



## Configuring 400G Digital Coherent Optics

The following 400G Digital Coherent QSFP-DD optical modules are supported:

- QDD-400G-ZR-S
- QDD-400G-ZRP-S



### Note

- The information in this chapter applies to all supported 400G Digital Coherent QSFP-DD optical modules unless otherwise specified.
- To determine the transceivers that Cisco hardware device supports, refer to the [Transceiver Module Group \(TMG\) Compatibility Matrix](#) tool.

This chapter describes the 400G Digital Coherent QSFP-DD optical modules and their supported configurations.

**Table 1: Hardware and Software Support**

| Hardware PID | Optics PID | Minimum IOS XR Software Release |
|--------------|------------|---------------------------------|
|--------------|------------|---------------------------------|

The 400G Digital Coherent QSFP-DD optical modules enable wavelength-division multiplexing (WDM) functionality in the router. These optical modules are DWDM C-band (196.1 THz to 191.3 THz) tunable optical modules. They can be used in both transponder and muxponder modes.

Cisco IOS XR software creates optics and coherent DSP controllers to configure and monitor the performance of the 400G Digital Coherent QSFP-DD optical modules. Optics controllers are used to configure and monitor optical parameters, such as frequency, chromatic dispersion, transmitted output power, modulation, and so on. Coherent DSP controllers are used to monitor network performance parameters like pre- and post-forward error correction (FEC) bit-error rate (pre-FEC BER, post-FEC BER), error corrected bits (EC-BITS), and so on. Forward error correction (FEC) is configured using optical controllers and monitored using coherent DSP controllers.

The 400G Digital Coherent QSFP-DD optical modules support traffic configuration and firmware download. The Cisco IOS XR software collects performance monitoring data and alarms using versatile DOM (VDM).

Due to more power consumption by the 400G Digital Coherent QSFP-DD optical modules, the Cisco IOS XR software operates the fans at an higher speed to cool these optical modules.

The 400G Digital Coherent QSFP-DD optical module configuration is divided into the following categories:

- Traffic configuration – Comprises configuring DAC rate, muxponder mode, modulation, and FEC parameters. Applicable for optics controllers:
  - [Configuring DAC Rate, on page 16](#)
  - [Configuring Muxponder Mode, on page 11](#)
  - [Configuring Modulation, on page 14](#)
  - [Configuring FEC, on page 17](#)
- Optical configuration – Comprises configuring frequency, chromatic dispersion, and optical transmit power. Applicable for optics controllers:
  - [Configuring Frequency, on page 4](#)
  - [Configuring Chromatic Dispersion, on page 6](#)
  - [Configuring Optical Transmit Power, on page 8](#)
- Performance monitoring (PM) – Enables or disables performance monitoring in optical modules. You can also configure PM parameters that comprise signal power, chromatic dispersion, optical signal-to-noise ratio (OSNR), and differential group delay (DGD). Applicable for optics controllers and coherent DSP controllers:
  - [Configuring Performance Monitoring, on page 21](#)
  - [Configuring PM Parameters, on page 21](#)
- Loopback configuration – Configures loopback. Applicable for coherent DSP controller:
  - [Configuring Loopback, on page 18](#)
- Alarms threshold configuration – Configures thresholds for monitoring alarms that include optical signal-to-noise ratio (OSNR), differential group delay (DGD), chromatic dispersion (cd high and low), and so on. Applicable for optics controllers:
  - [Configuring Alarms Threshold, on page 24](#)

The following table contains the possible traffic configuration values for the 400G Digital Coherent QSFP-DD optical modules, in the transponder and muxponder mode:

## FPD Upgrades Enabled for QDD-400G-ZR-S and QDD-400G-ZRP-S Optical Modules

**Table 2: Feature History Table**

| Feature Name                                                                              | Release Information | Feature Description                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FPD Upgrades Enabled for <a href="#">QDD-400G-ZR-S and QDD-400G-ZRP-S Optical Modules</a> | Release 7.3.2       | This feature allows you to perform Field Programmable Device (FPD) upgrades on the QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules to ensure they have the latest fixes and features. For more information about the optic module portfolio, see the <a href="#">Cisco 400G Digital Coherent Optics QSFP-DD Optical Modules Data Sheet</a> . |

Although an FPD upgrade is not mandatory in this release, we recommend upgrading the FPD to the latest version in the subsequent releases to ensure that all the latest fixes and features are enabled on the optical modules.

The QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules have two internal FPD image banks: image banks A and B. These image banks contain running and programmed FPD versions, which are fetched during boot-up. The active image is fetched from bank A, while the standby image is fetched from bank B. To upgrade the optical modules, you must perform the FPD upgrade twice, once for the active image bank and once for the standby image bank. After each upgrade, you must disable and re-enable the QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules using the [controller optics](#) command to activate the latest firmware.

