interconnect Module 8 (CIM8) is a pluggable, high-capacity multi-haul transceiver. The module can operate at line rates between 400G and 1200G in 100G increments. It utilizes a single optical carrier for both C-band and L-band operations.

#### CIM8-C-K9

CIM8-C-K9 is the C-band Coherent Interconnect module 8.

The frequency range supported on a 50 GHz or 100 MHz flex grid is from 1912500 to 1961000. Any frequency outside this range will trigger a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

The default frequency is 193.10 THz.

#### CIM8-CE-K9

CIM8-CE-K9 includes a pre-amplifier (EDFA).

The frequency range supported on a 50 GHz or 100 MHz flex grid is from 1912500 to 1961000. Any frequency outside this range will trigger a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

Due to the inclusion of the pre-amplifier, the optical performance is enhanced compared to the CIM8-C-K9, enabling longer reach.

#### CIM8-LE-K9

This variant of the CIM8 supports the L-band spectrum and includes a pre-amplifier (EDFA).

The frequency range supported on a 100 MHz flex grid is from 1861500 to 1909250. Any frequency outside this range triggers a "Port Pluggable Module Mismatched With Pre-Provisioned PPM" alarm, causing the link to go down.

There is no default frequency for the CIM8-LE-K9. You must configure the frequency for the laser to be activated.

In R24.3.1 and later releases, if a C-band CIM8 is replaced with an LE CIM8 and the frequency is configured within the specified range, the traffic should resume seamlessly.

PID	Frequency Range Supported	Default Frequency
CIM8-C-K9	1912500 to 1961000	193.10 THz
CIM8-CE-K9	1912500 to 1961000	193.10 THz

PID	Frequency Range Supported	Default Frequency
CIM8-LE-K9	1861500 to 1909250	No default frequency

The following table shows the different pluggables and datarates that each pluggable supports.

PID	Cards Supported	Supported Rates
CIM8-C-K9	2.4T and 2.4TX cards	400G, 500G, 600G, 700G, 800G, 900G, 1000G, 1100G, 1200G
CIM8-CE-K9	2.4TX card	400G, 500G, 600G, 700G, 800G, 900G, 1000G, 1100G, 1200G
CIM8-LE-K9	2.4TX card	400G, 500G, 600G, 700G, 800G, 900G, 1000G

## Muxponder Slice Mode for 2.4T and 2.4TX Cards

The line card is divided into two slices, namely, Slice 0 and Slice 1. Each slice contains a trunk port and three client ports. In this mode, the trunk ports operate independently, carrying different data rates. The slices enable the card to function as two different modules. For example, if you set the trunk as 400 G for Slice 0 and 600 G for Slice 1, then Trunk 0 delivers 400 G and Trunk 7 delivers 600 G.

*Figure 3: 2.4T Line Card Slices and Ports*

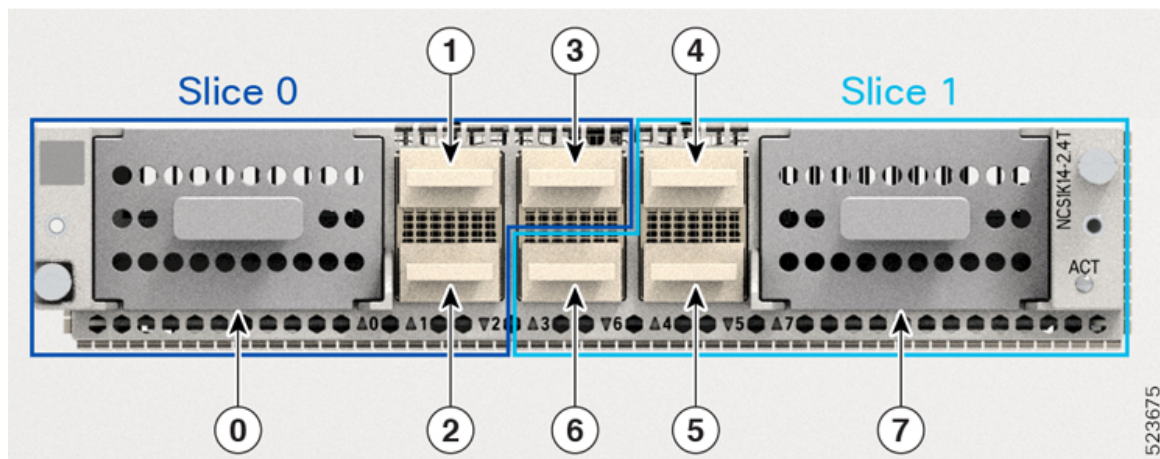


Figure 4: 2.4TX Line Card Slices and Ports

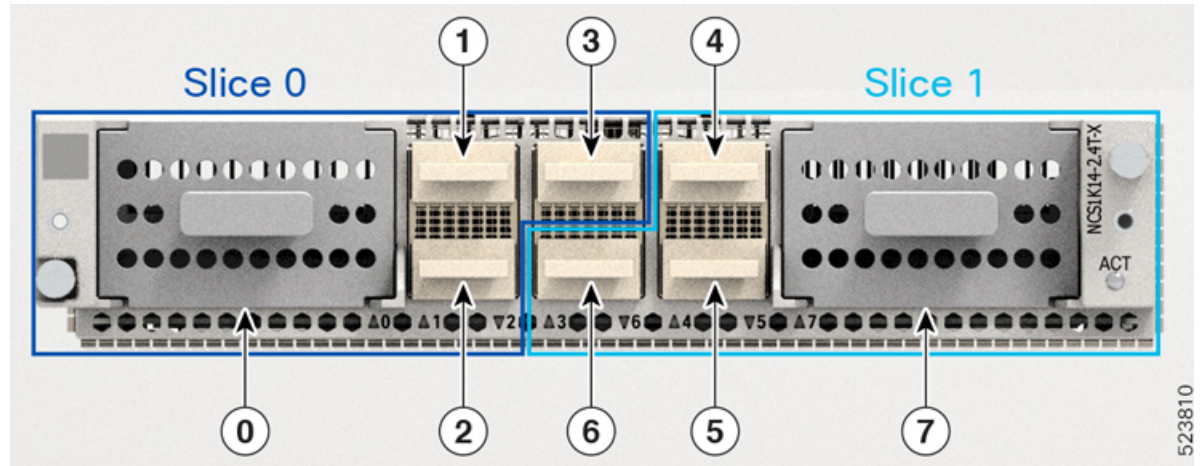


Table 10: Client-to-Trunk Mapping in Slice 0 and Slice 1 Modes

Slice 0		Slice 1	
Trunk Port	Client Ports	Trunk Port	Client Ports
0	1, 2, 3	7	4, 5, 6

## Data Rate Capabilities for 2.4T and 2.4TX Line Cards in Muxponder Slice Mode

The 2.4T and 2.4TX line cards support various trunk rates.

The table shows the releases from which the 2.4T and 2.4TX cards started supporting each trunk rate.

Table 11: Release-Wise Trunk Rates Supported by the 2.4T and 2.4TX Cards

Trunk Rate (G)	2.4T	2.4TX
400	7.11.1	24.1.1
500	-	24.1.1
600	7.11.1	24.1.1
700	-	24.2.1
800	7.11.1	24.1.1
900	-	24.2.1
1000	7.11.1	24.1.1
1100	-	24.2.1
1200	-	24.1.1

## Recommended Trunk Parameters in the 2.4T and 2.4TX Cards

### Baud Rate Ranges for Each Trunk Rate in the 2.4T Card

The 2.4T card carries signals at different trunk rates, with each trunk rate operating within a baud rate range.

In the *Baud Rate Ranges for Each Trunk Rate in the 2.4T Card* table, you can find the recommended baud rate ranges to maintain the signal health for each trunk rate in the network.

**Table 12: Baud Rate Ranges for Each Trunk Rate in the 2.4T Card**

Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)
400	43.34518	130.4647
500	49.61196	147.7235
600	59.53435	148.0555
700	69.45674	147.8182
800	79.37913	148.0555
900	89.30152	147.8709
1000	99.22392	148.0555
1100	109.1463	148.2068
1200	119.0687	148.0555

### Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card

The 2.4TX card carries trunk signals at different data rates. Each trunk data rate operates in a default baud rate. However, you can customize the baud rate within the recommended baud rate range based on your deployment scenario. To customize baud rate, see.

In the *Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card* table, you can find the recommended baud rate ranges to maintain the signal health for each trunk rate in the network. The table also features the bit per second information for the respective baud rates.

**Table 13: Baud Rate and Bit Rate Range for Each Trunk Rate in the 2.4TX Card**

Trunk Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)	Default Baud Rate (GBd)	Minimum Bit per Second (bps)	Maximum Bit per Second (bps)
400	43.34518	130.4647	127.931418	2.1	4.1
500	49.61196	147.7235	137.8340588	2.5	5
600	59.53435	148.0555	137.738007	2.8	5.1
700	69.45674	147.8182	138.08166	3.2	5
800	79.37913	148.0555	137.978388	3.5	5.1

Trunk Data Rate per Trunk (G)	Minimum Baud Rate (GBd)	Maximum Baud Rate (GBd)	Default Baud Rate (GBd)	Minimum Bit per Second (bps)	Maximum Bit per Second (bps)
900	89.30152	147.8709	137.89817	3.8	5.2
1000	99.22392	148.0555	137.834059	4.3	5.3
1100	109.1463	148.2068	137.78165	4.7	5.3
1200	119.0687	148.0555	137.738007	5.3	5.7

## Customize Baud Rates

The muxponder mode enables the 2.4T and 2.4TX cards to carry signals in default baud rates when you set up the trunk rate. However, you can customize the baud rates for each trunk rate based on the bandwidth in the network.

Use this procedure to customize the baud rates within the recommended range as per your deployment scenario.

### Before you begin

- Install the following pluggable modules as required.
  - QDD-4x100G
  - QDD-400G
- Enter the Cisco IOS XR configuration mode.

---

**Step 1** Locate the Trunk Optics Controller for the 2.4T or 2.4TX card.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
```

**Step 2** Enter baud rate.

**Example:**

```
RP/0/RP0/CPU0:ios(config-Optics)#baud-rate 120.0000
```

**Step 3** Save the changes.

**Example:**

```
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

---

## Client Pluggables for Configuring Muxponder Slice Modes

This section provides details about the client pluggable combinations that you need to set up the client rate for each trunk rate in slice 0 and slice 1.

### Pluggable Combinations in Muxponder Slice Modes

The client data rates and ports differ for each trunk rate in the muxponder slice 0 (Trunk 0) and muxponder slice 1 (Trunk 1) configurations. However, the type of client pluggable modules stays the same for both slice modes.

**Table 14: Trunk Rate and Client Pluggable Combinations for Slices 0 and Slice 1**

Trunk Rate (G) per Trunk	Card Support	Client Rate	Client Pluggable	Client Ports	
				Slice 0	Slice 1
400	2.4T, 2.4TX	400 GE	QDD-400G	1	4
		4x 100 GE	QDD-4x100G		
500	2.4TX	400 GE + 1x 100 GE	QDD-400G + QDD-4x100G	1, 2	4, 5
		5x 100 GE	2x QDD-4x100G		
600	2.4T, 2.4TX	400 GE + 2x 100 GE	QDD-400G + QDD-4x100G	1, 2	4, 5
		6x 100 GE	2x QDD-4x100G		
700	2.4TX	400 GE + 3x 100 GE	QDD-400G + QDD-4x100G	1, 2	4, 5
		7x 100 GE	2x QDD-4x100G		
800	2.4T, 2.4TX	2x 400 GE	2x QDD-400G	1, 2	4, 5
		400 GE + 4x 100 GE	QDD-400G + QDD-4x100G		
		8x 100 GE	2x QDD-4x100G		
900	2.4TX	2x 400 GE + 1x 100 GE	QDD-400G + QDD-4x100G	1, 2, 3	4, 5, 6
		400 GE + 5x 100 GE	QDD-400G + QDD-4x100G		
		9x 100 GE	3x QDD-4x100G		
1000	2.4T, 2.4TX	2x 400GE + 2x 100 GE	2x QDD-400G + 2x QDD-4x100G	1, 2, 3	4, 5, 6
		10x 100 GE	3x QDD-4x100G		



Trunk Rate (G) per Trunk	Card Support	Client Rate	Client Pluggable	Client Ports	
				Slice 0	Slice 1
1100	2.4TX	2x 400 GE + 3x 100 GE	2x QDD-400G + QDD-4x100G	1, 2, 3	4, 5, 6
		400 GE + 7x 100 GE	2x QDD-400G + QDD-4x100G		
		11x 100 GE	3x QDD-4x100G		
1200	2.4TX	3x 400 GE	3x QDD-400G	1, 2, 3	4, 5, 6
		2x 400 GE + 4x 100 GE	2x QDD-400G + QDD-4x100G		
		400 GE + 8x 100 GE	QDD-400G + 2x QDD-4x100G		
		12x 100 GE	3x QDD-4x100G		
		6x 2X100 GE	6x QDD-2X100-CWDM4-S	1, 2, 3, 4, 5, 6	—
	6x QDD-2X100-LR4-S				

<sup>1</sup> QDD-400G refers to QDD-400G-FR4-S, QDD-400G-LR4-S, QDD-400G-AOCxM, and QDD-400G-DR4-S pluggable modules.

<sup>2</sup> QDD-4x100G refers to QDD-4X100G-LR-S, QDD-4X100G-FR-S, and QDD-400G-DR4-S pluggable modules.

Make sure you use the appropriate values for client bitrate and trunk bitrate parameters when configuring the Muxponder slice mode using the **hw-module** command.

## Set Up the Client and Trunk Rate in the Muxponder Slice Mode for 2.4T and 2.4TX Cards

Use this procedure to set up the client and trunk rate in the muxponder slice mode for the 2.4T and 2.4TX cards.

This procedure considers that you are setting up the 600-G data rate in one of the trunk ports of the 2.4T or 2.4TX card. This scenario requires you to set the client rate for the client ports. Based on the client pluggable that you use, the client rate can change to 400-GE client, 100-GE client, or mixed client.

For more information on the the data rate on each client port, see [Client Pluggables for Configuring Muxponder Slice Modes](#), on page 33.

### Before you begin

- Install the following pluggables as required.
  - QDD-400G
  - QDD-4x100G

**Step 1** Specify the card location.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0
```

**Step 2** Configure the 2.4T or 2.4TX line cards in the muxponder slice mode.

For Trunk 0 port, enter the `muxponder-slice 0` mode.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#muxponder-slice 0
```

For Trunk 1 port, enter the `muxponder-slice 1` mode.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#muxponder-slice 1
```

**Note** You can configure both muxponder slice 0 and slice 1 modes when needed.

For more information on how to configure muxponder slice mode with QDD-4x100GE and QDD-4x100GE pluggables, see the [hw-module](#) command.

**Step 3** Set up the trunk rate for the 2.4T or 2.4TX card.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#trunk-rate 600G
```

**Step 4** Set up the client rate based on the pluggables that you use.

For the QDD-400G pluggable, run this command.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 2 client-type 400GE
```

For the QDD-4x100G pluggable, run this command.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 1 lane 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 2 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#client-port-rate 2 lane 2 client-type 100GE
```

**Note** Use the `lane` keyword to set up the 100-GE client rate in the client ports.

For the mixed client pluggable, use the combination of the QDD-400G and QDD-4x100G commands.

**Step 5** Save the configuration and exit the muxponder slice mode.

**Example:**

**Command**

```
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mlx)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

**Step 6** Verify the 600-G data rate that you set up.

The following sample shows the 600-G data rate (**Trunk Bitrate: 600G**) set up in client ports 1 (**FourHundredGigEctr0/1/0/1**) and 2 with breakout lanes 1 and 2 (**HundredGigEctr0/1/0/2/1** and **HundredGigEctr0/1/0/2/2**) using 400-GE and 100-GE client type pluggables (**Client Bitrate: MIXED**) in muxponder slice 0 (**Slice ID: 0**).

**Example:**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 0
```

```
Thu Nov 16 15:41:25.720 UTC
Location:                0/1/NXR0
Slice ID:                 0
Client Bitrate:          MIXED
Trunk Bitrate:           600G
Status:                  Provisioned
LLDP Drop Enabled:      FALSE
ARP Snoop Enabled:      FALSE
Client Port              Mapper/Trunk Port          CoherentDSP0/1/0/0
                          Traffic Split Percentage

FourHundredGigEctr0/1/0/1  ODU-FLEX0/1/0/0/1          100
HundredGigEctr0/1/0/2/1   ODU-FLEX0/1/0/0/2/1       100
HundredGigEctr0/1/0/2/2   ODU-FLEX0/1/0/0/2/2       100
```

The following sample shows the 600-G data rate (**Trunk Bitrate: 600G**) set up in client ports 0 with breakout lanes 1 to 4 (**HundredGigEctr0/1/0/1/1** to **HundredGigEctr0/1/0/1/4**) and 1 (**HundredGigEctr0/1/0/2/1**) using 100-GE client type pluggable (**Client Bitrate: 100GE**) in muxponder slice 0 (**Slice ID: 0**).

**Example:**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1/NXR0 mxponder-slice 0
```

```
Thu Nov 16 16:06:57.575 UTC
Location:                0/1/NXR0
Slice ID:                 0
Client Bitrate:          100GE
Trunk Bitrate:           600G
Status:                  Provisioned
LLDP Drop Enabled:      FALSE
ARP Snoop Enabled:      FALSE
Client Port              Mapper/Trunk Port          CoherentDSP0/1/0/0
                          Traffic Split Percentage

HundredGigEctr0/1/0/1/1   ODU-FLEX0/1/0/0/1/1       100
HundredGigEctr0/1/0/1/2   ODU-FLEX0/1/0/0/1/2       100
HundredGigEctr0/1/0/1/3   ODU-FLEX0/1/0/0/1/3       100
HundredGigEctr0/1/0/1/4   ODU-FLEX0/1/0/0/1/4       100
HundredGigEctr0/1/0/2/1   ODU-FLEX0/1/0/0/2/1       100
HundredGigEctr0/1/0/2/2   ODU-FLEX0/1/0/0/2/2       100
```

## Set Up 2x100G Clients in 1200G Trunk rate in the Muxponder Slice Mode for 2.4TX Cards

Use this procedure to set up 2x100G client pluggables in 1200G trunk rate in the muxponder slice mode for the 2.4TX card.

For more information on the the data rate on each client port, see [Client Pluggables for Configuring Muxponder Slice Modes](#), on page 33.

**Before you begin**

- Install either of the following pluggables in all 6 client ports.
  - QDD-2X100-CWDM4-S
  - QDD-2X100-LR4-S

**Step 1** Specify the card location.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1/NXR0
```

**Step 2** Configure the 2.4TX line cards in the muxponder slice mode.

For 6x2x100pluggables in 1200G trunk mode all client ports are in slice 0. Enter the `muxponder-slice 0` mode.

**Example:**

```
RP/0/RP0/CPU0:ios(config)#muxponder-slice 0
```

**Step 3** Set up the trunk rate for the 2.4T or 2.4TX card.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mp)#trunk-rate 1200G
```

**Step 4** Set up the client rate.

For the 2X100G pluggables, run this command.

**Example:**

```
RP/0/RP0/CPU0:ios(config-hwmod-mp)#client-rate 100GE
```

**Step 5** Save the configuration and exit the muxponder slice mode.

**Example:****Command**

```
RP/0/RP0/CPU0:ios(config-hwmod-mp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mp)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

**Step 6** Verify the 1200-G data rate that you set up.

The following sample shows the 1200-G data rate (**Trunk Bitrate: 1200G**) set up in all 12 client ports.

**Example:**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2/NXR0 muxponder-slice 0
```

```
Thu Nov 16 15:41:25.720 UTC
Location:                0/2/NXR0
Slice ID:                 0
Client Bit100GE
Trunk Bitrate:       1200G
Status:                  Provisioned
rate:                    LLDP Drop Enabled:  FALSE
ARP Snoop Enabled:      FALSE
Client Port              Mapper/Trunk Port      CoherentDSP0/2/0/0
                        Traffic Split Percentage
```

HundredGigEctr1r0/2/0/1/1	ODU-FLEX0/2/0/0/1	100
HundredGigEctr1r0/2/0/1/5	ODU-FLEX0/2/0/0/2	100
HundredGigEctr1r0/2/0/2/1	ODU-FLEX0/2/0/0/3	100
HundredGigEctr1r0/2/0/2/5	ODU-FLEX0/2/0/0/4	100
HundredGigEctr1r0/2/0/3/1	ODU-FLEX0/2/0/0/5	100
HundredGigEctr1r0/2/0/3/5	ODU-FLEX0/2/0/0/6	100
HundredGigEctr1r0/2/0/4/1	ODU-FLEX0/2/0/0/7	100
HundredGigEctr1r0/2/0/4/5	ODU-FLEX0/2/0/0/8	100
HundredGigEctr1r0/2/0/5/1	ODU-FLEX0/2/0/0/9	100
HundredGigEctr1r0/2/0/5/5	ODU-FLEX0/2/0/0/10	100
HundredGigEctr1r0/2/0/6/1	ODU-FLEX0/2/0/0/9	100
HundredGigEctr1r0/2/0/6/5	ODU-FLEX0/2/0/0/10	100

## Muxponder Mode for 2.4TX Card

The muxponder mode enables the 2.4TX card to split wavelengths in specific client ports between the two trunk ports. In the slice mode, the client ports that support wavelength splitting act the same as other client ports. However, in the muxponder mode, the 2.4TX card activates the split client ports. The shared client ports are client port 2 for 600G and client port 3 for 1000G.

### How Muxponder Mode Splits 400GE and 4x100GE Client Traffic

This use case explains the wavelength splitting for 600G trunk rate.

For 600G trunk rate, you must configure client port 1, 2, and 4 as 400GE or 4x100GE. Trunk 0 receives 400GE from port 1. Trunk 7 receives 400GE from port 4. As per split client configuration, port 2 gives 200GE to Trunk 0 and another 200GE to Trunk 7. In this way, both trunk ports deliver 600G trunk rate each.

## Recommended Connections for Point-to-Point Topology in Muxponder Mode

- Connect the port 0 and port 7 in the near end node to their respective port 0 and port 7 in the far end node.
- Make sure the optic fibers connected to trunk ports 0 and 7 are the same length. The difference must be less than 500 m; otherwise, you'll lose traffic on the split port.

## Data Rate Capabilities for the 2.4TX Card

*Table 15: Feature History*

Feature Name	Release Information	Description
Additional Muxponder Mode Trunk Rates for the NCS1K14-2.4T-X-K9 Line Card	Cisco IOS XR Release 24.3.1	The NCS1K14-2.4T-X-K9 line card now supports additional trunk rates of 500G and 900G in muxponder mode, enhancing flexibility and optimizing pluggable count alongside the existing 600G and 1000G rates.

The 2.4TX card supports different trunk rates.

Table 16: Release-Wise Trunk Rates Supported by the 2.4TX Cards

Trunk Rate (G)	Release Introduced
500	24.3.1
600	24.1.1
900G	24.3.1
1000G	24.1.1



**Note** For 600G and 1000G trunk rates, in R24.1.1, the shared client port supports only 400GE client and from R24.3.1, the shared client port supports both 400GE and 4x100GE clients.

## Client Pluggables for Configuring 2.4TX Muxponder Mode

Table 17: Feature History

Feature Name	Release Information	Description
100GE Channel Support for the 600G and 1000G Trunk Rate in NCS1K14-2.4T-X-K9 Muxponder Mode	Cisco IOS XR Release 24.3.1	The NCS1K14-2.4T-X-K9 line card now allows 100G breakout client support for 600G and 1000G trunk rate in muxponder mode. It features 4x100GE breakout channels in shared client ports, enabling easy integration with existing 100G networks using QDD-4X100G-LR-S, QDD-4X100G-FR-S, and QDD-400G-DR4-S pluggable modules. These channels offer high density and bandwidth efficiency without extra costs.

This section provides details about the client pluggable combinations that you need to set up the client rate for each trunk rate.

### Client Pluggable Combinations in Muxponder Mode

The 2.4TX muxponder mode supports various trunk rate per trunk with different client pluggable combinations.



**Note** From R24.3.1, the 2.4TX card supports 100GE client traffic in the shared client port for both 600G and 1000G trunk rates.

The client channel rate in the table refers to both the total client rate and the client rate per channel in the client ports. For example, **2x 400GE + 2x 100GE** indicates that the client traffic consists of two channels at 400GE each and two channels at 100GE each.

**Table 18: 2.4TX Muxponder Mode Port Configurations**

Trunk Rate (G) per Trunk	Total Configured Trunk Rate (G)	Client Channel Rate	Client Pluggable	Shared Client Port	Client Ports
500	1000	2x 400GE + 2x 100GE	2x QDD-400G + 1x QDD-4x100G	2	1, 4
		1x 400GE + 6x 100GE	1x QDD-400G + 2x QDD-4x100G		
		10x 100GE	3x QDD-4x100G		
600	1200	3x 400GE	3x QDD-400G	2	1, 4
		2x 400GE + 4x 100GE	2x QDD-400G + 1x QDD-4x100G		
		1x 400GE + 8x 100GE	1x QDD-400G + 2x QDD-4x100G		
900	1800	4x 400GE + 2x 100GE	4x QDD-400G + 1x QDD-4x100G	3	1, 2, 4, 5
		3x 400GE + 6x 100GE	3x QDD-400G + 2x QDD-4x100G		
		2x 400GE + 10x 100GE	2x QDD-400G + 3x QDD-4x100G		
		1x 400GE + 14x 100GE	1x QDD-400G + 4x QDD-4x100G		
		18x 100GE	5x QDD-4x100G		

Trunk Rate (G) per Trunk	Total Configured Trunk Rate (G)	Client Channel Rate	Client Pluggable	Shared Client Port	Client Ports
1000	2000	5x 400GE	5x QDD-400G	3	1, 2, 4, 5
		4x 400GE + 4x 100GE	4x QDD-400G + 1x QDD-4x100G		
		3x 400GE + 8x 100GE	3x QDD-400G + 2x QDD-4x100G		
		2x 400GE + 12x 100GE	2x QDD-400G + 3x QDD-4x100G		
		1x 400GE + 16x 100GE	1x QDD-400G + 4x QDD-4x100G		

### Understanding Client Rates per Client Port for Each Trunk Rate

The table shows the sample client rate per client port for each trunk rate. This simplified matrix helps you understand the traffic flow in each client port. It also indicates the number of channels that each client port uses to deliver the client traffic. The type of pluggable module inserted in the shared client port determines the traffic rate through breakout and non-breakout channels.

You can customize the configuration by mixing and matching the client pluggable modules according to your requirements.

**Table 19: Client Rate Traffic per Trunk Rate and Client Pluggable Combinations**

Trunk Rate (G) per Trunk	Client Pluggable	Client Rate (GE) per Trunk 0 Client Ports		Client Rate (GE) per Shared Client Ports		Client Rate (GE) per Trunk 1 client ports		
		1	2	2	3	4	5	6
500	2x QDD-400G + 1x QDD-4x100G	400	-	2x 100	-	400	-	-
	1x QDD-400G + 2x QDD-4x100G	400	-	2x 100 <sup>3</sup>	-	4x 100	-	-
	1x QDD-4x100G	4x 100	-	2x 100 <sup>3</sup>	-	4x 100	-	-
600	3x QDD-400G	400	-	400	-	400	-	-
	2x QDD-400G + 1x QDD-4x100G	400	-	4x 100 <sup>3</sup>	-	400	-	-
	1x QDD-400G + 2x QDD-4x100G	400	-	4x 100 <sup>3</sup>	-	4x 100	-	-



Trunk Rate (G) per Trunk	Client Pluggable	Client Rate (GE) per Trunk 0 Client Ports		Client Rate (GE) per Shared Client Ports		Client Rate (GE) per Trunk 1 client ports		
		1	2	2	3	4	5	6
900	4x QDD-400G + 1x QDD-4x100G	400	400	-	2x 100 <sup>3</sup>	400	400	-
	3x QDD-400G + 2x QDD-4x100G	400	400	-	2x 100 <sup>3</sup>	400	4x 100	-
	2x QDD-400G + 3x QDD-4x100G	400	400	-	2x 100 <sup>3</sup>	4x 100	4x 100	-
	1x QDD-400G + 4x QDD-4x100G	400	4x 100	-	2x 100 <sup>3</sup>	4x 100	4x 100	-
	5x QDD-4x100G	4x 100	4x 100	-	2x 100 <sup>3</sup>	4x 100	4x 100	-
1000	5x QDD-400G	400	400	-	400	400	400	-
	4x QDD-400G + 1x QDD-4x100G	400	400	-	4x 100	400	400	-
	3x QDD-400G + 2x QDD-4x100G	400	400	-	4x 100	400	4x 100	-
	2x QDD-400G + 3x QDD-4x100G	400	400	-	4x 100	4x 100	4x 100	-
	1x QDD-400G + 4x QDD-4x100G	400	4x 100	-	4x 100	4x 100	4x 100	-

<sup>3</sup> In this shared port, the pluggable capacity is 400GE or 4x 100GE, but, for this trunk rate, the 2.4TX card consumes only 2x 100GE client data.

## Set Up the Client and Trunk Rate in the Muxponder Mode for the 2.4TX Card

Use this procedure to configure a trunk rate in muxponder mode for the 2.4TX card.



**Note** This procedure considers that you're setting up the 600G trunk rate in the muxponder mode for the 2.4TX card. The commands and output shown are for 600G trunk rate. The commands and output change for other trunk rates.

This procedure uses a mix of client pluggable modules. For this procedure, the card has:

- QDD-4x100G pluggable in shared client port 2, and
- QDD-400G pluggable in client ports 1 and 4



**Note** For the 600G trunk rate, the split port supports both 400GE and 4x100GE. For more information on required pluggable modules for other trunk rates, see [Client Pluggables for Configuring 2.4TX Muxponder Mode](#), on page 40.

### Before you begin

- Install the pluggables as required.
  - QDD-400G
  - QDD-4x100G

**Step 1** Specify the card location.

**Example:**

```
RP/0/RP0/CPU0:ios (config) #hw-module location 0/1/NXR0
```

**Step 2** Enter the muxponder card mode.

**Example:**

```
RP/0/RP0/CPU0:ios (config-hwmod) #muxponder
```

**Step 3** Set up the trunk rate.

**Example:**

```
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #trunk-rate 600G
```

**Step 4** Set up the client rate for the QDD-400G and QDD-4x100G pluggable modules.

**Example:**

```
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 1 client-type 400GE
// QDD-400G pluggable in client port 1
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 2 lane 1 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 2 lane 2 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 2 lane 3 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 2 lane 4 client-type 100GE
// Enter lane for the QDD-4x100G pluggable in client port 2
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #client-port-rate 4 client-type 400GE
```

**Note** Use the **lane** keyword to set up the 100GE client rate in the client ports.

**Step 5** Save the configuration and exit the muxponder mode.

**Example:**

```
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #commit
RP/0/RP0/CPU0:ios (config-hwmod-mxp) #exit
// Exits muxponder mode
RP/0/RP0/CPU0:ios (config) #exit
// Exits configuration modrer
```

**Step 6** Verify the 600G mixed client rate configured for the 2.4TX muxponder mode.

The sample shows the 600G data rate (**Trunk Bitrate: 600G**) set up in client ports 1 and 4 (**FourHundredGigECtrlr0/2/0/1** and **FourHundredGigECtrlr0/2/0/4**) and split client port 2 with breakout lanes 1 to 4 (**HundredGigECtrlr0/2/0/2/1** to **HundredGigECtrlr0/2/0/2/4**).

**Example:**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2/NXR0 mxponder
```

```
Location:                0/2/NXR0
Client Bitrate:          MIXED
Trunk Bitrate:           600G
Status:                  Provisioned
LLDP Drop Enabled:      FALSE
ARP Snoop Enabled:      FALSE
Client Port              Mapper/Trunk Port          CoherentDSP0/2/0/0    CoherentDSP0/2/0/7
                                                                    Traffic Split Percentage

FourHundredGigECtrlr0/2/0/1  ODU-FLEX0/2/0/0/1                100
0
HundredGigECtrlr0/2/0/2/1   ODU-FLEX0/2/0/0/2/1              100
0
HundredGigECtrlr0/2/0/2/2   ODU-FLEX0/2/0/0/2/2              100
0
HundredGigECtrlr0/2/0/2/1   ODU-FLEX0/2/0/7/2/3                0
100
HundredGigECtrlr0/2/0/2/2   ODU-FLEX0/2/0/7/2/4                0
100
FourHundredGigECtrlr0/2/0/4  ODU-FLEX0/2/0/7/4                  0
100
```





## CHAPTER 3

# Configuring Controllers

There are three types of controllers for the line card. The controllers are the optics controller, the ethernet controller, and the coherent DSP controller. This chapter describes the procedures used to configure these controllers.

- [AINS, on page 47](#)
- [FEC, on page 54](#)
- [Laser Squelching, on page 58](#)
- [Idle Insertion, on page 62](#)
- [FlexO GID and IID, on page 68](#)
- [Link Layer Discovery Protocol \(LLDP\) Support on Management Interface, on page 69](#)
- [MAC Address Snooping on Client Ports, on page 73](#)
- [Transmit Shutdown, on page 75](#)
- [Loopback, on page 77](#)
- [Restore Factory Settings, on page 84](#)
- [Headless Mode, on page 85](#)
- [Trail Trace Identifier, on page 86](#)
- [Chromatic Dispersion, on page 89](#)
- [Transmit Power, on page 92](#)
- [Laser Bias Current High Threshold, on page 93](#)
- [Differential Group Delay Threshold, on page 95](#)
- [Optical Signal to Noise Ratio, on page 97](#)
- [Receive Power Threshold, on page 99](#)
- [Transmit Power Threshold, on page 101](#)
- [Frequency, on page 103](#)
- [Pseudo Random Binary Sequence, on page 103](#)
- [CCMD-16 Controllers, on page 110](#)
- [Configure Controller Parameters for NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L Cards, on page 113](#)
- [Configure Rx VOA Fixed Ratio to Zero, on page 118](#)

## AINS

The Automatic-In-Service (AINS) feature allows the controller to automatically move to the automatic-in-service state after the maintenance window is completed. A soak time period is associated with

the AINS state. The controller automatically moves to the In-Service state after the soak time period is completed. During the AINS maintenance window, alarms are not propagated to the EMS/NMS monitoring system.

You can configure AINS on the client ports of the QXP, 1.2T, 2.4T, and 2.4TX cards.

## AINS States

The following table lists the AINS states.

State	Description
None	AINS is not enabled on the controller or the soak time period is complete.
Pending	AINS is configured on the controller. However, the soak time period has not started because either the primary state of controller is in Shutdown, Admin down, or Not ready state or the secondary state is in Maintenance state. AINS can also move to Pending state if alarms are raised during the soak time period.
Running	AINS is enabled on the controller. The primary state of the controller is Up and the secondary state is AINS.

If there are any service-affecting alarms when AINS is running on ethernet or optics controllers, the AINS state moves to Pending state. When the alarms are cleared, the AINS state moves to Running state.

The AINS soak time period restarts when there are line card reloads, XR reloads, line card warm reloads, power cycles, or alarm conditioning.

## Soak Time Period

You can configure the soak time period to be between 1 minute to 48 hours.

All alarms are suppressed during the AINS state. When the optical and ethernet alarms are raised on the port during the soak time period, the AINS state moves to Pending. These alarms are not displayed in the output of the **show alarms brief card location 0/RP0/CPU0 active** command but in the output of the **show alarms brief card location 0/RP0/CPU0 conditions** command. When all the alarms clear, the soak time period starts, and the AINS state moves to Running. When the soak time period expires, the port moves to IS state.

## Configuring AINS

To configure AINS on a controller, use the following command:

**automatic-in-service controller** *controller rate controller* **hours** *hours* **minutes** *minutes*

The following is a sample to configure AINS on a controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#automatic-in-service controller coherentDSP 0/0/0/12 hours 0 minutes 15
RP/0/RP0/CPU0:ios(config)#commit
```

To configure AINS on a muxponder slice, use the following command:

**configure**

**hw-module location** *location mxponder-slice slice-number client-port-ains-soak hours hours minutes minutes*

**commit**

The following is a sample in which slice 0 client ports are configured with AINS with soak time period specified to be 40 minutes.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3/nxr0 mxponder-slice 0 client-port-ains-soak
  hours 0 minutes 40
RP/0/RP0/CPU0:ios(config)#commit
```

To configure AINS globally, use the following command:

**ains-soak hours hours minutes minutes**

The following is a sample to configure AINS globally.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#ains-soak hours 0 minutes 15
RP/0/RP0/CPU0:ios(config)#commit
```

## Disabling AINS

To disable AINS on all muxponder client ports, set the hours and minutes to 0. Use the following commands:

**configure**

**hw-module location** *location mxponder-slice slice-number client-port-ains-soak hours hours minutes minutes*

**commit**

The following is a sample in which AINS is disabled on all client ports.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3/nxr0 mxponder-slice 0 client-port-ains-soak
  hours 0 minutes 0
RP/0/RP0/CPU0:ios(config)#commit
```

To disable AINS on a muxponder slice, set the hours and minutes to 0. Use the following command:

**configure**

**hw-module location** *location mxponder-slice slice-number client-port-ains-soak hours hours minutes minutes*

**commit**

The following is a sample in which AINS is disabled on all client ports of slice 0.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3/nxr0 mxponder-slice 0 client-port-ains-soak
  hours 0 minutes 0
RP/0/RP0/CPU0:ios(config)#commit
```

## Displaying the AINS Configuration

The AINS Soak field in the output indicates the current state of AINS. The current state can be None, Pending, or Running. The Total Duration field indicates the total soak time period that is configured. The Remaining Duration field indicates the soak time that remains, after which, the AINS state moves to None.

This example displays the ethernet controller statistics with AINS Soak in running state.

```
RP/0/RP0/CPU0:ios#show controller HundredGigECtrlr 0/1/0/2
```

```
Thu Feb 21 19:52:55.001 UTC
```

```
Operational data for interface HundredGigECtrlr0/1/0/2:
```

```
State:
```

```
Administrative state: enabled
```

```
Operational state: Up
```

```
LED state: Green On
```

```
Maintenance: Disabled
```

```
AINS Soak: Running
```

```
  Total Duration: 0 hour(s) 15 minute(s)
```

```
  Remaining Duration: 0 hour(s) 5 minute(s) 37 second(s)
```

```
Laser Squelch: Disabled
```

```
Phy:
```

```
Media type: Not known
```

```
Autonegotiation disabled.
```

```
Operational values:
```

```
Speed: 100Gbps
```

```
Duplex: Full Duplex
```

```
Flowcontrol: None
```

```
Loopback: None (or external)
```

```
BER monitoring:
```

```
  Not supported
```

```
Holdoff Time: 0ms
```

This example displays the ethernet controller statistics with AINS Soak in pending state.

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

```
Thu Mar 12 13:52:12.129 UTC
```

```
Operational data for interface HundredGigECtrlr0/0/0/2:
```

```
State:
```

```
Administrative state: enabled
```

```
Operational state: Down (Reason: State undefined)
```

```
LED state: Red On
```

```
Maintenance: Disabled
```

```
AINS Soak: Pending
```

```
  Total Duration: 0 hour(s) 30 minute(s)
```

```
  Remaining Duration: 0 hour(s) 30 minute(s) 0 second(s)
```

```
Laser Squelch: Disabled
```

```
Phy:
```

```
Media type: Not known
```

```
Alarms:
```

```
  Current:
```

```
    Local Fault
```

```
Statistics:
```

```
  FEC:
```

```
    Corrected Codeword Count: 0
```

```
    Uncorrected Codeword Count: 9
```

```
Autonegotiation disabled.
```



```
Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  BER monitoring:
    Not supported
  Forward error correction: Standard (Reed-Solomon)
  Holdoff Time: 0ms
```

This example displays the optics controller statistics with AINS Soak in running state.

```
RP/0/RP0/CPU0:ios#show controller optics 0/1/0/3
Thu Feb 21 19:45:41.088 UTC

Controller State: Up

Transport Admin State: Automatic In Service

Laser State: On

LED State: Green

Optics Status

  Optics Type: 400G QSFP-DD DR4

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

  LOS/LOL/Fault Status:

  Alarm Statistics:
  -----
  HIGH-RX-PWR = 0           LOW-RX-PWR = 0
  HIGH-TX-PWR = 0           LOW-TX-PWR = 0
  HIGH-LBC = 0             HIGH-DGD = 0
  OOR-CD = 0               OSNR = 0
  WVL-OOL = 0             MEA = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0

  Performance Monitoring: Enable

  THRESHOLD VALUES
  -----

  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----
  Rx Power Threshold(dBm)   4.9        -12.0     0.0           0.0
  Tx Power Threshold(dBm)   3.5        -10.1     0.0           0.0
  LBC Threshold(mA)         N/A        N/A       0.00          0.00

  LBC High Threshold = 98 %
  Polarization parameters not supported by optics

Total TX Power = 6.39 dBm

Total RX Power = 5.85 dBm
```

Lane	Laser Bias	TX Power	RX Power	Output Frequency
1	75.0 %	0.59 dBm	0.63 dBm	230.43 THz
2	68.6 %	0.06 dBm	-0.68 dBm	230.43 THz
3	69.0 %	0.26 dBm	-0.63 dBm	230.43 THz
4	69.1 %	0.56 dBm	-0.10 dBm	230.43 THz

## Transceiver Vendor Details

```

Form Factor   : QSFP-DD
Name          : INNOLIGHT
Part Number   : T-DP4CNT-NGL
Rev Number    : 1A
Serial Number  : INLBFI940027
PID          : T-DP4CNT-NGL
VID          : 1A
Date Code(yy/mm/dd) : 21/08/21
Fiber Connector Type: MPO
Otn Application Code: Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: 400GBASE-DR4

```

Transceiver Temperature : 32 Celsius

```

AINS Soak           : Running
AINS Timer        : 0h, 15m
AINS remaining time : 771 seconds

```

When the soak time expires, AINS state changes from Running to None. The Transport Admin State of optics controller changes from Automatic In Service to In Service.

```
RP/0/RP0/CPU0:ios# show controllers optics 0/1/0/3
```

Thu Feb 21 20:02:34.126 UTC

Controller State: Up

**Transport Admin State: In Service**

Laser State: On

LED State: Green

Optics Status

Optics Type: Grey optics

Alarm Status:

-----  
Detected Alarms: None

LOS/LOL/Fault Status:

Alarm Statistics:

```

-----
HIGH-RX-PWR = 0          LOW-RX-PWR = 0
HIGH-TX-PWR = 0          LOW-TX-PWR = 0
HIGH-LBC = 0             HIGH-DGD = 0
OOR-CD = 0               OSNR = 0
WVL-OOL = 0              MEA = 0

```

```
IMPROPER-REM = 0
TX-POWER-PROV-MISMATCH = 0
```

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	4.9	-12.0	0.0	0.0
Tx Power Threshold(dBm)	3.5	-10.1	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 98 %  
Polarization parameters not supported by optics

Total TX Power = 6.41 dBm

Total RX Power = 5.85 dBm

Lane	Laser Bias	TX Power	RX Power	Output Frequency
1	74.9 %	0.60 dBm	0.63 dBm	230.43 THz
2	68.6 %	0.06 dBm	-0.70 dBm	230.43 THz
3	69.0 %	0.30 dBm	-0.63 dBm	230.43 THz
4	69.1 %	0.57 dBm	-0.11 dBm	230.43 THz

Transceiver Vendor Details

```
Form Factor      : QSFP28
Name             : CISCO-FINISAR
Part Number      : FTLC1152RGPL-C2
Rev Number       : CISCO-FINISAR
Serial Number    : FNS22150LEC
PID              : QSFP-100G-CWDM4-S
VID              : V02
CISCO-FINISAR
Date Code(yy/mm/dd) : 18/04/11
Fiber Connector Type: LC
Sonet Application Code: Not Set
Ethernet Compliance Code: 100GBASE-CWDM4
```

Transceiver Temperature : 32 Celsius

```
AINS Soak           : None
AINS Timer         : 0h, 0m
AINS remaining time : 0 seconds
```

This example displays the coherentDSP controller statistics with AINS Soak in running state for a 2.4TX card.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7
Port                : CoherentDSP 0/0/0/7
Controller State    : Up
Inherited Secondary State : Automatic-In-Service
Configured Secondary State : Normal
Derived State       : Automatic-In-Service
Loopback mode       : None
BER Thresholds      : SF = 1.0E-5 SD = 1.0E-7
Performance Monitoring : Enable
Bandwidth           : 800.0Gb/s
```

```

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0          SF_BER = 0
SD_BER = 0          BDI = 0 TIM = 1
FECMISMATCH = 0 FEC-UNC = 0          FLEXO_GIDM = 1
FLEXO-MM = 0          FLEXO-LOM = 0          FLEXO-RDI = 1
FLEXO-LOF = 1
Detected Alarms                          : None

Bit Error Rate Information
PREFEC BER                               : 2.95E-04
POSTFEC BER                              : 0.00E+00
Q-Factor                                  : 10.70 dB

Q-Margin                                  : 4.40 dB

Instantaneous Q-Margin                    : 4.40 dB

TTI :
    Remote hostname                       : chassisA164
    Remote interface                       : CoherentDSP 0/1/0/7
    Remote IP addr                         : 0.0.0.0

FEC mode                                  : Soft-Decision 15

Flexo-Mode                                : Enable
Flexo Details:
    Tx GID                                 : 1
    TX IID                                 : 1, 2, 3, 4, 5, 6, 7, 8,
    Rx GID                                 : 1
    RX IID                                 : 1, 2, 3, 4, 5, 6, 7, 8,

AINS Soak                                  : Running
AINS Timer                                  : 0h, 20m
AINS remaining time                        : 1196 seconds

```

## FEC

Forward Error Correction (FEC) is used for controlling errors during data transmission. This feature can be enabled on 1.2T and 2.4T cards and works by adding data redundancy to the transmitted message using an algorithm. This redundancy allows the receiver to detect and correct a limited number of errors occurring anywhere in the message, instead of having to ask the transmitter to resend the message.

FEC is automatically enabled on the pluggables installed in the Cisco NCS 1014. When you upgrade the software of an NCS 1014 with pluggables in the FEC disabled mode, traffic is affected.

The following sample shows the running FEC configuration on a 2.4T card:

```

RP/0/RP0/CPU0:ios#sh controllers fourHundredGigEctrlr 0/1/0/1
Fri Nov 17 10:01:22.840 UTC
Operational data for interface FourHundredGigEctrlr0/1/0/1:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Enabled
  AINS Soak: None

```

```

Total Duration: 0 hour(s) 0 minute(s)
Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled

```

## Phy:

Media type: Not known

## Statistics:

## FEC:

Corrected Codeword Count: 72671614	Valid: True	Start time:
15:53:12 Thu Nov 16 2023		
Uncorrected Codeword Count: 12	Valid: True	Start time:
15:53:12 Thu Nov 16 2023		
PCS:		
Total BIP errors: 0	Valid: True	Start time:
15:53:12 Thu Nov 16 2023		
Total frame errors: 0	Valid: False	Start time:
15:53:12 Thu Nov 16 2023		
Total Bad SH: 0	Valid: False	Start time:
15:53:12 Thu Nov 16 2023		

Autonegotiation disabled.

## Operational values:

```

Speed: 400Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: Line
BER monitoring:
  Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms

```

## Configuring FEC on the Ethernet Controller

To configure FEC on the Ethernet controller, use the following command:

**configure**

```
controller { HundredGigECtrlr | fourHundredGigECtrlr } R/S/I/P fec { none | standard }
```

**commit**

The following samples show how to configure FEC on the Ethernet controller:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/6/ fec standard
RP/0/RP0/CPU0:ios(config)#commit

```

The following sample shows the running FEC configuration on the Ethernet controller:

```

RP/0/RP0/CPU0:BH-SIT2#show controller HundredGigECtrlr 0/1/0/6
Tue Jul 16 15:30:30.165 IST
Operational data for interface HundredGigECtrlr0/1/0/6/2:

```

## State:

```

Administrative state: enabled
Operational state: Down (Reason: State undefined)
LED state: Red On
Maintenance: Disabled
AINS Soak: None

```

```

Total Duration: 0 hour(s) 0 minute(s)
Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled

```

```

Phy:
Media type: Not known
Alarms:
  Current:
    Loss of Frequency Sync Data
Statistics:
  FEC:
    Corrected Codeword Count: 0
    Uncorrected Codeword Count: 0

```

Autonegotiation disabled.

```

Operational values:
Speed: 100Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
BER monitoring:
  Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms

```

From Release 24.2.11, the **show controllers** command output displays post FEC BER and pre FEC BER for the Ethernet controllers of the 2.4T and 2.4TX cards.

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/1/0/2
Thu Jan 18 18:58:03.846 UTC
Operational data for interface FourHundredGigEctr1r0/1/0/2:

```

```

State:
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Disabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled

```

```

Phy:
Media type: Not known
Statistics:
  FEC:
    Corrected Codeword Count: 358543          Valid: True      Start time:
18:54:03 Thu Jan 18 2024
    Uncorrected Codeword Count: 0            Valid: True      Start time:
18:54:03 Thu Jan 18 2024
  PCS:
    Total BIP errors: 0                      Valid: True      Start time:
18:54:03 Thu Jan 18 2024
    Total frame errors: 0                   Valid: False     Start time:
18:54:03 Thu Jan 18 2024
    Total Bad SH: 0                         Valid: False     Start time:
18:54:03 Thu Jan 18 2024

```

Autonegotiation disabled.

Operational values:

```

Speed: 400Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
Pre FEC BER: 9.1E-10
Post FEC BER: 0.0E+00
BER monitoring:
    Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms

```

## FEC States for CoherentDSP Controller

The following table lists the FEC states for the coherentDSP controllers.

**Table 20: FEC State for CoherentDSP Controllers**

State	Description
EnhancedSD15	FEC Soft-Decision 15. (Default)

## Q-Margin Support

Q-margin is an important optical parameter that characterizes the health of an optical link. The Q-margin value is calculated based on the average bit error rate (BER) in the optical link.

### Enhanced Q-Margin Support

Enhanced Q-Margin is supported for Forward Error Correction (FEC) and Performance Monitoring on CoherentDSP controllers for 2.4T cards. Enhanced Q-margin provides a better error free signal in the optical link. The enhanced Q-margin value is calculated based on the maximum number of errors per frame. An attribute that is called instantaneous Q-margin is displayed in the output of the **show controllers coherentDSP** command. The lower the delta value between the instantaneous Q-margin value with the Q-margin value, the better the FEC performance of the NCS 1014 system. The instantaneous Q-margin values thus help you to optimize the system with continuous error correction in subsea transport networks.

## Configuring FEC on CoherentDSP Controllers

To configure FEC on the CoherentDSP controller, use the following command:

```

configure
controller coherentDSP R/S/I/P
fec {EnhancedSD15}
commit

```

The following sample shows how to configure FEC on the CoherentDSP controller:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ios(config-CoDSP)#fec EnhancedSD15
Tue Feb 25 11:25:52.670 UTC
WARNING! Changing FEC mode can impact traffic
RP/0/RP0/CPU0:ios(config-CoDSP)#commit

```

## Verifying FEC on CoherentDSP Controllers

The following sample shows the FEC configuration on the CoherentDSP controller:

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

Tue Feb 25 11:26:08.235 UTC

Port                               : CoherentDSP 0/0/0/0
Controller State                    : Up
Inherited Secondary State          : Normal
Configured Secondary State        : Normal
Derived State                      : In Service
Loopback mode                      : None
BER Thresholds                    : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring             : Enable
Bandwidth                          : 50.0Gb/s
Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0          SF_BER = 0
SD_BER = 0          BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                   : None
Bit Error Rate Information
PREFEC BER                        : 0.00E+00
POSTFEC BER                       : 0.00E+00
Q-Factor                          : 0.00 dB
Q-Margin                          : -5.00dB
Instantaneous Q_margin            : 0 dB

TTI :
Remote IP addr                    : 0.0.0.0
FEC mode                        : Soft-Decision 15

AINS Soak                         : None
AINS Timer                        : 0h, 0m
AINS remaining time               : 0 seconds
```

## Laser Squelching

You can enable laser squelching on Ethernet controllers. Laser squelching can be enabled on QXP, 1.2T, 2.4T, and 2.4TX cards which shuts down the laser in the event of trunk faults (LOS, LOF), and a SQUELCHED alarm is raised on the mapped client port.