## QDD-400G-ZR-S Transponder and Muxponder Configuration Values

The following table contains the possible Transponder and Muxponder configuration values for the QDD-400G-ZR-S optical module:

**Table 3: QDD-400G-ZR-S Transponder and Muxponder Configuration Values**

| TXP/MXP     | Client                | Trunk         | Modulation | FEC  | DAC Rate |
|-------------|-----------------------|---------------|------------|------|----------|
| 400G-TXP    | 1 client, 400G speed  | 1 trunk, 400G | 16 QAM     | cFEC | 1x1      |
| 4x100G- MXP | 4 clients, 100G speed | 1 trunk, 400G | 16 QAM     | cFEC | 1x1      |

## QDD-400G-ZRP-S Transponder and Muxponder Configuration Values

The following table contains the possible Transponder and Muxponder configuration values for the QDD-400G-ZRP-S optical module:

**Table 4: QDD-400G-ZRP-S Transponder and Muxponder Configuration Values**

| <b>TXP/MXP</b> | <b>Client</b>         | <b>Trunk</b>        | <b>Modulation</b> | <b>FEC</b> | <b>DAC Rate</b> |
|----------------|-----------------------|---------------------|-------------------|------------|-----------------|
| 400G-TXP       | 1 Client, 400G speed  | 1 trunk, 400G speed | 16 QAM            | oFEC       | 1x1.25          |
| 400G-TXP       | 1 Client, 400G speed  | 1 trunk, 400G speed | 16 QAM            | cFEC       | 1x1             |
| 4x100G- MXP    | 4 clients, 100G speed | 1 trunk, 400G speed | 16 QAM            | oFEC       | 1x1.25          |
| 4x100G- MXP    | 4 clients, 100G speed | 1 trunk, 400G speed | 16 QAM            | cFEC       | 1x1             |
| 3x100G-MXP     | 3 clients, 100G speed | 1 trunk, 300G speed | 8 QAM             | oFEC       | 1x1.25          |
| 2x100G-MXP     | 2 clients, 100G speed | 1 trunk, 200G speed | QPSK              | oFEC       | 1x1.5           |
| 1x100G-MXP     | 1 client, 100G speed  | 1 trunk, 100G speed | QPSK              | oFEC       | 1x1.5           |

- [Configuring Frequency, on page 4](#)
- [Configuring Chromatic Dispersion, on page 6](#)
- [Configuring Optical Transmit Power, on page 8](#)
- [Configuring Muxponder Mode, on page 11](#)
- [Configuring Modulation, on page 14](#)
- [Configuring DAC Rate, on page 16](#)
- [Configuring FEC, on page 17](#)
- [Configuring Loopback, on page 18](#)
- [Disable Auto-Squelching, on page 20](#)
- [Configuring Performance Monitoring, on page 21](#)
- [Configuring PM Parameters, on page 21](#)
- [Configuring Alarms Threshold, on page 24](#)
- [Alarms Troubleshooting, on page 26](#)

## Configuring Frequency

You can configure frequency on optics controllers. You can select any C band frequency between the range 196.1 to 191.3 THz, in both ITU and NON-ITU channels.


**Note**

The 100MHz-grid keyword accepts only frequency values as user input. The 50GHz-grid keyword accepts frequency, ITU-channel, or wavelength values as user input. The Cisco IOS XR software then calculates the frequency for a given wavelength or ITU-channel.

## Frequency Configuration Example

The following example shows how to configure frequency on the optics controller:

```
Router#config
Router(config)#controller optics 0/2/0/16
Router(config-Optics)#dwdm-carrier 100MHz-grid frequency 1921500
Router(config-Optics)#commit
Router(config-Optics)#exit
Router(config)#exit
```

## Running Configuration

This example shows the running configuration:

```
Router#show run controller optics 0/2/0/16
Fri May 28 01:42:32.488 UTC
controller Optics0/2/0/16
  dwdm-carrier 100MHz-grid frequency 1921500
  cd-low-threshold -5000
  cd-high-threshold -5000
!
```