Laser squelching uses an interrupt based method. Hence squelching happens faster when compared to previous releases. Squelch happens for client alarms also like Ingress LF, LOA, and CSF (not for egress client alarms) in addition to trunk fault cases.

To configure laser squelching on 1.2T card, use the following commands:

**configure**

**controller HundredGigECtrlr** *Rack/Slot/Instance/Port*

**laser-squelch**



**commit**

To configure laser squelching on a 2.4T and 2.4TX cards, use the following commands:

**configure**

**controller HundredGigECtrlr** *Rack/Slot/Instance/Port/Lane* | **controller fourHundredGigECtrlr**  
*Rack/Slot/Instance/Port*

**laser-squelch****commit**

**Note** In case of muxponder configuration on the 2.4TX card, and if laser squelch is configured on the split port, whenever a fault is received on any one trunk, the corresponding split port will be squelched.

The following is a sample where laser squelching is enabled on the Ethernet controller of a 2.4T card and a 2.4TX card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller fourHundredGigECtrlr 0/1/0/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#laser-squelch
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following is a sample to view the laser squelch status on the controller of a 2.4T card and a 2.4TX card.

```
RP/0/RP0/CPU0:ios#show controllers fourHundredGigECtrlr 0/0/0/4
Fri Nov 17 14:26:43.213 UTC
Operational data for interface FourHundredGigECtrlr0/0/0/4:
```

## State:

```
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Disabled
AINS Soak: Running
  Total Duration: 0 hour(s) 5 minute(s)
  Remaining Duration: 0 hour(s) 3 minute(s) 34 second(s)
Laser Squelch: Enabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled
```

## Phy:

Media type: Not known

## Statistics:

```
FEC:
  Corrected Codeword Count: 580070472          Valid: False      Start time:
13:12:29 Fri Nov 17 2023
  Uncorrected Codeword Count: 0                Valid: False      Start time:
13:12:29 Fri Nov 17 2023
PCS:
  Total BIP errors: 0                          Valid: False      Start time:
13:12:29 Fri Nov 17 2023
  Total frame errors: 0                       Valid: False      Start time:
13:12:29 Fri Nov 17 2023
  Total Bad SH: 0                             Valid: False      Start time:
13:12:29 Fri Nov 17 2023
```

Autonegotiation disabled.

```
Operational values:
Speed: 400Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
BER monitoring:
    Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms
```

## Protection Switching Use Cases

Fast-Squelching provides increased protection switching speed when there is a trunk fault or a client fault. Fast-Squelching is supported on 1.2T cards.



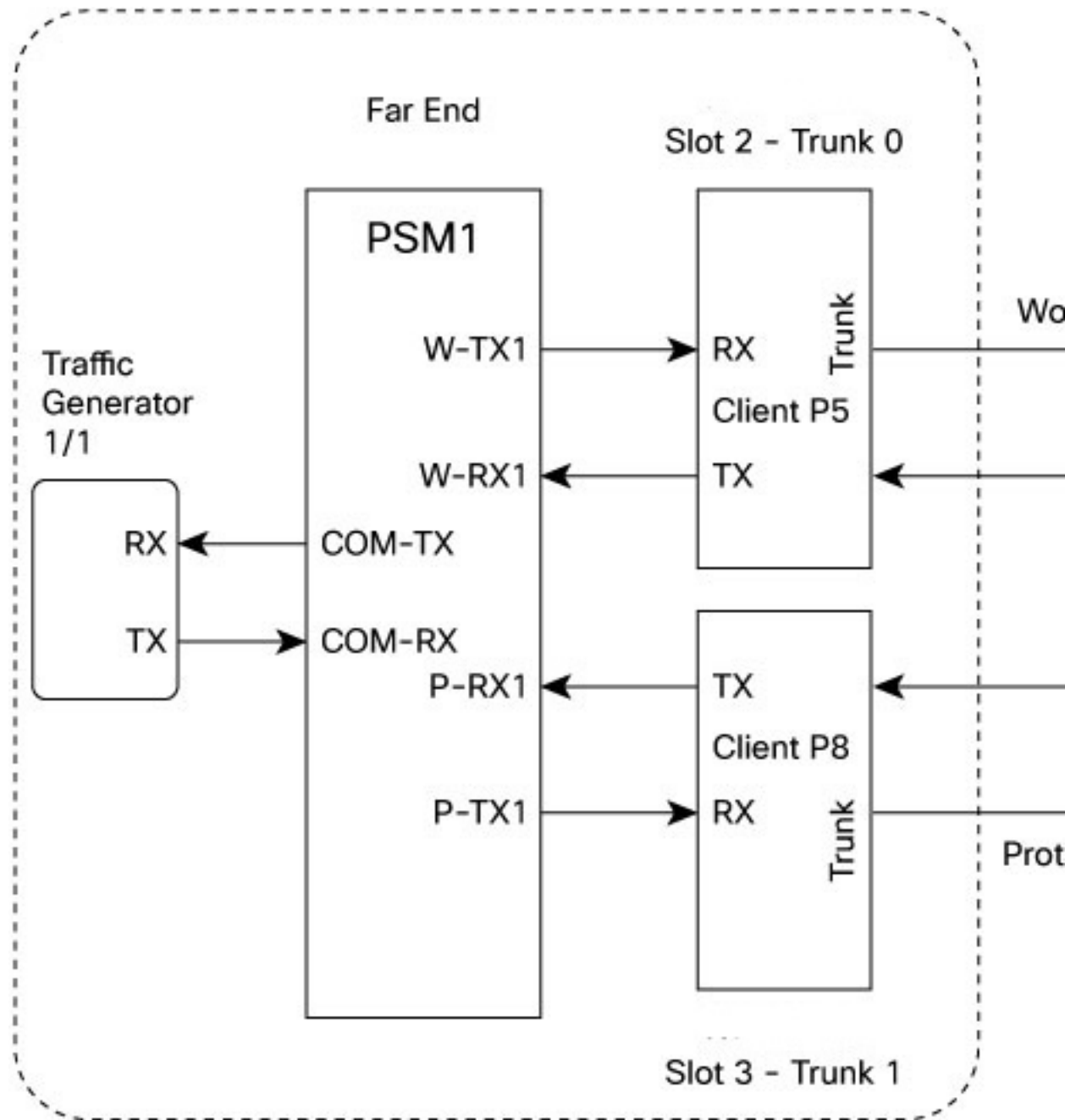
---

**Note** Protection Switching is not supported on 2.4T card.

---

The following sample topology includes a Far End (FE) station and a Near End (NE) station. Each station includes an NCS 1014 node having two line cards. The nodes are connected to the respective Traffic generators through a Protection Switching Module (PSM).

Figure 5: Reference Topology for Protection Switching



**Protection Switching Principle (Trunk fault)**

If there is a fiber cut in the trunk working path from the FE station to the NE station, an LOS alarm is raised on the NE working trunk. This results in the squelching of all client ports mapped to the working NE trunk port. As the laser of the client port is squelched, LOS is reported on the W-RX2 port of the PSM2. As the received optical power on the W-RX2 port of PSM is below the threshold, PSM2 switches to receive the optical signal in the P-RX2 port instead of the W-RX2 port. Hence switching happens for traffic from work to protect in FE station to NE station direction.

In the case of a unidirectional trunk fault, switching happens in one direction as explained above. In the other direction, when LOS is received at the W-RX2 port of PSM2, W-TX2 sends LOS for 25 milliseconds. When LOS is reported on the NE client port, fault gets propagated over the trunk, resulting in the squelching of FE station client ports. Finally, the LOS on the PSM port results in switching in this direction as well. In this way, bidirectional switching is implemented.

### Protection Switching Principle (Client fault)

When a client failure happens on the FE station, a Client Signal Failure (CSF) alarm is raised on the NE station trunk. The CSF on the trunk results in the squelching of the corresponding client port, and the PSM switching happens. In summary, a fault on the NE station client RX port results in CSF on the FE station trunk, and the switching happens. And, a fault on the NE station client TX port results in LOS on the PSM ports, and the switching happens.



#### Note

- PSM must be in the standalone mode.
- PSM alarm threshold must be set to +/-3 dBm from the actual power received in the PSM RX port.
- If line card protection is required, the working and protect path must be configured in two different line cards.
- If only client protection is required, the working and protection path can be configured in the same line card.
- If the LC trunk configuration is x50 rate, then we can't use single line card for work and protection due to x50 coupled mode limitations (coupled trunk).
- Manual switch, Force switch, and lock-out protection on PSM, result in bidirectional switching.

## Idle Insertion

When a fault occurs on the trunk port, you can hold the propagation of local faults using the idle insertion feature. This feature is can be enabled on the ethernet controllers of 1.2T, 2.4T, and 2.4TX cards by configuring the hold-off timer.

When the fault occurs on the trunk, idles are inserted in the traffic stream from the trunk port to the client port for the duration of the configured holdoff-time. If the trunk port remains faulty beyond the configured holdoff-time, a local fault is transmitted towards the client device. If the trunk recovers from the fault before the holdoff-time expires, traffic resumes.

This feature can be used on customer deployments to prevent reset of client ports during a PSM switchover.

### Configure Idle Insertion

You can enable the idle insertion feature on a 1.2T card using the following commands:

```
configure
```

```
controller HundredGigECtrlr Rack/Slot/Instance/Port
```

```
holdoff-time trunk-fault time-value
```

You can enable the idle insertion feature on 2.4T card and 2.4TX card using the following commands:

**configure**

**controller HundredGigECtrlr** *Rack/Slot/Instance/Port/Lane* | **controller fourHundredGigECtrlr** *Rack/Slot/Instance/Port*

**holdoff-time trunk-fault** *time-value*

The range of *timevalue* is from 0 ms to 3000 ms.



**Note** In case of muxponder configuration on the 2.4TX card, holdoff timer is not supported on the split ports.

**Example 1**

The following is a sample for enabling the hold off -timer in 100GE controller:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/0/0/4/1
RP/0/RP0/CPU0:ios (config-eth-ctrlr)#holdoff-time trunk-fault 3000
RP/0/RP0/CPU0:ios (config-eth-ctrlr)#commit
```

**View Hold Off Timer**

To view the hold-off time that is configured on 100GE controller, use the following command:

**show controllers hundredGigECtrlr** *Rack/Slot/Instance/Port*

**Example 2**

```
RP/0/RP0/CPU0:ios#show controllers HundredGigECtrlr 0/1/0/1
Fri Feb 22 18:58:06.888 UTC
Operational data for interface HundredGigECtrlr0/1/0/1:
```

State:

```
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Disabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
```

Phy:

```
Media type: Not known
Statistics:
  FEC:
    Corrected Codeword Count: 0
    Uncorrected Codeword Count: 0
```

Autonegotiation disabled.

Operational values:

```
Speed: 100Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
BER monitoring:
```

```

Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 3000ms

```

## Idle Insertion for Ethernet Controllers

Idle insertion for Ethernet controllers feature allows you to perform end-to-end link verification between 100GE or 400GE Ethernet controllers before bringing up the actual traffic. This feature enables you to perform pre-provisioning checks to isolate link errors in advance without any Ethernet testers.



**Note** OTU4 client rate is not supported.

Idle frames can be inserted in both the ingress and egress directions on Ethernet controllers and the LOCAL-FAULT and REMOTE-FAULT alarms are cleared. The performance monitoring counters on the pcs layer are monitored to check for any errors on the link.

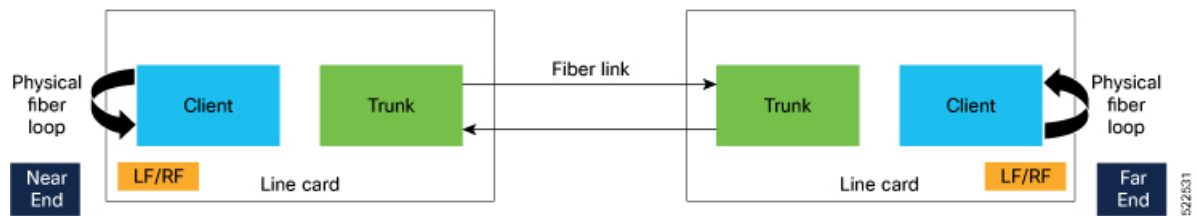


**Warning** Do not configure the Idle insertion for Ethernet controllers feature on the link that carries live traffic.

## Recommended Topology for Link Verification

The following diagram describes the recommended topology for link verification:

**Figure 6: Topology for Link Verification**



The following steps describe the sequence for link verification using this topology:

1. Both the near-end and far-end clients have the LOCAL-FAULT alarm if the trunk is up on both the ends.
2. Enable idle ingress on the near-end client. The idle frame transmits toward the trunk link and reaches the far-end client. The LOCAL-FAULT alarm is then cleared on the far-end client.
3. As the far-end client has fiber loop, the idle frame is inserted again into the same client RX toward the trunk link and reaches the near-end client. The LOCAL-FAULT alarm is then cleared on the near-end client as well.
4. When you enable idle insertion on any client and in any direction, the idle frame transmits in loop similar to this topology and all the LOCAL-FAULT and the REMOTE-FAULT alarms are cleared.
5. The link can be monitored after all the alarms are cleared. The link has a problem if any alarm is reported during the link test.

## Configuring Idle Insertion for Ethernet Controllers

### Before You Begin:

- Do not configure idle frame insertion with hold-off timer.

You can configure this feature by using the following commands:

```
configure  
controller hundredGigECtrlr Rack/Slot/Instance/Port/  
insert-idle ingress  
insert-idle egress  
commit  
end
```

The following is a sample for enabling the idle ingress and idle egress in 100GE controllers:

```
RP/0/RP0/CPU0:ios#configure  
RP/0/RP0/CPU0:ios(config)#controller hundredGigECtrlr 0/2/0/2  
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#insert-idle ingress  
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#insert-idle egress  
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit  
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#end
```

You can disable this feature by using the following commands:

```
configure  
controller hundredGigECtrlr Rack/Slot/Instance/Port  
no insert-idle ingress  
no insert-idle egress  
commit  
end
```

### Limitation

After disabling the idle frame insertion feature, the LOCAL-FAULT or REMOTE-FAULT alarm may not appear again because the idle frames are in loop. Hence, you must break the idle frame loop in the link by performing either one of the following:

- Perform fiber OIR on either the near-end or far-end client port.
- Perform shut and unshut operation on any client port.

## Verifying Idle Insertion Configuration for Ethernet Controllers

To verify the *idle ingress* and *idle egress* that is configured on the Ethernet controllers of a 1.2T card, use the following command:

```
RP/0/RP0/CPU0:ios# show controllers hundredGigECtrlr Rack/Slot/Instance/Port
```

### Example

```
RP/0/RP0/CPU0:ios#show controllers hundredGigEctrlr 0/2/0/2
Wed Mar 30 06:56:58.878 UTC
Operational data for interface HundredGigEctrlr0/2/0/2:
State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Disabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  Laser Squelch: Disabled
```

**Insert Idle Ingress: Enabled**

**Insert Idle Egress: Enabled**

```
Phy:
  Media type: Not known
  Statistics:
    FEC:
      Corrected Codeword Count: 0
      Uncorrected Codeword Count: 0
Autonegotiation disabled.
Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  BER monitoring:
    Not supported
  Forward error correction: Standard (Reed-Solomon)
  Holdoff Time: 0ms
```

## Enable Idle Insertion on QXP Card

You can enable idle insertion on 100GE or 400GE controllers for the QXP card.

### Configure Idle Insertion on 100GE Controllers

To configure idle insertion on the 100GE controllers for the QXP card, use the following commands:

**configure**

**controller HundredGigEctrlr** *Rack/Slot/Instance/Port*

**holdoff-time trunk-fault** *time-value*

**commit**

The range of *timevalue* is from 0 ms to 3000 ms.

The following is a sample where idle insertion is enabled on the 100GE controller for the QXP card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigEctrlr 0/1/0/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#holdoff-time trunk-fault 3000
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following is a sample to view the idle insertion status on the 100GE controller.



```

RP/0/RP0/CPU0:ios#show controller hundredGigEctrler 0/1/0/1
Fri Jul 23 16:07:11.541 UTC
Operational data for interface HundredGigEctrler0/1/0/1:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Disabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  Laser Squelch: Enabled

Phy:
  Media type: Not known
Statistics:
FEC:
Corrected Codeword Count: 134967789
Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  BER monitoring:
    Not supported
    Forward error correction: Standard (Reed-Solomon)
  Holdoff Time: 3000ms

```

### Configure Idle Insertion on 400GE Controllers

To configure idle insertion on the 400GE controllers for the QXP card, use the following commands:

```

configure
controller fourHundredGigEctrler Rack/Slot/Instance/Port
holdoff-time trunk-fault time-value
commit

```

The following is a sample where idle insertion is enabled on the 400GE controller for the NCS1K4-QXP-K9 card.

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller fourHundredGigEctrler 0/0/0/10
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#holdoff-time trunk-fault 2000
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit

```

The following is a sample to view the idle insertion status on the 400GE controller.

```

RP/0/RP0/CPU0:ios#show controller fourhundredGigEctrler 0/0/0/10
Fri Jul 23 16:07:11.541 UTC
Operational data for interface fourHundredGigEctrler0/0/0/10:

State:
  Administrative state: enabled

```

```

Operational state: Up
LED state: Green On
Maintenance: Disabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Enabled

Phy:
  Media type: Not known
Statistics:
FEC:
Corrected Codeword Count: 134967789
Uncorrected Codeword Count: 0

Autonegotiation disabled.

Operational values:
  Speed: 400Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  BER monitoring:
    Not supported
    Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 2000ms

```

## FlexO GID and IID

The 2.4T and 2.4TX cards use flexible OTN (flexO) interfaces on trunk ports. These flexO interfaces provide a flexible and interoperable mechanism to transport OTU signals by grouping standard lower rate interfaces. Each flexO interface group is identified by a flexO group identification (GID) number, which ranges 1–1,048,576. Each member of a flexO group is identified by a flexO instance identification (IID) number. The IID cannot be changed.

### Configuring FlexO GID

To configure flexO GID and IID on the coherentDSP controller, enter the following commands:

```

configure
controller coherentDSP R/S/I/P
flexo
gid <gid-no>
commit

```

The following sample shows how to configure flexO GID on the CoherentDSP controller:

```

P/0/RP0/CPU0:ios#configure terminal
Mon Feb  5 05:14:42.919 UTC
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ios(config-CoDSP)#flexo gid 1048575
RP/0/RP0/CPU0:ios(config-CoDSP)#commit

```

### Verifying FlexO GID

The following sample shows the flexO GID configuration on the CoherentDSP controller:

```

RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/0
Mon Feb  5 05:20:01.660 UTC

Port                               : CoherentDSP 0/0/0/0
Controller State                    : Up
Inherited Secondary State          : Normal
Configured Secondary State        : Normal
Derived State                       : In Service
Loopback mode                       : None
BER Thresholds                     : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring             : Enable
Bandwidth                           : 1200.0Gb/s

Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0          SF_BER = 0
SD_BER = 0          BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 1      FLEXP_GIDM = 0
FLEXP-MM = 0      FLEXP-LOM = 0  FLEXP-RDI = 0
FLEXP-LOF = 0
Detected Alarms                   : None

Bit Error Rate Information
PREFEC BER                        : 1.23E-02
POSTFEC BER                       : 0.00E+00
Q-Factor                          : 7.00 dB

Q-Margin                          : 0.80 dB

Instantaneous Q-Margin            : 0.80 dB

TTI :
    Remote hostname                : ios
    Remote interface               : CoherentDSP 0/0/0/7
    Remote IP addr                 : 0.0.0.0

FEC mode                          : Soft-Decision 15

Flexo-Mode                        : Enable
Flexo Details:
    Tx GID                        : 1
    TX IID                       : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
    Rx GID                        : 1
    RX IID                       : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,

AINS Soak                         : None
AINS Timer                        : 0h, 0m
AINS remaining time               : 0 seconds

```

## Link Layer Discovery Protocol (LLDP) Support on Management Interface

The LLDP can be configured on management interface of 1.2T, 2.4T, and 2.4TX cards. It requires a system to form LLDP neighborship over the system management interface, through which it advertises and learns LLDP neighbor information. This information about neighbors is used to learn about the neighbors and in turn the topology of the devices for Operations, Administration, and Maintenance (OAM) purposes.

**Advantages of LLDP**

- Provides support on non-Cisco devices.
- Enables neighbor discovery between non-Cisco devices.

**Limitation**

- When you disable LLDP globally, the LLDP gets disabled on all the interfaces.



**Note** By default, LLDP is enabled for NCS 1014. But when you enable and disable LLDP in the global configuration mode, LLDP gets disabled on all the interfaces.

**Workaround:** You must enable LLDP globally or reload the Router.

**Cisco Discovery Protocol (CDP) vs LLDP**

The CDP is a device discovery protocol that runs over Layer 2. Layer 2 is also known as the data link layer that runs on all Cisco devices, such as routers, bridges, access servers, and switches. This protocol allows the network management applications to automatically discover and learn about other Cisco devices that connect to the network.

The LLDP is also a device discovery protocol that runs over Layer 2. This protocol allows the network management applications to automatically discover and learn about other non-Cisco devices that connect to the network.

**Interoperability between non-Cisco devices using LLDP**

LLDP is also a neighbor discovery protocol that is used by network devices to advertise information about themselves to other devices on the network. This protocol runs over the data link layer, which allows two systems running different network layer protocols to learn about each other.

With LLDP, the user can also access the information about a particular physical network connection. If the user uses a non-Cisco monitoring tool (through SNMP), LLDP helps you identify the Object Identifiers (OIDs) that the system supports. The following OIDs are supported:

- 1.0.8802.1.1.2.1.4.1.1.4
- 1.0.8802.1.1.2.1.4.1.1.5
- 1.0.8802.1.1.2.1.4.1.1.6
- 1.0.8802.1.1.2.1.4.1.1.7
- 1.0.8802.1.1.2.1.4.1.1.8
- 1.0.8802.1.1.2.1.4.1.1.9
- 1.0.8802.1.1.2.1.4.1.1.10
- 1.0.8802.1.1.2.1.4.1.1.11
- 1.0.8802.1.1.2.1.4.1.1.12

**Neighbor Discovery**

System advertises the LLDP TLV (Type Length Value) details over the management network using which other devices in the management network can learn about this device.

### Configuring LLDP

- LLDP full stack functionality is supported on all three management interfaces supported in NCS 1014.
- You can selectively enable or disable LLDP on any of the management interfaces on demand.
- You can selectively enable or disable LLDP transmit or receive functionality at the management interface level.
- Information gathered using LLDP can be stored in the device Management Information Database (MIB) and queried with the Simple Network Management protocol (SNMP).
- LLDP operational data are available in both Command Line Interface and netconf-yang interface.

### Enabling LLDP Globally

When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations.



**Note** You can override this default operation at the interface to disable receive or transmit operations.

The following table describes the global LLDP attributes that the user can configure:

**Table 21:**

Attribute	Default	Range	Description
Holdtime	120	0–65535	Specifies the hold time (in sec). Hold time refers to the time or duration that an LLDP device maintains the neighbor information before discarding.
Reinit	2	2–5	Delay (in sec) for LLDP initialization on any interface
Timer	30	5-65534	Specifies the rate at which LLDP packets are sent (in sec)

The following example shows the commands to configure LLDP globally. The global LLDP configuration enables LLDP on all the three management interfaces.

```
RP/0/RP0/CPU0:regen#configure terminal
RP/0/RP0/CPU0:regen(config)#lldp management enable
RP/0/RP0/CPU0:regen(config)#lldp holdtime 30
RP/0/RP0/CPU0:regen(config)#lldp reinit 2
RP/0/RP0/CPU0:regen(config)#commit
```

### Verification

You can verify the LLDP configuration using the **show running-config lldp** command.

The output of **show running-config lldp** command is as follows:

```
RP/0/RP0/CPU0:regen#show running-config lldp
Tue Dec 10 10:36:11.567 UTC
lldp
timer 30
reinit 2
holdtime 120
management enable
!
```

You can verify the LLDP data using the **show lldp interface** and **show lldp neighbors** commands.

The output of **show lldp interface** command is as follows:

```
RP/0/RP0/CPU0:regen#show lldp interface
Thu Nov 7 08:45:22.934 UTC

MgmtEth0/RP0/CPU0/0:
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME

MgmtEth0/RP0/CPU0/1:
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME
```

The output of **show lldp neighbors** command is as follows:

```
RP/0/RP0/CPU0:M-131#show lldp neighbors
Mon Dec 2 11:01:20.143 CET
Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID          Local Intf          Hold-time  Capability  Port ID
[DISABLED]        MgmtEth0/RP0/CPU0/0  120        B           gi19
MYS-130           MgmtEth0/RP0/CPU0/1  120        R           MgmtEth0/RP0/CPU0/1
```

where [ DISABLED] shows that the LLDP is disabled on the interface MgmtEth0/RP0/CPU0/0.

### Enabling LLDP per Management Interface

The following example shows the commands to configure LLDP at the management interface level.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp enable
RP/0/RP0/CPU0:ios(config-if)#commit
```

### Disabling LLDP Transmit and Receive Operations

The following example shows the commands to disable the LLDP transmit operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp transmit disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

The following example shows the commands to disable the LLDP receive operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp receive disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

### Debugging LLDP Issues

The following commands are used for debugging issues in the LLDP functionality.

- **show lldp traffic**
- **debug lldp all**
- **debug lldp errors**
- **debug lldp events**
- **debug lldp packets**
- **debug lldp tlvs**
- **debug lldp trace**
- **debug lldp verbose**

## MAC Address Snooping on Client Ports

MAC address snooping allows you to learn the MAC address of the neighbor on 1.2T cards, that is connected to the client ports. You can enable ARP snooping on all client ports and learn the MAC address of neighbors through CLI.

This feature overcomes the limitation, where LLDP (Link Layer Discovery protocol) cannot be enabled in some networks.

### Limitations

- When you enable or disable MAC address snooping on any slice, few packets are dropped during configuration.
- Open config interface for enabling or disabling MAC address snooping is not supported.
- SNMP MIB is not supported for the MAC address attribute.



---

**Note** When you enable MAC address snooping on client ports, it overrides LLDP.

---

## Configuring MAC Address Snooping on Client Ports

You can configure MAC address or ARP snoop on slice in Muxponder slice mode using the following commands.

**configure**

**hw-module location** *location* **mxponder-slice** *slice-number*

**client-rate** 100GE

```
trunk-rate 600G { 100G | 150G | 200G | 250G | 300G | 350G | 400G | 450G | 500G | 550G | 600G }
```

```
arp-snoop
```

```
commit
```

### Example

The following is a sample in which, MAC address or ARP snoop is configured on the client ports of slice 0 in Muxponder slice mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 16 19:30:33.933 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3/nxr0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-rate 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 600G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#arp-snoop
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Mon Mar 16 19:30:52.636 UTC
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

The following is a sample in which, MAC address or ARP snoop is configured in Muxponder mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 16 19:08:17.154 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder arp-snoop
RP/0/RP0/CPU0:ios(config)#commit
```

The following sample shows the output of **show controllers hundredGigEctrlr** command, before configuring MAC address or ARP snoop on client ports.

```
RP/0/RP0/CPU0:ios#show controllers HundredGigEctrlr 0/1/0/2/1
Mon Mar 16 19:40:37.434 UTC
Operational data for interface HundredGigEctrlr0/1/0/2/1:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Disabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  Laser Squelch: Disabled

Phy:
  Media type: Not known

Autonegotiation disabled.

Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  BER monitoring:
    Not supported
  Holdoff Time: 0ms
```



## Viewing Neighbor MAC Address

You can view the neighbor's physical address after enabling MAC address or ARP snoop using the following command. MAC address snoop output is enabled after ARP packets are received on the respective 100G client.

**show controllers hundredGigEctr1r R/S/I/P**

The following sample shows the neighbor's MAC address after configuring MAC address or ARP snoop on client ports.

```
RP/0/RP0/CPU0:ios#show controllers HundredGigEctr1r 0/1/0/2/1
Mon Mar 16 19:41:08.047 UTC
Operational data for interface HundredGigEctr1r0/1/0/2/1:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Disabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  Laser Squelch: Disabled
  Neighbor Address:
    0010.9400.5502

Phy:
  Media type: Not known

Autonegotiation disabled.

Operational values:
  Speed: 100Gbps
  Duplex: Full Duplex
  Flowcontrol: None
```

## Transmit Shutdown

Transmit shut on trunk optics controller brings down the CIM8 and PICO transmit power. You can configure transmit shut on optics controller of a 1.2T, 2.4TX, or 2.4T card.

## Configuring Transmit Shutdown on Trunk Optics Controller

To perform transmit shutdown, enter the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:chassisA164(config)#controller optics 0/1/0/0
RP/0/RP0/CPU0:chassisA164(config-Optics)#transmit-shutdown
RP/0/RP0/CPU0:chassisA164(config-Optics)#commit
RP/0/RP0/CPU0:ios(config-Optics)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

## Verifying Transmit Shutdown on Trunk Optics Controller

To verify the transmit shutdown details on the trunk optics controller, use the following command:

**show controllers optics R/S/I/P****Example**

Following is an example to view the transmit shutdown details:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/0
Tue Dec 12 05:38:32.416 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: Off

LED State: Green

Optics Status
  Optics Type: CIM8 DWDM
  DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
  Wavelength=1552.524nm

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

  LOS/LOL/Fault Status:

  Alarm Statistics:

  -----
  HIGH-RX-PWR = 0          LOW-RX-PWR = 0
  HIGH-TX-PWR = 0          LOW-TX-PWR = 2
  HIGH-LBC = 0            HIGH-DGD = 0
  OOR-CD = 0              OSNR = 1
  WVL-OOL = 0            MEA = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0
  Laser Bias Current = 0.0 %
  Actual TX Power = -40.00 dBm
  RX Power = -6.60 dBm
  RX Signal Power = -7.06 dBm
  Frequency Offset = -846 MHz

  Performance Monitoring: Enable

  THRESHOLD VALUES
  -----

  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----
  Rx Power Threshold(dBm)   13.0       -17.0     0.0           0.0
  Tx Power Threshold(dBm)   5.0        -13.0     0.0           0.0
  LBC Threshold(mA)         N/A        N/A       0.00          0.00

  LBC High Threshold = 90 %
  Configured Tx Power = 2.00 dBm
  Configured CD High Threshold = 180000 ps/nm
  Configured CD lower Threshold = -180000 ps/nm
  Configured OSNR lower Threshold = 20.50 dB
  Configured DGD Higher Threshold = 90.00 ps
  Baud Rate = 137.9783780000 GBd
```

```

Bits per Symbol = 3.5200000000 bits/symbol
Modulation Type: PCS
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -10000 ps/nm CD-MAX 48000 ps/nm
Polarization Mode Dispersion = 0.0 ps
Second Order Polarization Mode Dispersion = 9.00 ps^2
Optical Signal to Noise Ratio = 36.90 dB
SNR = 16.10 dB
Polarization Dependent Loss = 0.90 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps
Filter Roll Off Factor : 0.100
Rx VOA Target Power : -2.0 dBm
NLEQ Compensation Mode : 0
Cross Polarization Gain Mode : 10
Proprietary Submarine Parameters
  Type : 1      Value : 0
  Type : 2      Value : 0
  Type : 3      Value : 0
  Type : 4      Value : 0
  Type : 5      Value : 10485760

```

#### Transceiver Vendor Details

```

Form Factor      : CIM8
Name             : CISCO-ACACIA
Serial Number    : N/A
PID              : CIM8-C-K9
VID              : N/A
Date Code (yy/mm/dd) : 23/10/20
Fiber Connector Type: LC
Otn Application Code: Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set

```

Transceiver Temperature : 38 Celsius

```

AINS Soak      : None
AINS Timer     : 0h, 0m
AINS remaining time : 0 seconds

```

## Loopback

You can configure loopback on the CoherentDSP and Ethernet controllers of QXP, 1.2T, 24TX and 2.4T cards to identify connection problems. The loopback can be configured only in the maintenance mode. Use the **controller controller-type** and the **secondary-admin-state maintenance** commands to place the controllers in the maintenance mode.

Loopback configuration alarm details for each controller are triggered whenever there is a change in the loopback configuration. Details such as, location of the controller, severity, configuration date and time, and description are available in the output of the **show alarms brief system active** and **show alarms brief history** commands.

### Configuring Loopback on the 1.2T Card

To configure the loopback on a 1.2T card, use the following commands:

```
controller controllertype Rack/Slot/Instance/Port
```

**sec-admin-state maintenance**

**loopback [ internal ]**




---

**Note** Line loopback is not supported on CoherentDSP controller of 1.2T card.

---

### Configuring Loopback on 2.4T Card and 2.4TX Card

To configure the loopback on 2.4T card and 2.4TX card, use the following commands:

```
controller {HundredGigECtrlr Rack/Slot/Instance/Port/Lane |
fourHundredGigECtrlr Rack/Slot/Instance/Port}
```

**sec-admin-state maintenance**

**loopback [ line | internal ]**




---

**Note** In case of muxponder configuration on the 2.4TX card, internal loopback must be applied on both trunk ports for the loopback behaviour to reflect on the split ports. For direct ports, the corresponding trunk internal loopback works as expected.

---

### Example 1

The following example shows how a internal loopback is configured on the Ethernet controller of a 1.2T card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller HundredGigECtrlr 0/1/0/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback internal
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
RP/0/RP0/CPU0:ios(config)#exit
```

### Example 2

The following example shows how a line loopback is configured on coherentDSP controller of a 2.4T card and 2.4TX card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/1/0/0
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback line
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
RP/0/RP0/CPU0:ios(config)#exit
```

### Example 3

The following example shows how to verify an internal loopback configured on the Ethernet controller of I.2T card.

```
RP/0/RP0/CPU0:ios#show controller HundredGigEctr1r 0/1/0/1
Fri Nov 17 10:01:22.840 UTC
Operational data for interface HundredGigEctr1r0/1/0/1:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Enabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  Laser Squelch: Disabled
  Insert Idle Ingress: Disabled
  Insert Idle Egress: Disabled

Phy:
  Media type: Not known
  Statistics:
    FEC:
      Corrected Codeword Count: 72671614           Valid: True      Start time:
15:53:12 Thu Nov 16 2023
      Uncorrected Codeword Count: 12             Valid: True      Start time:
15:53:12 Thu Nov 16 2023
    PCS:
      Total BIP errors: 0                       Valid: True      Start time:
15:53:12 Thu Nov 16 2023
      Total frame errors: 0                     Valid: False     Start time:
15:53:12 Thu Nov 16 2023
      Total Bad SH: 0                           Valid: False     Start time:
15:53:12 Thu Nov 16 2023

Autonegotiation disabled.

Operational values:
  Speed: 400Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: Internal
  BER monitoring:
    Not supported
  Forward error correction: Standard (Reed-Solomon)
  Holdoff Time: 0ms
```

### Configuring Loopback on the QXP Card

#### Example 1

The following example shows how to configure internal loopback on a coherent DSP controller.

```
RP/0/RP0/CPU0:ios#configure
Fri Jul 8 10:42:51.329 UTC
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ios(config-CoDSP)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-CoDSP)#loopback internal
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

```
Fri Jul 8 10:43:48.644 UTC
RP/0/RP0/CPU0:ios(config-CoDSP)#end
```

The following example shows how to verify the internal loopback configured on a coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/0
Fri Jul 8 10:45:53.820 UTC
Port : CoherentDSP 0/0/0/0
Controller State : Down
Inherited Secondary State : Normal
Configured Secondary State : Maintenance
Derived State : Maintenance
Loopback mode : Internal
BER Thresholds : SF = 1.0E-5 SD = 1.0E-7
Performance Monitoring : Enable
Bandwidth : 400.0Gb/s
Alarm Information:
LOS = 2 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0 SF_BER = 0
SD_BER = 0 BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0 FLEXO_GIDM = 0
FLEXO-MM = 0 FLEXO-LOM = 0 FLEXO-RDI = 0
FLEXO-LOF = 0
Detected Alarms : LOS
Bit Error Rate Information
PREFEC BER : 5.00E-01
POSTFEC BER : 0.00E+00
Q-Factor : 0.00 dB
Q-Margin : 0.00dB
OTU TTI Received
FEC mode : C_FEC
Flexo-Mode : Enable
Flexo Details:
Tx GID : 0
Rx GID : 0
AINS Soak : None
AINS Timer : 0h, 0m
AINS remaining time : 0 seconds
```

## Example 2

The following example shows how to configure line loopback on a coherent DSP controller.

```
RP/0/RP0/CPU0:ios#configure
Fri Jul 8 10:48:48.577 UTC
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ios(config-CoDSP)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-CoDSP)#loopback line
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
Fri Jul 8 10:49:26.809 UTC
RP/0/RP0/CPU0:ios(config-CoDSP)#end
```

The following example shows how to verify the line loopback configured on a coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/0
Fri Jul 8 10:49:44.073 UTC
Port : CoherentDSP 0/0/0/0
Controller State : Down
Inherited Secondary State : Normal
Configured Secondary State : Maintenance
Derived State : Maintenance
Loopback mode : Line
BER Thresholds : SF = 1.0E-5 SD = 1.0E-7
Performance Monitoring : Enable
```

```

Bandwidth : 400.0Gb/s
Alarm Information:
LOS = 2 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0 SF_BER = 0
SD_BER = 0 BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0 FLEXO_GIDM = 0
FLEXO-MM = 0 FLEXO-LOM = 0 FLEXO-RDI = 0
FLEXO-LOF = 0
Detected Alarms : LOS
Bit Error Rate Information
PREFEC BER : 5.00E-01
POSTFEC BER : 0.00E+00
Q-Factor : 0.00 dB
Q-Margin : 0.00dB
OTU TTI Received
FEC mode : C_FEC
Flexo-Mode : Enable
Flexo Details:
Tx GID : 0
Rx GID : 0
AINS Soak : None
AINS Timer : 0h, 0m
AINS remaining time : 0 seconds

```

### Example 3

The following example shows how to configure internal loopback on the 400GE controller.

```

RP/0/RP0/CPU0:ios#configure
Fri Jul 8 11:19:26.286 UTC
RP/0/RP0/CPU0:ios(config)#controller FourHundredGigECtrlr 0/0/0/3
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback internal
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
Fri Jul 8 11:19:47.496 UTC
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#end

```

The following example shows how to verify the internal loopback configured on the 400GE controller.

```

RP/0/RP0/CPU0:ios#show controllers FourHundredGigECtrlr 0/0/0/3
Fri Jul 8 11:19:59.597 UTC
Operational data for interface FourHundredGigECtrlr0/0/0/3:
State:
Administrative state: enabled
Operational state: Down (Reason: State undefined)
LED state: Red On
Maintenance: Enabled
AINS Soak: None
Total Duration: 0 hour(s) 0 minute(s)
Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled
Phy:
Media type: Not known
Alarms:
Current:
Loss of Signal
Statistics:
FEC:
Corrected Codeword Count: 702710
Uncorrected Codeword Count: 1147
Autonegotiation disabled.

```

```
Operational values:
Speed: 400Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: Internal
BER monitoring:
Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms
```

#### Example 4

The following example shows how to configure line loopback on the 4X100GE MXP.

```
RP/0/RP0/CPU0:ios(config)#controller hundredGigEctrler 0/3/0/1/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback line
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following example shows how to verify the line loopback configured on the 4X100GE MXP.

```
RP/0/RP0/CPU0:ios#sh controllers hundredGigEctrler 0/3/0/1/1
Fri Jul 22 10:34:39.730 UTC
Operational data for interface HundredGigEctrler0/3/0/1/1:
```

State:

```
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Enabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled
```

Phy:

```
Media type: Not known
Statistics:
  FEC:
    Corrected Codeword Count: 6110368          Valid: True      Start time:
13:10:41 Thu Jul 21 2022
    Uncorrected Codeword Count: 2771          Valid: True      Start time:
13:10:41 Thu Jul 21 2022
  PCS:
    Total BIP errors: 63700992                Valid: True      Start time:
13:10:41 Thu Jul 21 2022
    Total frame errors: 0                     Valid: False     Start time:
13:10:41 Thu Jul 21 2022
    Total Bad SH: 0                           Valid: False     Start time:
13:10:41 Thu Jul 21 2022
```

Autonegotiation disabled.

```
Operational values:
Speed: 100Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: Line
BER monitoring:
Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms
```



**Example 5**

The following example shows how to configure internal loopback on the 4X100GE MXP.

```
RP/0/RP0/CPU0:ios#conf
RP/0/RP0/CPU0:ios(config)#controller hundredGigEctrlr 0/3/0/7/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#loopback internal
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

The following example shows how to verify the internal loopback configured on the 4X100GE MXP.

```
RP/0/RP0/CPU0:ios#show controller HundredGigEctrlr 0/3/0/7/1
Fri Jul 22 10:40:34.928 UTC
```

Operational data for interface HundredGigEctrlr0/3/0/7/1:

State:

```
Administrative state: enabled
Operational state: Down (Reason: State undefined)
LED state: Red On
Maintenance: Enabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled
```

Phy:

```
Media type: Not known
Alarms:
  Current:
    Loss of Signal
Statistics:
  FEC:
    Corrected Codeword Count: 31426046
    Uncorrected Codeword Count: 2187
```

Autonegotiation disabled.

Operational values:

```
Speed: 100Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: Internal
BER monitoring:
  Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms
```

**Viewing Loopback Configuration Alarm**

The following example shows how to view the loopback configuration alarms.

```
RP/0/RP0/CPU0:ios#show alarms brief system active
Tue Sep 13 17:43:35.212 UTC
```

-----  
Active Alarms  
-----

Location	Severity	Group	Set Time	Description
----------	----------	-------	----------	-------------

```

-----
0/2          Minor      Controller      09/13/2022 17:34:32 UTC
HundredGigECtrlr0/2/0/2 - Internal Loopback Configured
0/2          Minor      Controller      09/13/2022 17:34:32 UTC
HundredGigECtrlr0/2/0/2 - Internal Loopback Configured
0/2          Minor      Controller      09/13/2022 17:34:32 UTC
HundredGigECtrlr0/2/0/2 - Line Loopback Configured

0/2          Major      Ethernet        09/13/2022 17:34:31 UTC
HundredGigECtrlr0/2/0/1/2 - Loss of Synchronization The Data Interface

0/2          Minor      Controller      09/13/2022 17:39:19 UTC   CoherentDSP0/2/0/0
- Internal Loopback Configured

```

## Restore Factory Settings



**Note** Perform this operation only on the console port.

You can restore the factory settings on the NCS 1014. The entire system configuration, including usernames, passwords, and IP addresses, is removed. You can perform this operation only through the console port and not on the management interface. To restore NCS 1014 to factory settings, use the **commit replace** command. After the **commit replace** operation completes, you must perform the IOS XR reload operation.

The **commit best-effort** command merges the target configuration with the running configuration and commits only valid changes (best effort). Some configuration changes might fail due to semantic errors.

### Example

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#commit replace
Tue Sep 24 09:36:59.430 UTC

```

This commit will replace or remove the entire running configuration. This operation can be service affecting.

```

Do you wish to proceed? [no]: yes
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#reload
Tue Sep 24 09:38:12.881 UTC

```

Standby card not present or not Ready for failover. Proceed? [confirm]

Preparing system for backup. This may take a few minutes especially for large configurations.

```
Status report: node0_RP0_CPU0: BACKUP INPROGRESS
```

```
Status report: node0_RP0_CPU0: BACKUP HAS COMPLETED SUCCESSFULLY
```

[Done]

Proceed with reload? [confirm]

```

Reloading node 0/RP0/CPU0

RL: Reboot initiated with code 1, cause User initiated graceful reload reboot_timeout 30
shutdown delay 0
RL: Shutdown initiated
Query the node to be reloaded
  NODE_IP of noded to be reloaded 198.51.100.1
sending stop hb
Cause: User initiated graceful reload
VM IP addr sent for reload 198.51.100.1

Received ack from sdrmgr for reload request.Returncode:0
successful disconnection from service
wd_disconnect_cb 548 CMP-WD disconnected successfully
Invmgr successful disconnection from service

RP/0/RP0/CPU0:ios#
Disconnecting from 'default-sdr--1' console. Continue(Y/N)?

Connecting to 'default-sdr--1' console
ÿÿÿÿÿÿÿÿbootlogd: ioctl(/dev/pts/2, TIOCCONS): Device or resource busy
/sbin/restorecon: lstat(/etc/adjtime) failed: No such file or directory
Configuring network interfaces... done.
Starting system message bus: dbus.
Starting OpenBSD Secure Shell server: sshd
sshd start/running, process 1739
Starting rpcbind daemon...done.
Starting random number generator daemonUnable to open file: /dev/tpm0
.
Starting system log daemon...0
Starting kernel log daemon...0
tftpd-hpa disabled in /etc/default/tftpd-hpa
Starting internet superserver: xinetd.
net.ipv4.ip_forward = 1
Libvirt not initialized for container instance
Starting crond: OK
SIOCADDRT: File exists

DBG_MSG: platform type is 0
[*] ima_policy have loaded, or IMA policy file does not exist
Start serial incoming on , Clearing ..
RP/0/RP0/CPU0:Sep 24 09:38:44.284 UTC: fpd-serv[256]: %PKT_INFRA-FM-3-FAULT_MAJOR :
ALARM_MAJOR :FPD-NEED-UPGRADE :DECLARE :0/PM0:

This (D)RP Node is not ready or active for login /configuration
.....
.....
.....

ios con0/RP0/CPU0 is now available

Press RETURN to get started.

!!!!!!!!!!!!!!!!!!!!!! NO root-system username is configured. Need to configure root-system
username. !!!!!!!!!!!!!!!!!!!!!!!

```

## Headless Mode

During process restarts, CPU reload, or removal of CPU, the NCS 1014 operates in headless mode for up to 72 hours. During this time, traffic is not impacted, although the control plane is not up and running. Fault

propagation continues to operate for failures on client and trunk ports. However, you cannot provision anything nor view operational data with a non-functional CPU. Performance monitoring data based on 15 minutes and 24 hour intervals is not supported with a non-functional CPU.

## Trail Trace Identifier

The Trail trace identifier (TTI) feature helps you to identify the signal from the source to the destination within the network. You can configure the TTI sent or expected in ASCII and HEX. When the expected TTI string does not match the received TTI trace string, the controller goes down and the TIM alarm is raised. To configure TTI on the coherent DSP controllers of a 1.2T, 2.4T, or 2.4TX card, use the following commands:

### configure

```
controller coherentDSP R/S/I/P tti {sent | expected} ascii | hextti-string
```

### commit




---

**Note** The *tti-string* can have a maximum of 64 characters for ASCII and 128 characters for HEX.

---

The following sample displays how to configure TTI on a coherent DSP controller with the sent and expected strings set to the same ASCII string. The state of the controller is up.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#controller coherentDSP
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent ascii hello
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected ascii hello cisco
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
Thu Dec 7 14:25:43.391 IST
RP/0/RP0/CPU0:ios(config-CoDSP)#end
```

The following is sample to view the TTI details on a coherentDSP controller.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/3/0/0
Thu Dec 7 14:26:37.345 IST

Port : CoherentDSP 0/3/0/0
Controller State : Down
Inherited Secondary State : Normal
Configured Secondary State : Normal
Derived State : In Service
Loopback mode : None
BER Thresholds : SF = 1.0E-5 SD = 1.0E-7
Performance Monitoring : Enable
Bandwidth : 800.0Gb/s

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0 SF_BER = 0
SD_BER = 0 BDI = 0 TIM = 1
FECMISMATCH = 0 FEC-UNC = 0 FLEXO_GIDM = 0
FLEXO-MM = 0 FLEXO-LOM = 0 FLEXO-RDI = 0
FLEXO-LOF = 0
Detected Alarms : TIM

Bit Error Rate Information
PREFEC BER : 2.57E-04
POSTFEC BER : 0.00E+00
```

```

Q-Factor : 10.80 dB

Q-Margin : 4.50 dB

Instantaneous Q-Margin : 4.50 dB

OTU TTI Sent

FULL TTI ASCII STRING : hello

OTU TTI Received

FULL TTI ASCII STRING : hello

OTU TTI Expected

FULL TTI ASCII STRING : hello cisco

FEC mode : Soft-Decision 15

Flexo-Mode : Enable
Flexo Details:
Tx GID : 1
TX IID : 1, 2, 3, 4, 5, 6, 7, 8,
Rx GID : 1
RX IID : 1, 2, 3, 4, 5, 6, 7, 8,

AINS Soak : None
AINS Timer : 0h, 0m
AINS remaining time : 0 seconds
    
```

The following example shows how to configure TTI on a coherent DSP controller with the sent and expected strings set to HEX strings.

```

RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ne(config)#controller coherentDSP 0/0/0/0
RP/0/RP0/CPU0:ne(config-CoDSP)#tti sent hex 6E6E6E2A2A2A
RP/0/RP0/CPU0:ne(config-CoDSP)#tti expected hex 3F4B4B4B3D3E3A
RP/0/RP0/CPU0:ne(config-CoDSP)#commit
RP/0/RP0/CPU0:ios(config)#exit
    
```

## Configure TTI on QXP Card

You can configure the TTI sent or expected string in the full ASCII format, or Source Access Point Identifier (SAPI)/Destination Access Point Identifier (DAPI) format on ODU-flex, ODU4, and coherentDSP controllers for the QXP card.



**Note** TTI operates only in trunk mode OR.

The following table lists the ASCII format that is supported for TTI:

ASCII with Character String	Controller
Full ASCII 64-character	CoherentDSP,odu4,odu-flex

SAPI ASCII 15-character	CoherentDSP,odu4,odu-flex
DAPI ASCII 15-character	CoherentDSP,odu4,odu-flex
Operator-specific ASCII 32-character	CoherentDSP,odu4,odu-flex

To configure TTI, use the following commands:

### configure

**controller** *controller-type R/S/I/P tti {sent | expected} {ascii | sapi ascii | dapi ascii | operator-specific ascii} tti-string*

### commit

The following is a sample configuration for FULL TTI for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent ascii cisco
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected ascii cisco123
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

The following is a sample configuration for TTI HEX for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent hex 6E6E6E2A2A2A
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected hex 3F4B4B4B3D3E3A
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

The following is a sample configuration for Operator specific TTI for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent operator-specific ascii hellooo
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected operator-specific ascii hellooo
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

The following is a sample configuration for Operator specific TTI HEX for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent operator-specific hex
6E6E6E2A2A2A3D3E3A3A6E6E2A2A2A3D
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected operator-specific hex 5A5A6D3A3B3C3F4B4B4B3D3E3A
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

The following is a sample configuration for SAPI for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent operator-specific ascii hellooo
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected operator-specific ascii hellooo
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

The following is a sample configuration for DAPI for coherentDSP controller

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/8
RP/0/RP0/CPU0:ios(config-CoDSP)#tti sent dapi ascii cisco123
RP/0/RP0/CPU0:ios(config-CoDSP)#tti expected dapi ascii hello
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
```

# Chromatic Dispersion

You can configure chromatic dispersion on optics controllers of 1.2T, 2.4TX, and 2.4T cards. When you configure the maximum and minimum values for chromatic dispersion for any data rate, ensure the minimum difference between the configured values is equal to or greater than 1500 ps/nm.

The following table lists the default CD search range for a 1.2T card.

Data Rate	BPS	Card Support	Default CD Search Range
200G to 500G	BPS <= 3	1.2T, 1.2TL	-10,000 to 100,000 ps/nm
	3 < BPS <= 4	1.2T, 1.2TL	-10,000 to 80,000 ps/nm
	4 < BPS <=5	1.2T	-5,000 to 20,000 ps/nm
600G	BPS=5.2578125	1.2T	-2000 to 2,000 ps/nm

The following table lists the default CD search range for 2.4T, 2.4TX, cards.

Line Rate				
	138GBd	128GBd	118GBd	108GBd
1200G	4000 to -5000	4000 to -5000	—	—
1000G	20000 to -5000	20000 to -5000	20000 to -5000	—
800G	48000 to -10000	48000 to -10000	48000 to -10000	35000 to -10000
600G	74000 to -10000	74000 to -10000	74000 to -10000	60000 to -10000
500G	90000 to -10000	90000 to -10000	90000 to -10000	72000 to -10000
400G	—	90000 to -10000	90000 to -10000	72000 to -10000



**Note** The cd-min and cd-max values must be set for BPS values that are greater than 4 in the 1.2T card.



**Note** When the user provisions the cd-min and cd-max values that are outside the range through CLI, the provisioned values are accepted; however, only the actual values supported by the hardware are applied.

The following is a sample where chromatic dispersion is configured on the optics controller.

```
RP/0/RP0/CPU0:ios#configure
Mon Aug 19 19:31:42.115 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/1/0/1
RP/0/RP0/CPU0:ios(config-Optics)#cd-max 4000
RP/0/RP0/CPU0:ios(config-Optics)#cd-min -1000
RP/0/RP0/CPU0:ios(config-Optics)#commit
Mon Aug 19 19:35:24.697 UTC
```

```

RP/0/RP0/CPU0:ios(config-Optics)#exit
RP/0/RP0/CPU0:ios(config)#exit

RP/0/RP0/CPU0:ios#show run controller optics 0/1/0/*
Mon Aug 19 19:57:41.859 UTC
controller Optics0/1/0/0
  transmit-power -15
  dwdm-carrier 50GHz-grid itu-ch 55
  enh-sop-tol-mode 1
  cross-pol-gain-mode 10
  lbc-high-threshold 5
!
controller Optics0/1/0/1
  description trunk power UP
  cd-min -1000
  cd-max 4000
  enh-colorless-mode 2
  enh-sop-tol-mode 3
  nleq-comp-mode 4
  cross-pol-gain-mode 2
  cross-pol-weight-mode 3
  cpr-win-mode 3
  cpr-ext-win-mode 8
  rx-voa fixed-ratio 1200
  filter-roll-off-factor 0.035
!
controller Optics0/1/0/5
  soak-time 10
!

```

## Chromatic Dispersion Threshold

You can configure the minimum and maximum acceptable chromatic dispersion for the trunk optics controllers. The CD alarm is raised if the chromatic dispersion goes below the minimum or exceeds the maximum value.

The following is a sample of configuring the minimum and maximum chromatic dispersion threshold:

To configure the maximum and minimum acceptable CD, use the following command:

**configure**

**controller optics** *R/S/I/P*

**cd-high-threshold** *cd-high*

**cd-low-threshold** *cd-low*

**commit**

The following sample configures the maximum and minimum acceptable CD on the controller optics:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
RP/0/RP0/CPU0:ios(config-Optics)#cd-high-threshold 2400
RP/0/RP0/CPU0:ios(config-Optics)#cd-low-threshold -2400
RP/0/RP0/CPU0:ios(config-Optics)#commit

```

The following sample shows the maximum and minimum acceptable CD configured on the controller optics:

```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC

Controller State: Up

```



Transport Admin State: In Service

Laser State: On

LED State: Yellow

Optics Status

Optics Type: CIM8 DWDM  
 DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,  
 Wavelength=1552.524nm

Alarm Status:

-----  
 Detected Alarms:  
           HIGH-RX-PWR    LOW-TX-PWR  
           HIGH-DGD

LOS/LOL/Fault Status:

Alarm Statistics:

-----  
 HIGH-RX-PWR = 1                  LOW-RX-PWR = 0  
 HIGH-TX-PWR = 0                  LOW-TX-PWR = 1  
 HIGH-LBC = 0                      HIGH-DGD = 6  
 OOR-CD = 0                       OSNR = 0  
 WVLT-OOL = 0                      MEA = 0  
 IMPROPER-REM = 1  
 TX-POWER-PROV-MISMATCH = 0  
 Laser Bias Current = 0.0 %  
 Actual TX Power = 0.97 dBm  
 RX Power = -0.53 dBm  
 RX Signal Power = -1.20 dBm  
 Frequency Offset = 63 MHz

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
-----	-----	-----	-----	-----
Rx Power Threshold(dBm)	-2.0	-3.0	0.0	0.0
Tx Power Threshold(dBm)	4.0	2.0	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 55 %  
 Configured Tx Power = 1.00 dBm  
**Configured CD High Threshold = 2400 ps/nm**  
**Configured CD lower Threshold = -2400 ps/nm**  
 Configured OSNR lower Threshold = 0.40 dB  
 Configured DGD Higher Threshold = 0.30 ps  
 Baud Rate = 63.1394679230 GBd  
 Bits per Symbol = 3.0000000000 bits/symbol  
 Modulation Type: 8QAM  
 Chromatic Dispersion 0 ps/nm  
 Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm  
 Polarization Mode Dispersion = 0.0 ps  
 Second Order Polarization Mode Dispersion = 29.00 ps^2  
 Optical Signal to Noise Ratio = 36.10 dB  
 SNR = 17.50 dB  
 Polarization Dependent Loss = 0.50 dB

```
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps
```

#### Transceiver Vendor Details

```
Form Factor           : CIM8
Name                  : CISCO-ACACIA
Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type: LC
Otn Application Code: Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set
```

```
Transceiver Temperature : 46 Celsius
```

```
AINS Soak             : None
AINS Timer             : 0h, 0m
AINS remaining time   : 0 seconds
```

## Transmit Power

To configure transmit power on the trunk (CIM8 and PICO) optics within the  $-190$  to  $+50$  range (in units of 0.1dBm), use the following commands:

```
RP/0/RP0/CPU0:ios#configure
Mon Aug 19 19:31:42.115 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/1/0/7
RP/0/RP0/CPU0:ios(config-Optics)#transmit-power -1.50
RP/0/RP0/CPU0:ios(config-Optics)#commit
Mon Aug 19 19:35:24.697 UTC
RP/0/RP0/CPU0:ios(config-Optics)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

The following is a sample in which transmit power of  $-1.50$  dBm is configured on the CIM8 optics.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Controller State: Up
Transport Admin State: Automatic In Service
Laser State: On
LED State: Green
Optics Status
  Optics Type: CIM8 DWDM
  DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
  Wavelength=1552.524nm
  Alarm Status:
  -----
  Detected Alarms: None
  LOS/LOL/Fault Status:
  Alarm Statistics:
  HIGH-RX-PWR = 0           LOW-RX-PWR = 2
  HIGH-TX-PWR = 0           LOW-TX-PWR = 1
  HIGH-LBC = 0              HIGH-DGD = 0
  OOR-CD = 0                OSNR = 1
```

```

WVL-OOL = 0                MEA = 0
IMPROPER-REM = 0
TX-POWER-PROV-MISMATCH = 0
Laser Bias Current = 0.0 %
Actual TX Power = 1.98 dBm
RX Power = -0.68 dBm
RX Signal Power = -1.25 dBm
Frequency Offset = -41 MHz
Performance Monitoring: Enable
THRESHOLD VALUES
Parameter                    High Alarm  Low Alarm  High Warning  Low Warning
-----
Rx Power Threshold(dBm)      13.0       -17.0      0.0           0.0
Tx Power Threshold(dBm)      5.0        -13.0      0.0           0.0
LBC Threshold(mA)            N/A        N/A        0.00          0.00
LBC High Threshold = 90 %
Configured Tx Power = 2.00 dBm
Configured CD High Threshold = 180000 ps/nm
Configured CD lower Threshold = -180000 ps/nm
Configured OSNR lower Threshold = 20.50 dB
Configured DGD Higher Threshold = 90.00 ps
Baud Rate = 137.9783940000 GBd
Bits per Symbol = 3.5200000000 bits/symbol
Modulation Type: PCS
Chromatic Dispersion -1 ps/nm
Configured CD-MIN -10000 ps/nm CD-MAX 48000 ps/nm
Polarization Mode Dispersion = 0.0 ps
Second Order Polarization Mode Dispersion = 13.00 ps^2
Optical Signal to Noise Ratio = 38.10 dB
SNR = 17.40 dB
Polarization Dependent Loss = 2.50 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps
Filter Roll Off Factor : 0.100
Rx VOA Target Power : -2.0 dBm
NLEQ Compensation Mode : 0
Cross Polarization Gain Mode : 10
Proprietary Submarine Parameters
Type : 1      Value : 0
Type : 2      Value : 0
Type : 3      Value : 0
Type : 4      Value : 0
Type : 5      Value : 0
Type : 6      Value : 1000
Type : 7      Value : 0
Type : 8      Value : 0
Type : 9      Value : 0
Type : 10     Value : 0

```

## Laser Bias Current High Threshold

You can configure the threshold of the laser bias current flowing on the physical pluggable port on the trunk optics controller. The range is 0 to 100%

To configure the laser bias current threshold, use the following command:

**configure**

**controller optics R/S/I/P**

**lbc-high-threshold lbc-value**

**commit**

The following sample configures the high laser bias threshold on the controller optics:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
RP/0/RP0/CPU0:ios(config-Optics)#lbc-high-threshold 55
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

The following sample shows the high laser bias threshold configured on the controller optics:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Yellow

Optics Status

    Optics Type: CIM8 DWDM
    DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
    Wavelength=1552.524nm

    Alarm Status:
    -----
    Detected Alarms:
                HIGH-RX-PWR    LOW-TX-PWR
                HIGH-DGD

    LOS/LOL/Fault Status:

    Alarm Statistics:

    -----
    HIGH-RX-PWR = 1                LOW-RX-PWR = 0
    HIGH-TX-PWR = 0                LOW-TX-PWR = 1
    HIGH-LBC = 0                   HIGH-DGD = 6
    OOR-CD = 0                     OSNR = 0
    WVL-OOL = 0                    MEA = 0
    IMPROPER-REM = 1
    TX-POWER-PROV-MISMATCH = 0
    Laser Bias Current = 0.0 %
    Actual TX Power = 0.97 dBm
    RX Power = -0.53 dBm
    RX Signal Power = -1.20 dBm
    Frequency Offset = 63 MHz

    Performance Monitoring: Enable

    THRESHOLD VALUES
    -----

    Parameter                    High Alarm  Low Alarm  High Warning  Low Warning
    -----
    Rx Power Threshold(dBm)      -2.0       -3.0       0.0           0.0
    Tx Power Threshold(dBm)       4.0        2.0        0.0           0.0
    LBC Threshold(mA)             N/A        N/A        0.00          0.00

LBC High Threshold = 55 %
    Configured Tx Power = 1.00 dBm
```

```

Configured CD High Threshold = 2400 ps/nm
Configured CD lower Threshold = -2400 ps/nm
Configured OSNR lower Threshold = 0.40 dB
Configured DGD Higher Threshold = 0.30 ps
Baud Rate = 63.1394679230 GBd
Bits per Symbol = 3.0000000000 bits/symbol
Modulation Type: 8QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm
Polarization Mode Dispersion = 0.0 ps
Second Order Polarization Mode Dispersion = 29.00 ps^2
Optical Signal to Noise Ratio = 36.10 dB
SNR = 17.50 dB
Polarization Dependent Loss = 0.50 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps

```

#### Transceiver Vendor Details

```

Form Factor           : CIM8
Name                  : CISCO-ACACIA
Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type : LC
Otn Application Code  : Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set

```

Transceiver Temperature : 46 Celsius

```

AINS Soak           : None
AINS Timer          : 0h, 0m
AINS remaining time : 0 seconds

```

## Differential Group Delay Threshold

You can configure the threshold value for the maximum acceptable differential group delay (DGD) on the trunk optics controllers. The DGD alarm is raised if DGD exceeds this value.

The range is 0–18000 (in the units of 0.01 ps).

To configure the maximum acceptable DGD, use the following command:

```

configure
controller optics R/S/I/P
dgd-high-threshold dgd-value
commit

```

The following sample configures the minimum acceptable DGD on the controller optics:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7

```

```
RP/0/RP0/CPU0:ios(config-Optics)#dgd-high-threshold 30
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

The following sample shows the maximum acceptable DGD configured on the controller optics:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC
```

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Yellow

Optics Status

```
Optics Type: CIM8 DWDM
DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
Wavelength=1552.524nm
```

Alarm Status:

-----

Detected Alarms:

```
        HIGH-RX-PWR    LOW-TX-PWR
        HIGH-DGD
```

LOS/LOL/Fault Status:

Alarm Statistics:

-----

```
HIGH-RX-PWR = 1          LOW-RX-PWR = 0
HIGH-TX-PWR = 0          LOW-TX-PWR = 1
HIGH-LBC = 0            HIGH-DGD = 6
OOR-CD = 0              OSNR = 0
WVL-OOL = 0            MEA = 0
IMPROPER-REM = 1
TX-POWER-PROV-MISMATCH = 0
Laser Bias Current = 0.0 %
Actual TX Power = 0.97 dBm
RX Power = -0.53 dBm
RX Signal Power = -1.20 dBm
Frequency Offset = 63 MHz
```

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.0	-3.0	0.0	0.0
Tx Power Threshold(dBm)	4.0	2.0	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 55 %

Configured Tx Power = 1.00 dBm

Configured CD High Threshold = 2400 ps/nm

Configured CD lower Threshold = -2400 ps/nm

Configured OSNR lower Threshold = 0.40 dB

**Configured DGD Higher Threshold = 0.30 ps**

Baud Rate = 63.1394679230 GBd

Bits per Symbol = 3.0000000000 bits/symbol

```

Modulation Type: 8QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm
Polarization Mode Dispersion = 0.0 ps
Second Order Polarization Mode Dispersion = 29.00 ps^2
Optical Signal to Noise Ratio = 36.10 dB
SNR = 17.50 dB
Polarization Dependent Loss = 0.50 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps

```

#### Transceiver Vendor Details

```

Form Factor           : CIM8
Name                  : CISCO-ACACIA
Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type : LC
Otn Application Code : Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set

```

Transceiver Temperature : 46 Celsius

```

AINS Soak             : None
AINS Timer             : 0h, 0m
AINS remaining time   : 0 seconds

```

## Optical Signal to Noise Ratio

You can configure the minimum acceptable Optical Signal to Noise ratio (OSNR) value on the 1.2T, 2.4TX, and 2.4T cards. The OSNR alarm is raised if OSNR goes below this value.

The range is 0–4000 (in units of 0.01db).

To configure the minimum acceptable OSNR, use the following command:

```

configure
controller optics R/S/I/P
osnr-low-threshold osnr-value
commit

```

The following sample configures the minimum acceptable OSNR on the controller optics:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
RP/0/RP0/CPU0:ios(config-Optics)#osnr-low-threshold 40
RP/0/RP0/CPU0:ios(config-Optics)#commit

```

The following sample shows the minimum acceptable OSNR configured on the controller optics:

```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC

```

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Yellow

Optics Status

Optics Type: CIM8 DWDM  
 DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,  
 Wavelength=1552.524nm

Alarm Status:

-----

Detected Alarms:

HIGH-RX-PWR      LOW-TX-PWR  
 HIGH-DGD

LOS/LOL/Fault Status:

Alarm Statistics:

-----

HIGH-RX-PWR = 1                      LOW-RX-PWR = 0  
 HIGH-TX-PWR = 0                      LOW-TX-PWR = 1  
 HIGH-LBC = 0                          HIGH-DGD = 6  
 OOR-CD = 0                            OSNR = 0  
 WV-L-OOL = 0                          MEA = 0  
 IMPROPER-REM = 1  
 TX-POWER-PROV-MISMATCH = 0  
 Laser Bias Current = 0.0 %  
 Actual TX Power = 0.97 dBm  
 RX Power = -0.53 dBm  
 RX Signal Power = -1.20 dBm  
 Frequency Offset = 63 MHz

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.0	-3.0	0.0	0.0
Tx Power Threshold(dBm)	4.0	2.0	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 55 %

Configured Tx Power = 1.00 dBm

Configured CD High Threshold = 2400 ps/nm

Configured CD lower Threshold = -2400 ps/nm

**Configured OSNR lower Threshold = 0.40 dB**

Configured DGD Higher Threshold = 0.30 ps

Baud Rate = 63.1394679230 GBd

Bits per Symbol = 3.0000000000 bits/symbol

Modulation Type: 8QAM

Chromatic Dispersion 0 ps/nm

Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm

Polarization Mode Dispersion = 0.0 ps

Second Order Polarization Mode Dispersion = 29.00 ps^2

Optical Signal to Noise Ratio = 36.10 dB

SNR = 17.50 dB



```
Polarization Dependent Loss = 0.50 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 1.00 ps
```

#### Transceiver Vendor Details

```
Form Factor           : CIM8
Name                  : CISCO-ACACIA
Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type : LC
Otn Application Code  : Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set
```

Transceiver Temperature : 46 Celsius

```
AINS Soak             : None
AINS Timer             : 0h, 0m
AINS remaining time   : 0 seconds
```

## Receive Power Threshold

You can configure the high and low threshold of the total optical signal power of the received signal on the 1.2T, 2.4TX, and 2.4T cards.

The range is -400 to 300 (in the units of 0.1 dBm).

To configure the high and low receive power threshold, use the following command:

### **configure**

**controller optics** *R/S/I/P*

**rx-high-threshold** *rx-high*

**rx-low-threshold** *rx-low*

### **commit**

The following sample configures the high receive power threshold on the controller optics:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
RP/0/RP0/CPU0:ios(config-Optics)#rx-high-threshold -20
RP/0/RP0/CPU0:ios(config-Optics)#rx-low-threshold -30
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

The following sample shows the high receive power threshold configured on the controller optics:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC
```

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Yellow

Optics Status

Optics Type: CIM8 DWDM  
 DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,  
 Wavelength=1552.524nm

Alarm Status:

-----

Detected Alarms:

HIGH-RX-PWR      LOW-TX-PWR  
 HIGH-DGD

LOS/LOL/Fault Status:

Alarm Statistics:

-----

HIGH-RX-PWR = 1                      LOW-RX-PWR = 0  
 HIGH-TX-PWR = 0                      LOW-TX-PWR = 1  
 HIGH-LBC = 0                         HIGH-DGD = 6  
 OOR-CD = 0                            OSNR = 0  
 WVL-OOL = 0                           MEA = 0  
 IMPROPER-REM = 1  
 TX-POWER-PROV-MISMATCH = 0  
 Laser Bias Current = 0.0 %  
 Actual TX Power = 0.97 dBm  
 RX Power = -0.53 dBm  
 RX Signal Power = -1.20 dBm  
 Frequency Offset = 63 MHz

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
<b>Rx Power Threshold(dBm)</b>	<b>-2.0</b>	<b>-3.0</b>	<b>0.0</b>	<b>0.0</b>
Tx Power Threshold(dBm)	4.0	2.0	0.0	0.0
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 55 %  
 Configured Tx Power = 1.00 dBm  
 Configured CD High Threshold = 2400 ps/nm  
 Configured CD lower Threshold = -2400 ps/nm  
 Configured OSNR lower Threshold = 0.40 dB  
 Configured DGD Higher Threshold = 0.30 ps  
 Baud Rate = 63.1394679230 GBd  
 Bits per Symbol = 3.0000000000 bits/symbol  
 Modulation Type: 8QAM  
 Chromatic Dispersion 0 ps/nm  
 Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm  
 Polarization Mode Dispersion = 0.0 ps  
 Second Order Polarization Mode Dispersion = 29.00 ps^2  
 Optical Signal to Noise Ratio = 36.10 dB  
 SNR = 17.50 dB  
 Polarization Dependent Loss = 0.50 dB  
 Polarization Change Rate = 0.00 rad/s  
 Differential Group Delay = 1.00 ps

## Transceiver Vendor Details

```

Form Factor           : CIM8
Name                  : CISCO-ACACIA
Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type : LC
Otn Application Code  : Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set

```

```
Transceiver Temperature : 46 Celsius
```

```

AINS Soak             : None
AINS Timer             : 0h, 0m
AINS remaining time   : 0 seconds

```

## Transmit Power Threshold

You can configure the high and low threshold of the total optical signal power of the transmitted signal on the 1.2T, 2.4TX, and 2.4T cards.

The range is  $-400$  to  $300$  (in the units of  $0.1$  dBm).

To configure the high and low transmit power threshold, use the following command:

**configure**

**controller optics** *R/S/I/P*

**tx-high-threshold** *tx-high*

**tx-low-threshold** *tx-low*

**commit**

The following sample configures the high transmit power threshold on the controller optics:

```

RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/7
RP/0/RP0/CPU0:ios(config-Optics)#tx-high-threshold 40
RP/0/RP0/CPU0:ios(config-Optics)#tx-low-threshold 20
RP/0/RP0/CPU0:ios(config-Optics)#commit

```

The following sample shows the high transmit power threshold configured on the controller optics:

```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7
Fri Nov 12 10:58:50.595 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Yellow

```

## Optics Status

Optics Type: CIM8 DWDM  
 DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,  
 Wavelength=1552.524nm

## Alarm Status:

-----

## Detected Alarms:

HIGH-RX-PWR    LOW-TX-PWR  
 HIGH-DGD

## LOS/LOL/Fault Status:

## Alarm Statistics:

-----

HIGH-RX-PWR = 1                    LOW-RX-PWR = 0  
 HIGH-TX-PWR = 0                    LOW-TX-PWR = 1  
 HIGH-LBC = 0                        HIGH-DGD = 6  
 OOR-CD = 0                         OSNR = 0  
 WV-L-OOL = 0                       MEA = 0  
 IMPROPER-REM = 1  
 TX-POWER-PROV-MISMATCH = 0  
 Laser Bias Current = 0.0 %  
 Actual TX Power = 0.97 dBm  
 RX Power = -0.53 dBm  
 RX Signal Power = -1.20 dBm  
 Frequency Offset = 63 MHz

Performance Monitoring: Enable

## THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.0	-3.0	0.0	0.0
<b>Tx Power Threshold(dBm)</b>	<b>4.0</b>	<b>2.0</b>	<b>0.0</b>	<b>0.0</b>
LBC Threshold(mA)	N/A	N/A	0.00	0.00

LBC High Threshold = 55 %  
 Configured Tx Power = 1.00 dBm  
 Configured CD High Threshold = 2400 ps/nm  
 Configured CD lower Threshold = -2400 ps/nm  
 Configured OSNR lower Threshold = 0.40 dB  
 Configured DGD Higher Threshold = 0.30 ps  
 Baud Rate = 63.1394679230 GBd  
 Bits per Symbol = 3.0000000000 bits/symbol  
 Modulation Type: 8QAM  
 Chromatic Dispersion 0 ps/nm  
 Configured CD-MIN -48000 ps/nm CD-MAX 48000 ps/nm  
 Polarization Mode Dispersion = 0.0 ps  
 Second Order Polarization Mode Dispersion = 29.00 ps^2  
 Optical Signal to Noise Ratio = 36.10 dB  
 SNR = 17.50 dB  
 Polarization Dependent Loss = 0.50 dB  
 Polarization Change Rate = 0.00 rad/s  
 Differential Group Delay = 1.00 ps

## Transceiver Vendor Details

Form Factor                    : CIM8  
 Name                            : CISCO-ACACIA

```

Part Number           : 10-3500-01
Rev Number            : 01
Serial Number         : ACA24480037
PID                   : CIM8-C-K9
VID                   : VES1
Date Code (yy/mm/dd) : 23/11/10
Fiber Connector Type : LC
Otn Application Code  : Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set

```

Transceiver Temperature : 46 Celsius

```

AINS Soak              : None
AINS Timer              : 0h, 0m
AINS remaining time    : 0 seconds

```

## Frequency

You can configure the frequency on trunk ports of the 1.2T, 2.4TX, and 2.4T line cards.

The following table lists the frequency range with grid spacing supported on the line card:

Line Card	Frequency Range (THz)	Default Frequency (THz)	Grid Spacing
1.2T	191.25 to 196.1	193.1	50GHz and 100MHz
1.2TL <sup>4</sup>	186.1 to 190.85	188.5	100MHz
2.4T	191.25 to 196.1	193.1	50GHz and 100MHz
2.4TX using C band trunk pluggables	191.25 to 196.1	193.1	50GHz and 100MHz
2.4TX using L band trunk pluggables	186.15 to 190.925	No default frequency	100MHz

<sup>4</sup> Only non-ITU channels are supported

To configure the wavelength, use the following commands:

```
configure
```

```
controller optics Rack/Slot/Instance/Port
```

```
dwdm-carrier {100MHz-grid frequency frequency} | {50GHz-grid [frequency frequency]}
```

```
commit
```

## Pseudo Random Binary Sequence

The Pseudo Random Binary Sequence (PRBS) feature feature enables data integrity checks between NCS1014 trunk and client links without generating client traffic.

To ensure that the traffic is error-free during link bring up without relying on the peer port, you must enable the PRBS feature on both the transmitting and receiving ports of your NCS 1014 trunk. The transmitting trunk port creates a bit pattern and sends it to the peer NCS 1014 device. The device then confirms if the sent bit pattern is received. The 1.2T card supports PRBS on the ODU4 controller.

You can configure PRBS on the NCS 1014 trunk and client ports of a 1.2T, 2.4T, and 2.4TX cards.

- **Source mode** — The NCS 1014 at trunk port generates PRBS signal on the line continuously as per the configured PRBS pattern.
- **Sink mode** — The NCS 1014 at trunk port gets locked to the ingress signal according to the configured pattern, analyzes and reports the errors.
- **Source-Sink mode** — The NCS 1014 at trunk port acts as both the PRBS transmitter and receiver, that is, it generates PRBS signal as per the configured pattern, and also gets locked to the ingress signal with the same pattern, and reports the errors.

NCS 1014 trunk port supports the following PRBS patterns:

- **PRBS31** — Sequence length is from  $2^{31} - 1$  bits.
- **PRBS23** — Sequence length is from  $2^{23} - 1$  bits.
- **PRBS15** — Sequence length is from  $2^{15} - 1$  bits.
- **PRBS11** — Sequence length is from  $2^{11} - 1$  bits.
- **PRBS7** — Sequence length is from  $2^7 - 1$  bits.



**Tip** We recommend that for higher datarates like 100G and 400G:

- use high sequence length PRBS patterns and
- use PRBS inverted pattern.



**Note** Interoperability for ethernet PRBS PN23 pattern is not supported in the 2.4T and 2.4TX cards.



**Note** In case of muxponder configuration, PRBS is not supported on the split ports of the 2.4TX card.

## Configuring Pseudo Random Binary Sequence

You can configure PRBS on a coherentDSP or Ethernet controller of a 1.2T, 2.4T, or 2.4TX card. PRBS can also be configured on a ODU controller of the 1.2T card. Before enabling PRBS, the secondary admin state of the controllers must be set to *maintenance*.

### Configure PRBS on CoherentDSP Controller

To configure PRBS on the trunk port of the coherentDSP controller of a 1.2T, 2.4T, or 2.4TX card, use the following configuration commands in the configuration mode:

**controller coherentDSP** *R/S/I/P*

**secondary-admin-state maintenance**

**prbs mode** {source | sink | source-sink} **pattern** {pn31 | pn23 | pn15 | pn7}

#### Example to Configure PRBS on CoherentDSP Controller:

Use the following sample configuration to configure PRBS on trunk ports of a coherentDSP controller:

```
RP/0/RP0/CPU0:ios(config)#controller CoherentDSP 0/0/0/7
RP/0/RP0/CPU0:ios(config-CoDSP)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-CoDSP)#prbs mode source-sink pattern pn15
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
Wed Nov 15 18:11:55.450 UTC
```

### Configure PRBS on ODU Controller

You can configure PRBS in the following combinations for an ODU controller on a 1.2T card. The client ports need to have a physical loopback in all the combinations.

- Near End client and Near End trunk ODU4
- Near End client and Far End client ODU4
- Near End client and Far End trunk ODU4
- Near End trunk and Far End trunk ODU4

To enable PRBS on ODU4 controller's trunk ports of a 1.2T card, use these commands in configuration mode:

**controller odu4** *R/S/I/P*

**secondary-admin-state maintenance**

**opu prbs mode** {source | sink | source-sink} **pattern** {pn31 | pn23 | pn15 | pn7}

Example to Configure PRBS on ODU Controller:

Following is an example to configure PRBS on client ports of an ODU controller of a 1.2T card:

```
RP/0/RP0/CPU0:ios(config)#controller odu4 0/0/0/4
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#prbs mode source-sink pattern pn23
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

### Configure PRBS on Ethernet Controller

To configure PRBS on the client ports of an Ethernet controller of the 2.4T and 2.4TX cards, use the following commands in the configuration mode:

**controller** {fourHundredGigECtrlr} *R/S/I/P*

**secondary-admin-state maintenance**

**opu prbs mode** {source | sink | source-sink} **pattern** {pn31 | pn23 }

Example to Configure PRBS on Ethernet Controller:

Following is an example to configure PRBS on client ports of an Ethernet controller of a 2.4T card:

```
RP/0/RP0/CPU0:ios(config)#controller FourHundredGigEctr1r 0/3/0/1
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#prbs mode source-sink pattern pn31
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

## Verifying PRBS

You can monitor the status of Pseudo Random Binary Sequence (PRBS) using the following command:

**show controllers coherentDSP | ODU4 | fourHundredGigEctr1r R/S/I/P prbs-details**

### Example to view PRBS details on Ethernet controller

Use the following sample configuration to display PRBS details configured on an Ethernet controller:

```
RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/0/0/4
Wed Nov 15 18:39:29.478 UTC
Operational data for interface FourHundredGigEctr1r0/0/0/4:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
  Maintenance: Enabled
  AINS Soak: None
    Total Duration: 0 hour(s) 0 minute(s)
    Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
  PRBS:
    Status: Locked
    Mode: Source-sink
    Pattern: PN23
    Direction: Line
    Framing: Framed
    Laser Squelch: Disabled
    Insert Idle Ingress: Disabled
    Insert Idle Egress: Disabled

Phy:
  Media type: Not known
  Statistics:
    FEC:
      Corrected Codeword Count: 2019127152          Valid: True      Start time:
17:35:46 Wed Nov 15 2023
      Uncorrected Codeword Count: 6                Valid: True      Start time:
17:35:46 Wed Nov 15 2023
    PCS:
      Total BIP errors: 0                          Valid: True      Start time:
17:35:46 Wed Nov 15 2023
      Total frame errors: 0                        Valid: False     Start time:
17:35:46 Wed Nov 15 2023
      Total Bad SH: 0                              Valid: False     Start time:
17:35:46 Wed Nov 15 2023

Autonegotiation disabled.

Operational values:
  Speed: 400Gbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: Internal
```



```

BER monitoring:
  Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms

```

### Example to view PRBS details on CoherentDSP controller

Use the following sample configuration to display PRBS details configured on a coherentDSP controller:

```

RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 prbs-details
Wed Nov 15 18:13:35.210 UTC

```

```

-----PRBS details-----
PRBS Test           : Enable
PRBS Mode           : Source-Sink
PRBS Pattern        : PN15
PRBS Status         : Locked

```

### Example to view PRBS details on ODU controller

Use the following sample configuration to display PRBS details configured on an ODU controller where the PRBS status is displayed as **Not Applicable**, when the mode is **Source**.

```

RP/0/RP0/CPU0:ios#show controllers ODU4 0/3/0/8 prbs-details
Mon Jan 11 05:29:12.436 UTC

```

```

-----PRBS details-----
PRBS Test           : Enable
PRBS Mode           : Source
PRBS Pattern        : PN7
PRBS Status         : Not Applicable

```

## Viewing PRBS Performance Monitoring Parameters

To view the PRBS performance monitoring parameters on a coherentDSP, ODU, or Ethernet controller, use the following command:

```
show controllers coherentDSP | ODU4 R/S/I/P pm {current | history} {15-min|24-hour} prbs
```

Following is an example of how to view the cumulative count of PRBS bit errors in the 15-min sampling interval on a CoherentDSP controller:

```

RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 pm current 15-min prbs
Wed Nov 15 18:19:10.308 UTC

```

```

PRBS in the current interval [18:15:00 - 18:19:10 Wed Nov 15 2023]

```

```

PRBS current bucket type : Valid

```

```

EBC           : 0           Threshold : 0           TCA(enable)  : NO
FOUND-COUNT   : 0           Threshold : 0           TCA(enable)  : NO
LOST-COUNT    : 0           Threshold : 0           TCA(enable)  : NO

```

```

FOUND-AT-TS   : NULL

```

```

LOST-AT-TS      : NULL

CONFIG-PTRN    : PRBS_PATTERN_PN15
STATUS         : LOCKED

```

Last clearing of "show controllers OTU" counters never

Following is an example of how to view PRBS performance monitoring parameters for a 15-minute sampling interval on an ODU controller:

```

RP/0/RP0:ios#show controllers ODU4 0/3/0/1 pm current 15-min prbs
Mon Jan 11 00:58:48.327 UTC

PRBS in the current interval [00:45:00 - 00:58:48 Mon Jan 11 2021]
PRBS current bucket type : Valid
EBC                      : 40437528165
FOUND-COUNT              : 1 FOUND-AT-TS : 00:51:22 Mon Jan 11 2021
LOST-COUNT               : 1 LOST-AT-TS  : 00:52:52 Mon Jan 11 2021
CONFIG-PTRN              : PRBS_PATTERN_PN7
Last clearing of "show controllers ODU" counters never

```

The following tables describes the fields of PRBS PM parameters.

Following is an example of how to view PRBS performance monitoring parameters for a 15-minute sampling interval on an Ethernet controller:

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/0/0/4 pm current 15-min prbs
Wed Nov 15 18:48:19.114 UTC

PRBS in the current interval [18:45:00 - 18:48:19 Wed Nov 15 2023]

PRBS current bucket type : Valid

EBC          : 0          Threshold : 0          TCA(enable) : NO
FOUND-COUNT  : 0          Threshold : 0          TCA(enable) : NO
LOST-COUNT   : 0          Threshold : 0          TCA(enable) : NO

FOUND-AT-TS  : NULL
LOST-AT-TS   : NULL

CONFIG-PTRN  : PRBS_PATTERN_PN23
STATUS       : LOCKED

Last clearing of "show controllers ETHERNET" counters never

```

The following tables describes the fields of PRBS PM parameters.

**Table 22: PRBS PM Parameters**

PM Parameter	Description
EBC	Cumulative count of PRBS bit errors in the sampling interval (15-minute or 24-hour). PRBS bit errors are accumulated only if PRBS signal is locked.
FOUND-COUNT	Number of state transitions from signal unlocked state to signal locked state in the sampling interval. If state change is not observed in the interval, the count is 0.

PM Parameter	Description
LOST-COUNT	Number of state transitions from signal locked state to signal unlocked state in the sampling interval. If state change is not observed in the interval, the count is 0.
FOUND-AT-TS	Latest timestamp when the PRBS state moves from unlocked state to locked state in the sampling interval. If state change is not observed in the interval, the value is null.
CONFIG-PTRN	Configured PRBS pattern on the port.
STATUS	Displays the PRBS status.

## Clearing Bit Errors and Lock Time for PRBS

Lock time is the time that is elapsed since the last PRBS lock is detected.

The following sample shows that bit errors are observed during the PRBS test:

```
RP/0/RP0/CPU0:ios#show controllers odu4 0/2/0/5 prbs-details
Fri Nov 13 03:21:44.191 UTC
```

```
-----PRBS details-----
PRBS Test : Enable
PRBS Mode : Source-Sink
PRBS Pattern : INVERTED PN31
PRBS Status : Locked
PRBS Direction : Line
PRBS Lock Time(in seconds) : 28
PRBS Bit Errors : 23776
```

To clear the lock time and bit errors before the PRBS test, use the **clear** command:

```
RP/0/RP0/CPU0:ios#clear controller odu4 0/2/0/5 prbs-details
Fri Nov 13 03:21:50.726 UTC
PRBS bit errors cleared
```

The following sample displays the bit errors and lock time are removed.

```
RP/0/RP0/CPU0:ios#show controllers odu4 0/2/0/5 prbs-details
Fri Nov 14 03:21:44.191 UTC
```

```
-----PRBS details-----
PRBS Test : Enable
PRBS Mode : Source-Sink
PRBS Pattern : INVERTED PN31
PRBS Status : Locked
PRBS Direction : Line
PRBS Lock Time(in seconds) : 2
PRBS Bit Errors : 0
```

## CCMD-16 Controllers

The NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L cards have two types of controllers. The controllers are OMS and OCH controllers. When the NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L 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 ?
```

The following output shows the active OCH controllers in *Slot 0* from *port 1 to 16*.

### Output Example

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

To view the OMS controllers, run the following command:

### Command

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

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

### Output Example

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

## OCH Controller

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

**Table 23: 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

Card	Port Type	OCH Ports	Interfaces
NCS1K14-CCMD-16-L	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 and NCS1K14-CCMD-16-L cards, the OMS controllers are automatically created by default. The OMS controllers for the NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L cards are:

**Table 24: Supported Interfaces**

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

**Table 25: Feature History**

Feature Name	Release Information	Feature Description
Supported Functionalities of CCMD-16-C and CCMD-16-L Line Cards	Cisco IOS XR Release 7.11.1	Supported Functionalities of CCMD-16-C and CCMD-16-L Line Cards: The software supports Variable Optical Attenuator (VoA), power monitoring and reporting of parameters to the controllers at the OCH and OMS level. It helps in configuring the amplifier parameters for optimizing signal transmissions.  The software also supports in-band and out-of-band tone detection and monitoring and reporting of alarms.

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

**Table 26: 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 <b>show controller oms</b> output.

EDFA-ADD Gain Range	<pre>controller Oms R/S/I/P   egress-ampli-gain-range &lt;normal     extended&gt;</pre>	
------------------------	---	--



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>
```

		<p>New applied config:</p> <pre>controller Oms R/S/I/P egress-ampli-gain-range extended commit</pre> <p>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.</p> <p>Scenario 4:</p> <p>Current running config:</p> <pre>controller Oms R/S/I/P egress-ampli-gain &lt;gain value in normal mode&gt;</pre> <p>New applied config:</p> <pre>..... controller Oms R/S/I/P egress-ampli-gain-range extended egress-ampli-gain &lt;gain value in extended mode&gt; commit replace</pre>
EDFA-ADD Gain	<pre>controller Oms R/S/I/P egress-ampli-gain &lt;val in 0.1 dB&gt;</pre>	<p>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 <b>show controller oms</b> output can be used for finding the applied gain.</p>
EDFA-DROP Control Mode	<pre>controller Oms R/S/I/P ingress-ampli-mode power-control</pre>	<p>The default mode is gain-control.</p> <p>Use this command to change the mode to power-control mode.</p> <p>You can delete this configuration to revert to gain-control mode.</p>
EDFA-DROP Power	<pre>controller Oms R/S/I/P ingress-ampli-power &lt;vale in 0.1 dBm&gt;</pre>	<p>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 <b>show controller oms</b> output.</p>
EDFA-DROP Gain	<pre>controller Oms R/S/I/P ingress-ampli-gain &lt;val in 0.1 dB&gt;</pre>	<p>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 <b>show controller oms</b> output can be used for finding the applied gain.</p>

VoA Attenuation	<pre>controller Oms R/S/I/P tx-voa-attenuation &lt;val in 0.1 dB&gt; rx-voa-attenuation &lt;val in 01. dB&gt;</pre>	<p>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 <b>show controller oms</b> output can be used for finding the applied attenuation.</p>
Shutdown (COM Port)	<pre>controller Oms R/S/I/P shutdown</pre>	<p>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.</p> <p>Here the default value is 'unshut'.</p>
Shutdown (Ch Ports)	<pre>controller Och R/S/I/P shutdown</pre>	<p>The channel port will be marked as out-of-service.</p>

**Configure Operational Parameters**

The different operational parameters supported are given below.

**Table 27: Operational Parameters**

Parameter	CLI	Description
Photo Diodes (COM Port)	<p><b>OMS Controller</b></p> <pre>Tx Power and Rx Power</pre>	<p>Rx Power = Inband power + OOB Tx Power = Inband power + OOB</p> <p>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.</p>
Photo Diodes (CH Ports)	<p><b>OCH Controller</b></p> <pre>Tx Power and Rx Power</pre>	<p>It reports the power transmitted and received on the channel ports.</p>
Amplifier Parameters	<p><b>OMS Controller</b></p> <pre>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</pre>	<p>Egress and ingress amplifier parameters.</p>

VoA Parameters	<b>OMS Controller</b> Tx VoA Attenuation and Rx VoA Attenuation	VoA attenuation parameters.
----------------	--	-----------------------------

### Configure Optical Safety Parameters

Use the following parameters for configuring optical safety.

**Table 28: 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 <b>show controller oms</b> output can be used for finding the OSRI configuration and status.

## Configure Rx VOA Fixed Ratio to Zero

You can configure the Rx VOA attenuation to a fixed ratio of zero, effectively disabling the Rx VOA entirely.



**Warning** Disabling Rx VOA attenuation in certain scenarios may destabilize the network. Practice caution and contact the Cisco TAC team for more information.

**Step 1** This configuration sets the rx-voa fixed-ratio to zero.

**Example:**

```
RP/0/RP0/CPU0:NE80#configur
Tue Aug 6 07:44:28.125 UTC
Current Configuration Session Line      User      Date              Lock
00001000-00001569-00000000 vty0 cisco Tue Aug 6 05:33:16 2024
RP/0/RP0/CPU0:NE80(config)#controller optics 0/2/0/0 rx-voa fixed-ratio 0
RP/0/RP0/CPU0:NE80(config)#controller optics 0/2/0/7 rx-voa fixed-ratio 0
RP/0/RP0/CPU0:NE80(config)#commit
Tue Aug 6 07:44:48.545 UTC
RP/0/RP0/CPU0:NE80(config)#end
```

**Step 2** Verify whether the rx-voa fixed ratio is set to fixed ration zero using *show running-config controller* command.

**Example:**

```
RP/0/RP0/CPU0:N112#show running-config controller optics 0/2/0/0
Thu May 16 09:19:51.223 UTC
description optics0/2/0/0
dwdm-carrier 100MHz-grid frequency 1909000
rx-voa fixed-ratio 0
```

**Step 3** Verify whether the rx-voa fixed-ratio is set to fixed ration zero using the *show controllers optics* command.

**Example:**

```

RP/0/RP0/CPU0:123#show controllers optics 0/2/0/0
Controller State: Up
Transport Admin State: In Service
Laser State: On
LED State: Green
Optics Status
Optics Type: CIM8 DWDM
DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
Wavelength=1552.524nm
Alarm Status:
-----
Detected Alarms: None
LOS/LOL/Fault Status:
Alarm Statistics:
-----
HIGH-RX-PWR = 0 LOW-RX-PWR = 0
HIGH-TX-PWR = 0 LOW-TX-PWR = 0
HIGH-LBC = 0 HIGH-DGD = 0
OOR-CD = 0 OSNR = 0
WVL-OOL = 0 MEA = 0
IMPROPER-REM = 0
TX-POWER-PROV-MISMATCH = 0
Laser Bias Current = 0.0 %
Actual TX Power = 2.00 dBm
RX Power = -0.01 dBm
RX Signal Power = 1.94 dBm
Frequency Offset = 0 MHz
Performance Monitoring: Enable
THRESHOLD VALUES
-----
Parameter High Alarm Low Alarm High Warning Low Warning
-----
Rx Power Threshold(dBm) 13.0 -17.0 0.0 0.0
Tx Power Threshold(dBm) 5.0 -13.0 0.0 0.0
LBC Threshold(mA) N/A N/A 0.00 0.00
LBC High Threshold = 90 %
Configured Tx Power = 2.00 dBm
Configured CD High Threshold = 180000 ps/nm
Configured CD lower Threshold = -180000 ps/nm
Configured OSNR lower Threshold = 20.40 dB
Configured DGD Higher Threshold = 88.00 ps
Baud Rate = 137.9783940000 GBd
Bits per Symbol = 3.5200000000 bits/symbol
Modulation Type: PCS
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -10000 ps/nm CD-MAX 48000 ps/nm
Polarization Mode Dispersion = 0.0 ps
Second Order Polarization Mode Dispersion = 44.00 ps^2
Optical Signal to Noise Ratio = 36.60 dB
SNR = 18.20 dB
Polarization Dependent Loss = 0.40 dB
Polarization Change Rate = 4639.00 rad/s
Differential Group Delay = 2.00 ps
Filter Roll Off Factor : 0.100
Rx VOA Fixed Ratio : 0.00 dB
NLEQ Compensation Mode : 0
Cross Polarization Gain Mode : 10
Proprietary Submarine Parameters
Type : 1 Value : 0
Type : 2 Value : 0
Type : 3 Value : 0
Type : 4 Value : 0
Type : 5 Value : 10485760

```

```
Transceiver Vendor Details
Form Factor : CIM8
Name : ACACIA
Part Number : 10-100508-01
Rev Number : 10
Serial Number : N/A
PID : CIM8-CE-K9
VID : VES1
Firmware Version : Major.Minor.Build
Active : 80.130.19
Inactive : 80.130.19
Date Code(yy/mm/dd) : 24/06/18
Fiber Connector Type: LC
Otn Application Code: Not Set
Sonet Application Code: Not Set
Ethernet Compliance Code: Not set
Transceiver Temperature : 36 Celsius
AINS Soak : None
AINS Timer : 0h, 0m
AINS remaining time : 0 seconds
```

---



## CHAPTER 4

# Performance Monitoring

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



**Note** Downgrade to 7.11.1 or earlier releases from 24.1.1 can lead to a restart of the pm\_collector process. To avoid this, clear the PM historical data before the downgrade using the following commands:

```
process shutdown pm_collector
run
cd /misc/config
rm chkpt_pm_collector_*
exit
```

Use the following commands if you are already experiencing a continuous pm\_collector restart.

```
process shutdown pm_collector
run
cd /misc/config
rm chkpt_pm_collector_*
exit
process start pm_collector
```

- [Performance Monitoring, on page 121](#)
- [Performance Monitoring for NCS1K14-2.4T-X-K9 Card, on page 141](#)
- [Performance Monitoring for NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L Cards, on page 141](#)
- [Configuring PM Parameters for NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L Cards, on page 142](#)

## Performance Monitoring

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



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```
process shutdown pm_collector
run
cd /misc/config
rm chkpt_pm_collector_*
exit
```

Use the following commands if you are already experiencing a continuous pm\_collector restart.

```
process shutdown pm_collector
run
cd /misc/config
rm chkpt_pm_collector_*
exit
process start pm_collector
```

## Configuring PM Parameters

You can configure and view the performance monitoring parameters for the Optics, Ethernet, odu-flex, and coherent DSP controllers.

To configure PM parameters, use the following commands.

### configure

**show controller** *controllertype R/S/I/P* { **pm** { **current** | **history** } { **30-sec 15-min** || **24-hour** } { **optics** | **ether** | **fec** | **otn** | **prbs** } **linenumber** }

### commit

### Examples

The following is a sample in which the performance monitoring parameters of Optics controller are configured for 24-hour intervals.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/1/5 pm 24-hour optics threshold osnr max
345
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the performance monitoring parameters of the Ethernet controller are configured for 15-minute intervals.

```
RP/0/RP0/CPU0:chassisA164(config)#controller fourHundredGigEctrler 0/1/0/4 pm 15-min ether
threshold rx-pkt 1
```

The following is a sample in which performance monitoring parameters of Coherent DSP controller are configured for 30-second intervals.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/0/0/7 pm 30-sec fec threshold post-fec-ber
max OE-15
RP/0/RP0/CPU0:ios(config)#commit
```



## Viewing PM Parameters

To view the performance monitoring parameters for Optics, Ethernet, and Coherent DSP controllers, use the following command:

```
show controllers controllertype R/S/I/P { pm { current | history } { 30 sec | 15-min | 24-hour } { optics | ether | fec | otn | prbs} linenumber }
```

**Example 1:** The following command displays the current performance monitoring parameters of the Optics controller with 15-minute intervals:

```
RP/0/RP0/CPU0:ios#show controller optics 0/1/0/3 pm current 15-min optics 3
Fri Sep 22 13:53:37.120 IST

Optics in the current interval [13:45:00 - 13:53:37 Fri Sep 22 2023]

Optics current bucket type : Valid
      MIN      AVG      MAX      Operational      Configured      TCA      Operational
      Configured      TCA
      Threshold(max) (max)
      Threshold(min)  Threshold(min) (min) Threshold(max)
LBC[% ]      : 56.8      56.8      56.8      0.0      NA      NO      100.0
      NA      NO
OPT[dBm]     : -40.00     -40.00     -40.00     -30.00     NA      NO      63.32
      NA      NO
OPR[dBm]     : -40.00     -40.00     -40.00     -30.00     NA      NO      63.32
      NA      NO
```

**Example 2:** The following command displays the current performance monitoring parameters of the client Optics controller with 15-minute intervals:

```
RP/0/RP0/CPU0:ios#show controller optics 0/2/0/1 pm current 15-min optics 1
Fri Sep 22 13:56:52.123 IST

Optics in the current interval [13:45:00 - 13:56:52 Fri Sep 22 2023]

Optics current bucket type : Valid
      MIN      AVG      MAX      Operational      Configured      TCA      Operational
      Configured      TCA
      Threshold(max) (max)
      Threshold(min)  Threshold(min) (min) Threshold(max)
LBC[% ]      : 24.8      25.7      26.7      0.0      NA      NO      100.0
      NA      NO
OPT[dBm]     : -0.12     -0.00     0.11     -30.00     NA      NO      63.32
      NA      NO
OPR[dBm]     : -0.67     -0.46     -0.24     -30.00     NA      NO      63.32
      NA      NO
```

**Example 3:** The following command displays the current performance monitoring parameters of the client Ethernet controller with 15-minute intervals:

```
RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/0/0/4 pm current 15-min ether
ETHER in the current interval [16:15:00 - 16:18:44 Fri Nov 17 2023]
ETHER current bucket type : Valid
  RX-UTIL[%]      : 0.00      Threshold : 0.00      TCA(enable) :
NO
  TX-UTIL[%]      : 0.00      Threshold : 0.00      TCA(enable) :
NO
  RX-PKT          : 0      Threshold : 0      TCA(enable) :
NO
  STAT-PKT        : 0      Threshold : 0      TCA(enable) :
NO
  OCTET-STAT      : 0      Threshold : 0      TCA(enable) :
NO
  OVERSIZE-PKT    : 0      Threshold : 0      TCA(enable) :
```

```

NO
  FCS-ERR          : 0          Threshold : 0          TCA(enable) :
NO
  LONG-FRAME       : 0          Threshold : 0          TCA(enable) :
NO
  JABBER-STATS    : 0          Threshold : 0          TCA(enable) :
NO
  64-OCTET        : 0          Threshold : 0          TCA(enable) :
NO
  65-127-OCTET    : 0          Threshold : 0          TCA(enable) :
NO
  128-255-OCTET   : 0          Threshold : 0          TCA(enable) :
NO
  256-511-OCTET   : 0          Threshold : 0          TCA(enable) :
NO
  512-1023-OCTET  : 0          Threshold : 0          TCA(enable) :
NO
  1024-1518-OCTET : 0          Threshold : 0          TCA(enable) :
NO
  IN-UCAST        : 0          Threshold : 0          TCA(enable) :
NO
  IN-MCAST        : 0          Threshold : 0          TCA(enable) :
NO
  IN-BCAST        : 0          Threshold : 0          TCA(enable) :
NO
  OUT-UCAST       : 0          Threshold : 0          TCA(enable) :
NO
  OUT-BCAST       : 0          Threshold : 0          TCA(enable) :
NO
  OUT-MCAST       : 0          Threshold : 0          TCA(enable) :
NO
  TX-PKT          : 0          Threshold : 0          TCA(enable) :
NO
  OUT-OCTET       : 0          Threshold : 0          TCA(enable) :
NO
  IFIN-ERRORS     : 0          Threshold : 0          TCA(enable) :
NO
  IFIN-OCTETS     : 0          Threshold : 0          TCA(enable) :
NO
  STAT-MULTICAST-PKT : 0      Threshold : 0          TCA(enable) :
NO
  STAT-BROADCAST-PKT : 0      Threshold : 0          TCA(enable) :
NO
  STAT-UNDERSIZED-PKT : 0      Threshold : 0          TCA(enable) :
NO
  IN_GOOD_BYTES   : 0          Threshold : 0          TCA(enable) :
NO
  IN_GOOD_PKTS    : 0          Threshold : 0          TCA(enable) :
NO
  IN_DROP_OTHER   : 0          Threshold : 0          TCA(enable) :
NO
  OUT_GOOD_BYTES  : 0          Threshold : 0          TCA(enable) :
NO
  OUT_GOOD_PKTS   : 0          Threshold : 0          TCA(enable) :
NO
  IN_PKT_64_OCTET : 0          Threshold : 0          TCA(enable) :
NO
  IN_PKTS_65_127_OCTETS : 0      Threshold : 0          TCA(enable) :
NO
  IN_PKTS_128_255_OCTETS : 0      Threshold : 0          TCA(enable) :
NO
  IN_PKTS_256_511_OCTETS : 0      Threshold : 0          TCA(enable) :
NO
  IN_PKTS_512_1023_OCTETS : 0      Threshold : 0          TCA(enable) :

```

```

NO
  IN_PKTS_1024_1518_OCTETS : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKT_64_OCTET          : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKTS_65_127_OCTETS   : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKTS_128_255_OCTETS  : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKTS_256_511_OCTETS  : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKTS_512_1023_OCTETS : 0          Threshold : 0          TCA(enable) :
NO
  OUT_PKTS_1024_1518_OCTETS : 0          Threshold : 0          TCA(enable) :
NO
  TX_UNDERSIZED_PKT        : 0          Threshold : 0          TCA(enable) :
NO
  TX_OVERSIZED_PKT         : 0          Threshold : 0          TCA(enable) :
NO
  TX_JABBER                 : 0          Threshold : 0          TCA(enable) :
NO
  TX_BAD_FCS                : 0          Threshold : 0          TCA(enable) :
NO

```

**Example 4:** The following command displays the current performance monitoring for FEC for the Coherent DSP controller for FEC 15-minute intervals:

```

RP/0/RP0/CPU0:ios#show controller coherentDSP 0/2/0/0 pm current 15-min fec
Fri Sep 22 14:02:19.236 IST

g709 FEC in the current interval [14:00:00 - 14:02:19 Fri Sep 22 2023]

FEC current bucket type : Valid
  EC-BITS : 545156378205          Threshold : 5400000000000          TCA(enable) :
YES
  UC-WORDS : 0                    Threshold : 5                      TCA(enable) :
YES

Threshold          TCA          MIN          AVG          MAX          Threshold          TCA
(max)             (enable)
PreFEC BER        : 5.19E-03  5.36E-03  6.09E-03  0E-15          NO
  0E-15           NO
PostFEC BER       : 0E-15    0E-15    0E-15    0E-15          NO
  0E-15           NO
Q[dB]             : 8.10     8.10     8.10     0.00          NO
  0.00            NO
Q_Margin[dB]     : 2.10     2.10     2.10     0.00          NO
  0.00            NO
Instantaneous Q_Margin [dB] : 1.70    1.77    1.80     0.00          NO
  0.00            NO

```

**Example 5:** The following command displays the current performance monitoring parameters for PRBS of the Coherent DSP controller with 15-minute intervals:

```

RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 pm current 15-min prbs
Mon Feb 13 00:58:48.327 UTC
PRBS in the current interval [00:45:00 - 00:58:48 Mon Feb 13 2019]
PRBS current bucket type : Valid
EBC : 40437528165
FOUND-COUNT : 1 FOUND-AT-TS : 00:51:22 Mon Feb 13 2019
LOST-COUNT : 1 LOST-AT-TS : 00:52:52 Mon Feb 13 2019
CONFIG-PTRN : PRBS_PATTERN_PN31
Last clearing of "show controllers OTU" counters never

```

**Example 6:** The following command displays the current performance monitoring of PCS of the Ethernet controller with 30-second intervals:

```
RP/0/RP0/CPU0:ios#show controllers hundredGigEctrlr 0/1/0/2/1 pm current 30-sec pcs
Fri Sep 22 14:04:33.676 IST
```

```
Ethernet PCS in the current interval [14:04:30 - 14:04:33 Fri Sep 22 2023]
```

```
Ethernet PCS current bucket type : Valid
BIP[00] : 0 Threshold : 0
  TCA(enable) : NO
BIP[01] : 0 Threshold : 0
  TCA(enable) : NO
BIP[02] : 0 Threshold : 0
  TCA(enable) : NO
BIP[03] : 0 Threshold : 0
  TCA(enable) : NO
BIP[04] : 0 Threshold : 0
  TCA(enable) : NO
BIP[05] : 0 Threshold : 0
  TCA(enable) : NO
BIP[06] : 0 Threshold : 0
  TCA(enable) : NO
BIP[07] : 0 Threshold : 0
  TCA(enable) : NO
BIP[08] : 0 Threshold : 0
  TCA(enable) : NO
BIP[09] : 0 Threshold : 0
  TCA(enable) : NO
BIP[10] : 0 Threshold : 0
  TCA(enable) : NO
BIP[11] : 0 Threshold : 0
  TCA(enable) : NO
BIP[12] : 0 Threshold : 0
  TCA(enable) : NO
BIP[13] : 0 Threshold : 0
  TCA(enable) : NO
BIP[14] : 0 Threshold : 0
  TCA(enable) : NO
BIP[15] : 0 Threshold : 0
  TCA(enable) : NO
BIP[16] : 0 Threshold : 0
  TCA(enable) : NO
BIP[17] : 0 Threshold : 0
  TCA(enable) : NO
BIP[18] : 0 Threshold : 0
  TCA(enable) : NO
BIP[19] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[00] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[01] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[02] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[03] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[04] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[05] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[06] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[07] : 0 Threshold : 0
```

TCA(enable) : NO		
FRM-ERR[08]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[09]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[10]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[11]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[12]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[13]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[14]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[15]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[16]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[17]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[18]	: 0	Threshold : 0
TCA(enable) : NO		
FRM-ERR[19]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[00]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[01]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[02]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[03]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[04]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[05]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[06]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[07]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[08]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[09]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[10]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[11]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[12]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[13]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[14]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[15]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[16]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[17]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[18]	: 0	Threshold : 0
TCA(enable) : NO		
BAD-SH[19]	: 0	Threshold : 0

```

TCA(enable) : NO
ES : 0 Threshold : 0
TCA(enable) : NO
SES : 0 Threshold : 0
TCA(enable) : NO
UAS : 0 Threshold : 0
TCA(enable) : NO
ES-FE : 0 Threshold : 0
TCA(enable) : NO
SES-FE : 0 Threshold : 0
TCA(enable) : NO
UAS-FE : 0 Threshold : 0
TCA(enable) : NO

```

**Example 7:** The following command displays the history performance monitoring of PCS of the Ethernet controller with 30-second intervals:

```
RP/0/RP0/CPU0:ios#show controllers hundredGigECtrlr 0/1/0/2/1 pm history 30-sec pcs 1
Fri Sep 22 14:06:14.193 IST
```

```
Ethernet PCS in the current interval [14:05:30 - 14:06:00 Fri Sep 22 2023]
```

```
Ethernet PCS current bucket type : Valid
```

```

BIP[00] : 0
BIP[01] : 0
BIP[02] : 0
BIP[03] : 0
BIP[04] : 0
BIP[05] : 0
BIP[06] : 0
BIP[07] : 0
BIP[08] : 0
BIP[09] : 0
BIP[10] : 0
BIP[11] : 0
BIP[12] : 0
BIP[13] : 0
BIP[14] : 0
BIP[15] : 0
BIP[16] : 0
BIP[17] : 0
BIP[18] : 0
BIP[19] : 0
FRM-ERR[00] : 0
FRM-ERR[01] : 0
FRM-ERR[02] : 0
FRM-ERR[03] : 0
FRM-ERR[04] : 0
FRM-ERR[05] : 0
FRM-ERR[06] : 0
FRM-ERR[07] : 0
FRM-ERR[08] : 0
FRM-ERR[09] : 0
FRM-ERR[10] : 0
FRM-ERR[11] : 0
FRM-ERR[12] : 0
FRM-ERR[13] : 0
FRM-ERR[14] : 0
FRM-ERR[15] : 0
FRM-ERR[16] : 0
FRM-ERR[17] : 0
FRM-ERR[18] : 0
FRM-ERR[19] : 0
BAD-SH[00] : 0
BAD-SH[01] : 0

```

```

BAD-SH[02]          : 0
BAD-SH[03]          : 0
BAD-SH[04]          : 0
BAD-SH[05]          : 0
BAD-SH[06]          : 0
BAD-SH[07]          : 0
BAD-SH[08]          : 0
BAD-SH[09]          : 0
BAD-SH[10]          : 0
BAD-SH[11]          : 0
BAD-SH[12]          : 0
BAD-SH[13]          : 0
BAD-SH[14]          : 0
BAD-SH[15]          : 0
BAD-SH[16]          : 0
BAD-SH[17]          : 0
BAD-SH[18]          : 0
BAD-SH[19]          : 0
ES                  : 0
SES                 : 0
UAS                 : 0
ES-FE               : 0
SES-FE              : 0
UAS-FE              : 0

```

**Example 8:** The following command displays the current performance monitoring parameters of the trunk optics controller with 10-second intervals as flexi-bin:

```

RP/0/RP0/CPU0:ios#show controllers optics 0/1/0/0 pm current flex-bin optics 1
Fri Sep 22 14:08:37.001 IST

```

Optics in the current interval [14:08:30 - 14:08:36 Fri Sep 22 2023]

Flexible bin interval size: 10 seconds

Optics current bucket type : Valid

	MIN	AVG	MAX	Operational	Configured	TCA	Operational
	Configured	TCA		Threshold(min)	Threshold(min)	(min)	Threshold(max)
	Threshold(max)	(max)					
LBC[% ]	: 0.0	0.0	0.0	0.0	NA	NO	0.0
	NA	NO					
OPT[dBm]	: -1.53	-1.49	-1.45	0.00	NA	NO	0.00
	NA	NO					
OPR[dBm]	: -1.62	-1.61	-1.57	0.00	NA	NO	0.00
	NA	NO					
CD[ps/nm]	: 2	2	3	0	NA	NO	0
	NA	NO					
DGD[ps ]	: 3.00	3.00	3.00	0.00	NA	NO	0.00
	NA	NO					
SOPMD[ps^2]	: 9.00	21.57	40.00	0.00	NA	NO	0.00
	NA	NO					
OSNR[dB]	: 37.90	37.90	37.90	0.00	NA	NO	0.00
	NA	NO					
PDL[dB]	: 1.10	1.10	1.10	0.00	NA	NO	0.00
	NA	NO					
PCR[rad/s]	: 0.00	26.29	93.00	0.00	NA	NO	0.00
	NA	NO					
RX_SIG[dBm]	: -2.14	-2.09	-2.05	0.00	NA	NO	0.00
	NA	NO					
FREQ_OFF[Mhz]	: 873	902	938	0	NA	NO	0
	NA	NO					
SNR[dB]	: 20.90	20.97	21.10	0.00	NA	NO	0.00
	NA	NO					
SNR-AX[dB]	: 20.90	21.00	21.10	0.00	NA	NO	0.00

```

          NA          NO
SNR-AY [dB] : 20.90   20.99   21.00   0.00           NA          NO   0.00
          NA          NO
SNR-BX [dB] : 19.20   19.40   19.60   0.00           NA          NO   0.00
          NA          NO
SNR-BY [dB] : 19.30   19.40   19.50   0.00           NA          NO   0.00
          NA          NO
SOP-S1      : 0.00    1.09    2.55    0.00           NA          NO   0.00
          NA          NO
SOP-S2      : 0.31    0.32    0.33    0.00           NA          NO   0.00
          NA          NO
SOP-S3      : 0.94    0.94    0.94    0.00           NA          NO   0.00
          NA          NO

```

**Example 9:** The following command displays the history performance monitoring parameters of the trunk optics controller with 10-second intervals as flexi-bin.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/1/0/0 pm history flex-bin optics 1 bucket 1
Fri Sep 22 14:09:54.425 IST
```

```
Optics in interval 1 [14:09:40 - 14:09:50 Fri Sep 22 2023]
```

```
Flexible bin interval size: 10 seconds
```

```
Optics history bucket type : Valid
```

```

          MIN          AVG          MAX
LBC[% ]   : 0.0        0.0        0.0
OPT [dBm] : -1.52     -1.49     -1.47
OPR [dBm] : -1.63     -1.59     -1.55
CD [ps/nm] : 1         1          2
DGD [ps ]  : 2.00     2.70     3.00
SOPMD [ps^2]: 4.00    14.00    27.00
OSNR [dB]  : 37.90    37.90    37.90
PDL [dB]   : 1.10     1.10     1.10
PCR [rad/s] : 0.00    16.00    96.00
RX_SIG [dBm] : -2.13  -2.08    -2.02
FREQ_OFF [Mhz]: 833    870      916
SNR [dB]   : 20.80    20.94    21.10
SNR-AX [dB]: 20.80    20.97    21.10
SNR-AY [dB]: 20.90    20.93    21.10
SNR-BX [dB]: 19.30    19.42    19.50
SNR-BY [dB]: 19.20    19.42    19.50
SOP-S1     : 0.00     1.53     2.55
SOP-S2     : 0.30     0.32     0.33
SOP-S3     : 0.94     0.94     0.95

```

**Example 10:** The following command displays the current performance monitoring parameters of the coherentDSP controller as flexi-bin:

```
RP/0/0/CPU0:ios#show controllers coherentDSP 0/1/0/0 pm current flex-bin fec
Fri Sep 22 14:11:11.213 IST
```

```
g709 FEC in the current interval [14:11:10 - 14:11:10 Fri Sep 22 2023]
```

```
Flexible bin interval size: 10 seconds
```

```
FEC current bucket type : Valid
```

```

          EC-BITS      : 2532544513          Threshold : 0          TCA(enable) :
NO
          UC-WORDS     : 0                  Threshold : 0          TCA(enable) :
NO

```

```

          Threshold    TCA          MIN          AVG          MAX          Threshold    TCA
          (min)        (enable)

```



(max)	(enable)					
PreFEC BER 0E-15	NO	:	3.39E-03	3.44E-03	3.59E-03	0E-15 NO
PostFEC BER 0E-15	NO	:	0E-15	0E-15	0E-15	0E-15 NO
Q[dB] 0.00	NO	:	8.60	8.60	8.60	0.00 NO
Q_Margin[dB] 0.00	NO	:	2.60	2.60	2.60	0.00 NO
Instantaneous Q_Margin [dB] 0.00	NO	:	2.30	2.30	2.30	0.00 NO

**Example 11:** The following command displays the current performance monitoring FEC parameters of the coherentDSP OTN with 15-minute intervals:

```
show controllers coherentDSP 0/0/0/7 pm current 15-min otn
Fri Nov 17 16:33:50.820 UTC
g709 OTN in the current interval [16:30:00 - 16:33:50 Fri Nov 17 2023]
OTN current bucket type : Valid
ES-NE : 0 Threshold : 500 TCA(enable) : YES
ESR-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
SES-NE : 0 Threshold : 500 TCA(enable) : YES
SESR-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
UAS-NE : 0 Threshold : 500 TCA(enable) : YES
BBE-NE : 0 Threshold : 10000 TCA(enable) : YES
BBER-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
FC-NE : 0 Threshold : 10 TCA(enable) : YES

ES-FE : 0 Threshold : 500 TCA(enable) : YES
ESR-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
SES-FE : 0 Threshold : 500 TCA(enable) : YES
SESR-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
UAS-FE : 0 Threshold : 500 TCA(enable) : YES
BBE-FE : 0 Threshold : 10000 TCA(enable) : YES
BBER-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
FC-FE : 0 Threshold : 10 TCA(enable) : YES
```

**Example 12:** The following command displays the current performance monitoring for OTN parameters of the ODU-Flex with 15-minute intervals:

```
RP/0/RP0/CPU0:ios#show controllers odu-flex 0/0/0/7/4 pm current 15-min otn pathmonitor
Fri Nov 17 16:44:34.849 UTC
g709 OTN in the current interval [16:30:00 - 16:44:34 Fri Nov 17 2023]
OTN current bucket type : Valid
ES-NE : 0 Threshold : 87 TCA(enable) : YES
ESR-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
SES-NE : 0 Threshold : 1 TCA(enable) : YES
SESR-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
UAS-NE : 0 Threshold : 3 TCA(enable) : YES
BBE-NE : 0 Threshold : 85040 TCA(enable) : YES
BBER-NE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
FC-NE : 0 Threshold : 10 TCA(enable) : YES

ES-FE : 0 Threshold : 87 TCA(enable) : YES
ESR-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
SES-FE : 0 Threshold : 1 TCA(enable) : YES
SESR-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
UAS-FE : 0 Threshold : 3 TCA(enable) : YES
BBE-FE : 0 Threshold : 85040 TCA(enable) : YES
BBER-FE : 0.00000 Threshold : 0.00000 TCA(enable) : NO
FC-FE : 0 Threshold : 10 TCA(enable) : YES
```

**Example 13:** Displays the current performance monitoring parameters of the coherentDSP with 15-minute intervals FEC:

```

RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 pm current 15-min fec
Fri Nov 17 16:16:05.276 UTC

g709 FEC in the current interval [16:15:00 - 16:16:05 Fri Nov 17 2023]

FEC current bucket type : Valid
  EC-BITS   : 19795040790          Threshold : 5400000000000          TCA(enable) :
YES
  UC-WORDS  : 0                    Threshold : 5                          TCA(enable) :
YES

Threshold      TCA                MIN      AVG      MAX      Threshold      TCA
              (enable)
              (min)      (enable)
PreFEC BER    : 2.70E-04  2.79E-04  2.88E-04  0E-15          NO
  0E-15      NO
PostFEC BER   : 0E-15    0E-15    0E-15    0E-15          NO
  0E-15      NO
Q[dB]         : 10.70    10.70    10.70    0.00           NO
  0.00       NO
Q_Margin[dB]  : 4.40     4.45     4.50     0.00           NO
  0.00       NO
Instantaneous Q_Margin [dB] : 4.40    4.45    4.50    0.00           NO
  0.00       NO

```

**Example 14:** The following command displays the current performance monitoring parameters of the Ethernet controller with 15-minute intervals for FEC.

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/0/0/1 pm current 15-min fec

Ethernet FEC in the current interval [11:30:00 - 11:31:00 Mon Oct 30 2023]

FEC current bucket type : Valid
  EC-WORDS   : 8406          Threshold : 0                          TCA(enable) :
NO
  UC-WORDS   : 0            Threshold : 0                          TCA(enable) :
NO

```

**Example 15:** The following command displays the current performance monitoring parameters of the trunk optics with 15-minute intervals.

```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/7 pm current 15-min optics 1
Optics in the current interval [16:00:00 - 16:11:43 Fri Nov 17 2023]
Optics current bucket type : Valid

MIN      AVG      MAX      Operational      Configured      TCA      Operational
Configured      TCA                Threshold(min)  Threshold(min)  (min)  Threshold(max)
Threshold(max) (max)
LBC[% ]      : 0.0      0.0      0.0      5.0              NA              NO      85.0
  NA
OPT[dBm]     : 1.96     2.01     2.04     -12.01           NA              NO      4.00
  NA
OPR[dBm]     : -0.55    -0.46    -0.35    -14.09           NA              NO      11.00
  NA
CD[ps/nm]    : -1       0        0        -9700            NA              NO      46560
  NA
DGD[ps ]     : 0.00     1.00     1.00     0.00             NA              NO      81.00
  NA
SOPMD[ps^2]  : 2.00     24.45    93.00    0.00             NA              NO      60000.00
  NA
OSNR[dB]     : 37.90    39.11    40.70    21.50            NA              NO      99.00
  NA
PDL[dB]      : 1.70     1.91     2.10     0.00             NA              NO      3.00
  NA

```

```

PCR[rad/s] : 0.00      0.00      0.00      0.00      NA      NO      2500000.00
  NA      NO
RX_SIG[dBm] : -1.07     -0.78     -0.64     -15.09     NA      NO      3.00
  NA      NO
FREQ_OFF[Mhz]: -112      -51       14       -3200     NA      NO      3200
  NA      NO
SNR[dB] : 17.20      17.48     17.70     0.00      NA      NO      100.00
  NA      NO
SNR-X[dB] : 17.40      17.67     18.00     0.00      NA      NO      300.00
  NA      NO
SNR-Y[dB] : 17.00      17.31     17.60     0.00      NA      NO      300.00
  NA      NO
SOP-S1 : 0.00      0.00      0.00     -1.00     NA      NO      1.00
  NA      NO
SOP-S2 : 0.00      0.00      0.00     -1.00     NA      NO      1.00
  NA      NO
SOP-S3 : 0.00      0.00      0.00     -1.00     NA      NO      1.00
  NA      NO

```

**Example 16:** Displays the current performance monitoring parameters of the client optics with 15-minute intervals.

```

RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/4 pm current 15-min optics 1
Fri Nov 17 16:13:38.671 UTC

```

```

Optics in the current interval [16:00:00 - 16:13:38 Fri Nov 17 2023]

```

```

Optics current bucket type : Valid

```

	MIN Configured	AVG TCA	MAX	Operational Threshold(min)	Configured Threshold(min)	TCA (min)	Operational Threshold(max)
LBC[%]	83.3	83.3	83.3	0.0	NA	NO	100.0
OPT[dBm]	1.23	1.23	1.23	-2.01	NA	NO	4.00
OPR[dBm]	1.19	1.21	1.24	-5.00	NA	NO	4.00

**Example 17:** Displays the current performance monitoring parameters of the client with 15-minute intervals PCS.

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctrlr 0/0/0/4 pm current 15-min pcs
Ethernet PCS in the current interval [16:15:00 - 16:26:15 Fri Nov 17 2023]

```

```

Ethernet PCS current bucket type : Valid

```

```

BIP[00] : 0      Threshold : 0
  TCA(enable) : NO
BIP[01] : 0      Threshold : 0
  TCA(enable) : NO
BIP[02] : 0      Threshold : 0
  TCA(enable) : NO
BIP[03] : 0      Threshold : 0
  TCA(enable) : NO
BIP[04] : 0      Threshold : 0
  TCA(enable) : NO
BIP[05] : 0      Threshold : 0
  TCA(enable) : NO
BIP[06] : 0      Threshold : 0
  TCA(enable) : NO
BIP[07] : 0      Threshold : 0
  TCA(enable) : NO
BIP[08] : 0      Threshold : 0
  TCA(enable) : NO
BIP[09] : 0      Threshold : 0
  TCA(enable) : NO

```

```

BIP[10] : 0 Threshold : 0
  TCA(enable) : NO
BIP[11] : 0 Threshold : 0
  TCA(enable) : NO
BIP[12] : 0 Threshold : 0
  TCA(enable) : NO
BIP[13] : 0 Threshold : 0
  TCA(enable) : NO
BIP[14] : 0 Threshold : 0
  TCA(enable) : NO
BIP[15] : 0 Threshold : 0
  TCA(enable) : NO
BIP[16] : 0 Threshold : 0
  TCA(enable) : NO
BIP[17] : 0 Threshold : 0
  TCA(enable) : NO
BIP[18] : 0 Threshold : 0
  TCA(enable) : NO
BIP[19] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[00] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[01] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[02] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[03] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[04] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[05] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[06] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[07] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[08] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[09] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[10] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[11] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[12] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[13] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[14] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[15] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[16] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[17] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[18] : 0 Threshold : 0
  TCA(enable) : NO
FRM-ERR[19] : 0 Threshold : 0
  TCA(enable) : NO
BAD-SH[00] : 0 Threshold : 0
  TCA(enable) : NO
BAD-SH[01] : 0 Threshold : 0
  TCA(enable) : NO

```

```

BAD-SH[02]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[03]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[04]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[05]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[06]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[07]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[08]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[09]                : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[10]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[11]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[12]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[13]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[14]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[15]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[16]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[17]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[18]               : 0                Threshold : 0
    TCA(enable) : NO
BAD-SH[19]               : 0                Threshold : 0
    TCA(enable) : NO
ES                        : 0                Threshold : 0
    TCA(enable) : NO
SES                       : 0                Threshold : 0
    TCA(enable) : NO
UAS                       : 0                Threshold : 0
    TCA(enable) : NO
ES-FE                     : 0                Threshold : 0
    TCA(enable) : NO
SES-FE                   : 0                Threshold : 0
    TCA(enable) : NO
UAS-FE                   : 0                Threshold : 0
    TCA(enable) : NO

```

**Example 18:** Displays the FEC performance monitoring parameters of the Ethernet controllers for various time intervals.

From Release 24.2.11, the **show controllers** command output displays post FEC BER and pre FEC BER for the Ethernet controllers of the 2.4T and 2.4TX cards.

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/1/0/4 pm current flex-bin fec
Mon Dec 18 11:30:29.101 UTC

Ethernet FEC in the current interval [11:30:20 - 11:30:28 Mon Dec 18 2023]

Flexible bin interval size: 10 seconds

FEC current bucket type : Valid
    EC-WORDS   : 11174                Threshold : 0                TCA(enable) : NO

```

```

UC-WORDS : 0
Threshold : 0
TCA(enable) : NO

MIN      AVG      MAX      Threshold  TCA      Threshold  TCA
          (min)    (enable)  (max)    (enable)
PreFEC BER:  2.8E-09  2.9E-09  3.1E-09  0E-15     NO      0E-15     NO
PostFEC BER:  0E-15  0E-15  0E-15  0E-15     NO      0E-15     NO

```

```
RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctrlr 0/1/0/4 pm history flex-bin fec 1
Mon Dec 18 11:48:04.229 UTC
```

```
Ethernet FEC in interval 1 [11:47:50 - 11:48:00 Mon Dec 18 2023]
```

```
Flexible bin interval size: 10 seconds
```

```
FEC history bucket type : Valid
```

```
EC-WORDS : 12128
```

```
UC-WORDS : 0
```

```

MIN      AVG      MAX
PreFEC BER :  2.6E-09  2.9E-09  3.0E-09
PostFEC BER:  0E-15  0E-15  0E-15

```

## Instantaneous Q-Margin

### Scenarios on Instantaneous Q-margin

In the following scenarios, the initial few PM buckets are displayed as valid although the instantaneous Q-margin values are displayed as invalid in those buckets. The PM is performed for 30 sec, 15 mins, and 24 hours, respectively.

- Shutdown or no shutdown on optics
- Trunk rate change
- Fiber cut

To overcome such situations, avoid the initial PM bucket readings while monitoring the instantaneous Q-margin values for these scenarios.

The following sample illustrates that the initial PM bucket readings for specified scenarios are invalid and at a later point the PM buckets readings are valid although the instantaneous Q-margin value is invalid.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/2/0/0 pm history flex-bin fec 1
Fri Sep 22 14:17:01.008 IST
```

```
g709 FEC in interval 1 [14:16:50 - 14:17:00 Fri Sep 22 2023]
```

```
Flexible bin interval size: 10 seconds
```

```
FEC history bucket type : Valid
```

```
EC-BITS : 25615718133
```

```
UC-WORDS : 0
```

```

MIN      AVG      MAX
PreFEC BER :  3.37E-03  3.49E-03  3.90E-03
PostFEC BER :  0E-15  0E-15  0E-15
Q           :  8.60  8.60  8.60
Q_margin   :  2.50  2.56  2.60
Instantaneous Q_margin :  2.20  2.20  2.20

```

Now, the PM buckets are valid although the instantaneous Q-margin value is invalid.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/2/0/0 pm history 30-sec fec 1
Sep 22 08:52:03.750 UTC
```

```
g709 FEC in interval 1 [08:51:50 - 08:52:00 Fri Sep 22 2023]
```

```
FEC history bucket type : Invlid
EC-BITS : 35072302421
```

```
UC-WORDS : 0
```

	MIN	AVG	MAX
PreFEC BER	5.20E-03	5.30E-03	5.64E-03
PostFEC BER	0E-15	0E-15	0E-15
Q	8.10	8.10	8.10
Q_margin	2.10	2.10	2.10
Instantaneous Q_margin	1.80	1.80	1.80

### Clearing PM Parameters

To clear the performance monitoring parameters for Ethernet and Coherent DSP controllers, use this command:

**clear controller *controllertype* R/S/I/P pm**

**Example 1:** Clears the PM parameters on the Coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controller coherentDSP 0/0/0/0 pm current 15-min fec
Fri Sep 22 14:28:12.100 IST
```

```
g709 FEC in the current interval [14:15:00 - 14:28:12 Fri Sep 22 2023]
```

```
FEC current bucket type : Valid
```

```
EC-BITS : 1159814176244 Threshold : 5400000000000 TCA(enable) :
YES
UC-WORDS : 0 Threshold : 5 TCA(enable) :
YES
```

Threshold	TCA	MIN	AVG	MAX	Threshold	TCA
(max)	(enable)				(min)	(enable)
PreFEC BER		0E-15	2.14E-03	2.28E-02	0E-15	NO
0E-15	NO					
PostFEC BER		0E-15	1.37E-10	6.59E-08	0E-15	NO
0E-15	NO					
Q[dB]		0.00	4.14	8.60	0.00	NO
0.00	NO					
Q_Margin[dB]		-6.00	-1.89	2.60	0.00	NO
0.00	NO					
Instantaneous Q_Margin [dB]		-21474836.48	-28144.25	2.30	0.00	
NO	0.00	NO				

Last clearing of "show controllers OTU" counters never

```
RP/0/RP0/CPU0:ios#clear controller coherentDSP 0/0/0/0 pm
```

```
Mon Jun 10 11:44:31.650 UTC
```

```
RP/0/RP0/CPU0:ios#show controller coherentDSP 0/0/0/0 pm current 15-min fec
```

```
Fri Sep 22 14:30:06.833 IST
```

```
g709 FEC in the current interval [14:30:00 - 14:30:06 Fri Sep 22 2023]
```

```
FEC current bucket type : Valid
```

```
EC-BITS : 17889249955 Threshold : 5400000000000 TCA(enable) :
YES
```

```

UC-WORDS : 0
Threshold : 5
TCA(enable) :
YES

Threshold TCA MIN AVG MAX Threshold TCA
(max) (enable) (min) (enable)
PreFEC BER : 3.38E-03 3.49E-03 3.85E-03 0E-15 NO
0E-15 NO
PostFEC BER : 0E-15 0E-15 0E-15 0E-15 NO
0E-15 NO
Q[dB] : 8.60 8.60 8.60 0.00 NO
0.00 NO
Q_Margin[dB] : 2.50 2.50 2.60 0.00 NO
0.00 NO
Instantaneous Q_Margin [dB] : 2.20 2.20 2.20 0.00 NO
0.00 NO

```

Last clearing of "show controllers OTU" counters 00:00:07

**Example 2:** To clear the PM parameters on the Ethernet controller, use the following command:

```
RP/0/RP0/CPU0:ios#clear controller HundredGigEctrlr 0/0/0/2/1 pm
```

### Viewing Ethernet Statistics

To view the PM statistics for the Ethernet controllers, use the following command:

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctrlr 0/0/0/4 stats
Fri Nov 17 16:28:34.138 UTC
Statistics for interface FourHundredGigEctrlr0/0/0/4 (cached values):
Ingress:
  Input total bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input good bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input total packets = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input 802.1Q frames = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pause frames = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 64 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 65-127 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 128-255 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 256-511 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 512-1023 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 1024-1518 bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input pkts 1519-Max bytes = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input good pkts = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input unicast pkts = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input multicast pkts = 0 Valid = False Start time =
13:12:29 Fri Nov 17 2023
  Input broadcast pkts = 0 Valid = False Start time =

```



```

13:12:29 Fri Nov 17 2023
  Input drop overrun          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input drop abort           = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input drop invalid VLAN    = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input drop invalid DMAC    = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input drop invalid encap   = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input drop other           = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error giant          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error runt           = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error jabbers        = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error fragments      = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error CRC            = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error collisions     = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error symbol         = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input error other          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input MIB giant            = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input MIB jabber           = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Input MIB CRC              = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Egress:
  Output total bytes         = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output good bytes          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output total packets       = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output 802.1Q frames       = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pause frames        = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 64 bytes       = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 65-127 bytes   = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 128-255 bytes  = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 256-511 bytes  = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 512-1023 bytes = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 1024-1518 bytes = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output pkts 1519-Max bytes = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output good pkts           = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
  Output unicast pkts        = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023

```

```

Output multicast pkts          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Output broadcast pkts         = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Output drop underrun          = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Output drop abort             = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Output drop other             = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023
Output error other            = 0          Valid = False      Start time =
13:12:29 Fri Nov 17 2023

```



**Note** Performance monitoring statistics are not supported for the input unicast packets, output unicast packets, and input error fragments counters for Ethernet clients.

### PM History Persistence

PM history parameters for Optics, Ethernet, and coherent DSP controllers are retained even after a line card cold reload, line card warm reload, XR reload, Calvados reload, RP reload, Hw-module all reload, power cycle, or upgrade of the NCS 1014 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.

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 1014 reload happens during the rollover time, one of the following scenarios occurs:

- 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 0/3/0/2/2 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.

## Performance Monitoring for NCS1K14-2.4T-X-K9 Card

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 30-second, 15-minute, or 24-hour intervals. These parameters simplify troubleshooting operations and enhance data that can be collected directly from the equipment.

### Limitations

On the 2.4TX card in the muxponder mode, PM parameters do not show the Runt and invalid Start Frame Delimiter (SFD) values for the split ports 2 and 3 for 600G and 1000G trunk rates respectively.

## Performance Monitoring for NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L Cards

Table 29: Feature History

Feature Name	Release Information	Feature Description
Supported Functionalities of CCMD-16-C and CCMD-16-L Line Cards	Cisco IOS XR Release 7.11.1	Supported Functionalities of CCMD-16-C and CCMD-16-L Line Cards: The software supports Variable Optical Attenuator (VoA), power monitoring and reporting of parameters to the controllers at the OCH and OMS level. It helps in configuring the amplifier parameters for optimizing signal transmissions.  The software also supports in-band and out-of-band tone detection and monitoring and reporting of alarms.

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 OCH and OMS controllers in 30-second, 15-minute, 24-hour intervals or in 10-second flexible bin interval. These parameters simplify troubleshooting operations and enhance data that can be collected directly from the equipment.

### PM Parameters Supported on OMS Controller

The PM parameters that are supported on OMS controller are given below.

Table 30: PM Parameters Supported on OMS Controller

Controller	Supported PM Parameters	Description
------------	-------------------------	-------------

OMS	OPT (dBm)	Transmitted power
	OPR (dBm)	Received Power
	OPBR (dBm)	Back Reflection Power
	OPBRR (dB)	Back Reflection Ratio
	EAGN (dB)	Egress Ampli Gain
	EATL (dB)	Egress Ampli Tilt
	IAGN (dB)	Ingress Ampli Gain
IATL (dB)	Ingress Ampli Tilt	

### PM Parameters Supported on OCH Controller

The PM parameters that are supported on OCH controller are given below.

Controller	Supported PM Parameters	Description
OCH	OPT (dBm)	Transmitted Power
	OPR (dBm)	Received Power

## Configuring PM Parameters for NCS1K14-CCMD-16-C and NCS1K14-CCMD-16-L Cards

You can configure and view the performance monitoring parameters for the OMS and OCH controllers.

To configure minimum and maximum threshold for individual parameters, use the following commands.

### configure

```
controller controllertype R/S/I/P pm {30-sec | 15-min | 24-hour} optics threshold { parameter-name }
{max|min} {value}
```

### commit

To enable reporting of threshold crossing alarms for individual parameters, use the following commands.

### configure

```
controller controllertype R/S/I/P pm {30-sec | 15-min | 24-hour} optics report { parameter-name }
{min-tca|max-tca}
```

### commit

### Examples

The following is a sample with the performance monitoring parameters of OMS controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:(config)#controller oms 0/1/0/0 pm 30-sec optics threshold opt min < value >
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample with the performance monitoring parameters of OCH controller

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:(config)#controller och 0/1/0/1 pm 30-sec optics threshold opt min < value >
RP/0/RP0/CPU0:ios(config)#commit
```

### Viewing PM Parameters

To view the performance monitoring parameters for OMS and OCH controllers, use this command:

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

Examples for viewing PM parameters for OMS controller are given below:

#### Example 1

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers oms 0/1/0/0 pm current 30-sec optics 1

Optics in the current interval [15:02:30 - 15:02:36 Mon Nov 20 2023]

Optics current bucket type : Valid
      MIN      AVG      MAX      Operational      Configured      TCA      Operational
      Configured      TCA
      Threshold(max) (max)
OPT[dBm] : -8.30      -8.24      -8.20      -50.00      NA      NO      30.00
      NA      NO
OPR[dBm] : -1.80      -1.76      -1.60      -50.00      NA      NO      30.00
      NA      NO
OPBR[dBm] : -11.61     -11.61     -11.61     -50.00     NA      NO     -10.00
      NA      NO
OPBRR[dB] : -3.30      -3.30     -3.30     -50.00     NA      NO      0.00
      NA      NO
EAGN[dB] : 2.00      2.00      2.00      -3.00      NA      NO      22.00
      NA      NO
EATL[dB] : 0.00      0.00      0.00      -6.50      NA      NO      6.50
      NA      NO
IAGN[dB] : 5.00      5.00      5.00      0.00      NA      NO      10.00
      NA      NO
IATL[dB] : 0.00      0.00      0.00      -6.50      NA      NO      6.50
      NA      NO
```

Last clearing of "show controllers OPTICS" counters never

#### Example 2

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers oms 0/1/0/0 pm current 15-min optics 1

Optics in the current interval [15:00:00 - 15:03:18 Mon Nov 20 2023]

Optics current bucket type : Valid
      MIN      AVG      MAX      Operational      Configured      TCA      Operational
      Configured      TCA
      Threshold(max) (max)
OPT[dBm] : -8.30      -8.23     -8.20     -50.00     NA      NO      30.00
      NA      NO
OPR[dBm] : -1.80      -1.60     -1.30     -50.00     NA      NO      30.00
      NA      NO
OPBR[dBm] : -11.61     -11.61     -11.61     -50.00     NA      NO     -10.00
      NA      NO
OPBRR[dB] : -3.40      -3.34     -3.30     -50.00     NA      NO      0.00
      NA      NO
```

```

EAGN[dB]      : 2.00      2.00      2.00      -3.00      NA      NO      22.00
                NA      NO
EATL[dB]      : 0.00      0.00      0.00      -6.50      NA      NO      6.50
                NA      NO
IAGN[dB]      : 5.00      5.00      5.00      0.00      NA      NO      10.00
                NA      NO
IATL[dB]      : 0.00      0.00      0.00      -6.50      NA      NO      6.50
                NA      NO

```

Last clearing of "show controllers OPTICS" counters never

### Example 3

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers oms 0/1/0/0 pm current flex-bin optics 1
```

Optics in the current interval [15:03:40 - 15:03:44 Mon Nov 20 2023]

Flexible bin interval size: 10 seconds

```

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] : -8.30 -8.22 -8.20 0.00 NA NO 0.00 NA NO
OPR[dBm] : -1.50 -1.50 -1.50 0.00 NA NO 0.00 NA NO
OPBR[dBm] : -11.61 -11.61 -11.61 0.00 NA NO 0.00 NA NO
OPBRR[dB] : -3.40 -3.38 -3.30 0.00 NA NO 0.00 NA NO
EAGN[dB] : 2.00 2.00 2.00 0.00 NA NO 0.00 NA NO
EATL[dB] : 0.00 0.00 0.00 0.00 NA NO 0.00 NA NO
IAGN[dB] : 5.00 5.00 5.00 0.00 NA NO 0.00 NA NO
IATL[dB] : 0.00 0.00 0.00 0.00 NA NO 0.00 NA NO

```

Last clearing of "show controllers OPTICS" counters never

### Example 4

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers oms 0/1/0/0 pm current 24-hour optics 1
```

Optics in the current interval [00:00:00 - 15:04:07 Mon Nov 20 2023]

```

Optics current bucket type : Valid
                MIN      AVG      MAX      Operational      Configured      TCA      Operational
                Configured      TCA
                Threshold(max) (max)      Threshold(min)      Threshold(min) (min) Threshold(max)
OPT[dBm]      : -8.30      -8.27      -8.20      -50.00      NA      NO      30.00
                NA      NO
OPR[dBm]      : -3.00      -1.62      -0.20      -50.00      NA      NO      30.00
                NA      NO
OPBR[dBm]     : -11.61     -11.61     -11.51     -50.00     NA      NO      -10.00
                NA      NO
OPBRR[dB]     : -3.40      -3.31     -3.30     -50.00     NA      NO      0.00
                NA      NO
EAGN[dB]      : 2.00      2.00      2.00      -3.00      NA      NO      22.00
                NA      NO
EATL[dB]      : 0.00      0.00      0.10     -6.50      NA      NO      6.50
                NA      NO
IAGN[dB]      : 5.00      5.00      5.00      0.00      NA      NO      10.00
                NA      NO
IATL[dB]      : 0.00      0.00      0.00     -6.50      NA      NO      6.50
                NA      NO

```

Last clearing of "show controllers OPTICS" counters never

Examples for viewing PM parameters for OCH controller are given below:

### Example 1

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers och 0/1/0/2 pm current 30-sec optics 1

Optics in the current interval [15:04:30 - 15:04:39 Mon Nov 20 2023]

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] : -1.40 -1.36 -1.30 -50.00 NA NO 30.00 NA NO
OPR[dBm] : -5.80 -5.71 -5.70 -50.00 NA NO 30.00 NA NO
```

### Example 2

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers och 0/1/0/2 pm current 15-min optics 1

Optics in the current interval [15:00:00 - 15:05:03 Mon Nov 20 2023]

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] : -1.80 -1.50 -1.30 -50.00 NA NO 30.00 NA NO
OPR[dBm] : -5.80 -5.75 -5.70 -50.00 NA NO 30.00 NA NO
```

Last clearing of "show controllers OPTICS" counters never

### Example 3

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers och 0/1/0/2 pm current flex-bin optics 1

Optics in the current interval [15:05:20 - 15:05:28 Mon Nov 20 2023]

Flexible bin interval size: 10 seconds

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] : -1.40 -1.36 -1.30 0.00 NA NO 0.00 NA NO
OPR[dBm] : -5.80 -5.73 -5.70 0.00 NA NO 0.00 NA NO
```

Last clearing of "show controllers OPTICS" counters never

### Example 4

```
RP/0/RP0/CPU0:Tethys_P2A_DT_03#show controllers och 0/1/0/2 pm current 24-hour optics 1

Optics in the current interval [00:00:00 - 15:06:11 Mon Nov 20 2023]

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] : -3.00 -1.58 -0.10 -50.00 NA NO 30.00 NA NO
OPR[dBm] : -5.80 -5.76 -5.70 -50.00 NA NO 30.00 NA NO
```

Last clearing of "show controllers OPTICS" counters never

## Viewing PM History Parameters

To view the performance monitoring parameters for OMS and OCH controllers, use this command:

**show controllers *controllertype* R/S/I/P pm history { 30 sec | 15-min | 24-hour } optics { *linenumber* }**

### Example

```
RP/0/RP0/CPU0:Tethys_P2A_DT_02#show controllers oms 0/3/0/0 pm history 30-sec optics 1
bucket 1
Wed Dec 6 11:04:50.821 UTC
```

Optics in interval 1 [11:04:00 - 11:04:30 Wed Dec 6 2023]

Optics history bucket type : Valid

MIN AVG MAX

OPT[dBm]	: -8.30	-8.27	-8.20
OPR[dBm]	: -3.00	-1.62	-0.20
OPBR[dBm]	: -11.61	-11.61	-11.51
OPBRR[dB]	: -3.40	-3.31	-3.30
EAGN[dB]	: 2.00	2.00	2.00
EATL[dB]	: 0.00	0.00	0.10
IAGN[dB]	: 5.00	5.00	5.00
IATL[dB]	: 0.00	0.00	0.00





## CHAPTER 5

# Pseudo Random Binary Sequence

Pseudo Random Binary Sequence (PRBS) feature allows users to perform data integrity checks on their encapsulated packet data payloads using a pseudo-random bit stream pattern. PRBS generates a bit pattern and sends it to the peer router that uses this feature to detect if the sent bit pattern is intact or not.

- [Pseudo Random Binary Sequence, on page 147](#)

## Pseudo Random Binary Sequence

Pseudo Random Binary Sequence (PRBS) feature allows users to perform data integrity checks on their encapsulated packet data payloads using a pseudo-random bit stream pattern. PRBS generates a bit pattern and sends it to the peer router that uses this feature to detect if the sent bit pattern is intact or not.

The Pseudo Random Binary Sequence (PRBS) feature allows you to perform data integrity checks between the NCS1014 trunk links and client links without enabling the actual client traffic.

PRBS supports:

- Trunk PRBS(`coherentDSPCtrl`)
- Client PRBS(`HundredGigECtrlr` and `FourHundredGigECtrlr`)

You must enable the PRBS feature on both the transmitting and receiving NCS 1014 trunk ports. The transmitting trunk port generates a bit pattern and sends it to the peer NCS 1014 device. The device detects if the sent bit pattern is received.

You can configure PRBS on the NCS 1014 trunk port and client port for the NCS1K4-2.4T-K9 card.

- **Source mode** — The NCS 1014 at trunk port generates PRBS signal on the line continuously as per the configured PRBS pattern.
- **Sink mode** — The NCS 1014 at trunk port gets locked to the ingress signal according to the configured pattern, analyzes and reports the errors.
- **Source-Sink mode** — The NCS 1014 at trunk port acts as both the PRBS transmitter and receiver, that is, it generates PRBS signal as per the configured pattern, and also gets locked to the ingress signal with the same pattern, and reports the errors.

## Trunk PRBS

NCS 1014 trunk port supports the following PRBS patterns:

- **PRBS31** — Sequence length is from  $2^{31} - 1$  bits
- **PRBS23** — Sequence length is from  $2^{23} - 1$  bits
- **PRBS15** — Sequence length is from  $2^{15} - 1$  bits
- **PRBS7** — Sequence length is from  $2^7 - 1$  bits.



**Note** NCS1K4-2.4T-K9 Interoperability for ethernet PRBS PN23 pattern is not supported.

## Configuring Trunk PRBS on NCS1K4-2.4T-K9

Use the following sample configuration to configure PRBS trunk mode on the NCS1K4-2.4T-K9:

```
RP/0/RP0/CPU0:ios(config)#controller CoherentDSP0/0/0/7
RP/0/RP0/CPU0:ios(config-CoDSP)#secondary-admin-state maintenance
RP/0/RP0/CPU0:ios(config-CoDSP)#prbs mode source-sink pattern pn15
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
Wed Nov 15 18:11:55.450 UTC
```

**Table 31: Feature History**

Feature Name	Release Information	Description
Cumulative PRBS on CoherentDSP controllers	Cisco IOS XR Release 24.3.1	The cumulative PRBS (Pseudo-Random Binary Sequence) on CoherentDSP controllers enhances troubleshooting capabilities between the trunk ports.  Show coherentDSP R/S/I/P prbs-details command output now includes the newly supported fields.

Use the following sample configuration to display PRBS details:

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 prbs-details
Wed Nov 15 18:13:35.210 UTC

-----PRBS details-----
PRBS Test           : Enable
PRBS Mode           : Source-Sink
PRBS Pattern        : PN15
PRBS Status         : Locked
PRBS Lock Time(in seconds) : 37
PRBS Bit Errors     : 0
PRBS Found Count    : 1
PRBS Lost Count     : 0
PRBS Configured Time : 11 Feb 00:20:43 (719 seconds elapsed)
PRBS First Lock Established Time: 11 Feb 00:32:05 (37 seconds elapsed)
Result Summary      : PASS
```

The Result Summary will display PASS if the PRBS bit errors are 0 and the PRBS elapsed lock time is equal to the elapsed first lock established time.

Use `clear controller coherentDSP 0/0/0/7 prbs-details` to clear the counters.

Use the following sample configuration to display cumulative count of PRBS bit errors in the 15-min sampling interval:

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/0/0/7 pm current 15-min prbs
Wed Nov 15 18:19:10.308 UTC
```

```
PRBS in the current interval [18:15:00 - 18:19:10 Wed Nov 15 2023]
```

```
PRBS current bucket type : Valid
```

```
EBC          : 0          Threshold : 0          TCA(enable) : NO
FOUND-COUNT  : 0          Threshold : 0          TCA(enable) : NO
LOST-COUNT   : 0          Threshold : 0          TCA(enable) : NO
```

```
FOUND-AT-TS : NULL
LOST-AT-TS  : NULL
```

```
CONFIG-PTRN : PRBS_PATTERN_PN15
STATUS      : LOCKED
```

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

## Client PRBS

NCS 1014 client port supports the following PRBS patterns:

- **PRBS31** — Sequence length is from  $2^{31} - 1$  bits
- **PRBS23** — Sequence length is from  $2^{23} - 1$  bits

## Configuring Client PRBS on NCS1K4-2.4T-K9

Use the following sample configuration to configure PRBS client mode on the NCS1K4-2.4T-K9:

```
RP/0/RP0/CPU0:ios(config)#controller fourHundredGigECtrlr 0/0/0/4
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#prbs mode source-sink pattern pn23
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#sec-admin-state maintenance
RP/0/RP0/CPU0:ios(config-eth-ctrlr)#commit
```

Use the following sample configuration to display four hundred gigabit client controllers details:

```
RP/0/RP0/CPU0:ios#show controllers fourHundredGigECtrlr 0/0/0/4
Wed Nov 15 18:39:29.478 UTC
Operational data for interface FourHundredGigECtrlr0/0/0/4:
```

```
State:
```

```
Administrative state: enabled
Operational state: Up
LED state: Green On
Maintenance: Enabled
AINS Soak: None
  Total Duration: 0 hour(s) 0 minute(s)
  Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
PRBS:
  Status: Locked
  Mode: Source-sink
  Pattern: PN23
  Direction: Line
```

```

Framing: Framed
Laser Squelch: Disabled
Insert Idle Ingress: Disabled
Insert Idle Egress: Disabled

```

## Phy:

```

Media type: Not known
Statistics:
  FEC:
    Corrected Codeword Count: 2019127152          Valid: True      Start time:
17:35:46 Wed Nov 15 2023
    Uncorrected Codeword Count: 6                 Valid: True      Start time:
17:35:46 Wed Nov 15 2023
  PCS:
    Total BIP errors: 0                          Valid: True      Start time:
17:35:46 Wed Nov 15 2023
    Total frame errors: 0                        Valid: False     Start time:
17:35:46 Wed Nov 15 2023
    Total Bad SH: 0                              Valid: False     Start time:
17:35:46 Wed Nov 15 2023

```

Autonegotiation disabled.

## Operational values:

```

Speed: 400Gbps
Duplex: Full Duplex
Flowcontrol: None
Loopback: Internal
BER monitoring:
  Not supported
Forward error correction: Standard (Reed-Solomon)
Holdoff Time: 0ms

```

Use the following sample configuration to display four hundred gigabit client controller PRBS bit errors in the 15-min sampling interval:

```

RP/0/RP0/CPU0:ios#show controllers fourHundredGigEctr1r 0/0/0/4 pm current 15-min prbs
Wed Nov 15 18:48:19.114 UTC

```

PRBS in the current interval [18:45:00 - 18:48:19 Wed Nov 15 2023]

PRBS current bucket type : Valid

```

EBC          : 0          Threshold : 0          TCA(enable) : NO
FOUND-COUNT  : 0          Threshold : 0          TCA(enable) : NO
LOST-COUNT   : 0          Threshold : 0          TCA(enable) : NO

```

```

FOUND-AT-TS  : NULL
LOST-AT-TS   : NULL

```

```

CONFIG-PTRN  : PRBS_PATTERN_PN23
STATUS       : LOCKED

```

Last clearing of "show controllers ETHERNET" counters never