## Verification

This example shows how to verify the frequency configuration:

```
Router#show controller optics 0/2/0/16
Fri May 28 01:47:23.953 UTC
Controller State: Up
Transport Admin State: In Service
Laser State: Off
LED State: Off
FEC State: FEC ENABLED
Optics Status
  Optics Type: QSFPDD 400G ZRP
  DWDM carrier Info: C BAND, MSA ITU Channel=80, Frequency=192.15THz,
  Wavelength=1560.200nm
  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 mA
  Actual TX Power = -40.00 dBm
  RX Power = -40.00 dBm
  RX Signal Power = -40.00 dBm
  Frequency Offset = 0 MHz
  Laser Temperature = 0.00 Celsius
  Laser Age = 0 %
  DAC Rate = 1x1.25
  Performance Monitoring: Enable
  THRESHOLD VALUES
  -----
  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----
  Rx Power Threshold(dBm)   13.0      -24.0      10.0          -22.0
```

```

Tx Power Threshold(dBm)          0.0      -16.0      -2.0      -14.0
LBC Threshold(mA)                 0.00     0.00     0.00     0.00
Temp. Threshold(celsius)          80.00    -5.00    75.00     0.00
Voltage Threshold(volt)           3.46     3.13     3.43     3.16
LBC High Threshold = 98 %
Configured Tx Power = -10.00 dBm
Configured CD High Threshold = -5000 ps/nm
Configured CD lower Threshold = -5000 ps/nm
Configured OSNR lower Threshold = 9.00 dB
Configured DGD Higher Threshold = 80.00 ps
Baud Rate = 60.1385459900 GBd
Modulation Type: 16QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -26000 ps/nm CD-MAX 26000 ps/nm
Second Order Polarization Mode Dispersion = 0.00 ps^2
Optical Signal to Noise Ratio = 0.00 dB
Polarization Dependent Loss = 0.00 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 0.00 ps
Temperature = 21.00 Celsius
Voltage = 3.42 V
Transceiver Vendor Details
Form Factor                      : QSFP-DD
Optics type                      : QSFPDD 400G ZRP
Name                            : CISCO-ACACIA
OUI Number                      : 7c.b2.5c
Part Number                     : DP04QSDD-E30-19E
Rev Number                      : 10
Serial Number                   : ACA244900GN
PID                             : QDD-400G-ZRP-S
VID                             : ES03
Firmware Version                : 161.06
Date Code(yy/mm/dd)            : 20/12/08
!
```

## Configuring Chromatic Dispersion

You can configure chromatic dispersion on optics controllers. When you configure the maximum and minimum values for chromatic dispersion for any data rate, ensure that the minimum difference between the configured values is equal to or greater than 1000 ps/nm.

The following table lists the default CD search range:

**Table 5: Default CD Search Range**

| Muxponder Rate | FEC Value | Default CD Search Range (Min-Max) |
|----------------|-----------|-----------------------------------|
| 400            | OFEC      | -26000 to +26000                  |
| 400            | CFEC      | -2400 to +2400                    |
| 300            | OFEC      | -50000 to +50000                  |
| 200            | OFEC      | -50000 to +50000                  |
| 100            | OFEC      | -80000 to +80000                  |



**Note** For **cd-max** and **cd-min** range details, see the controller optics command.

### Chromatic Dispersion Configuration Example

This example shows how to configure chromatic dispersion on the optics controller:

```
Router#configure
Router(config)#controller optics 0/0/0/13
Router(config-Optics)#cd-max 4000
Router(config-Optics)#cd-min -4000
Router(config-Optics)#commit
Router(config-Optics)#exit
Router(config)#exit
```

### Running Configuration

This example shows the running configuration for the optics controller:

```
Router#show run controller optics 0/0/0/13
Thu May 13 12:24:42.353 UTC
controller Optics0/0/0/13
  cd-min -4000
  cd-max 4000
!
```

### Verification

This example shows how to verify the configured chromatic dispersion values for the optics controller:

```
Router#show controller optics 0/0/0/13
Controller State: Up
Transport Admin State: In Service
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status
  Optics Type: QSFPDD 400G ZR
  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 = 35
  WVL-OOL = 0              MEA = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0
  Laser Bias Current = 0.0 %
  Actual TX Power = -7.87 dBm
  RX Power = -8.27 dBm
  RX Signal Power = -8.43 dBm
  Frequency Offset = 130 MHz
  Performance Monitoring: Enable
  THRESHOLD VALUES
  -----
  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----
```

```

Rx Power Threshold(dBm)          1.9      -28.2      0.0      -25.0
Tx Power Threshold(dBm)          0.0      -15.0      -2.0      -16.0
LBC Threshold(mA)                 0.00     0.00     0.00     0.00
Temp. Threshold(celsius)         80.00    -5.00    75.00    15.00
Voltage Threshold(volt)           3.46     3.13     3.43     3.16
LBC High Threshold = 98 %
Configured Tx Power = -6.00 dBm
Configured CD High Threshold = 80000 ps/nm
Configured CD lower Threshold = -80000 ps/nm
Configured OSNR lower Threshold = 9.00 dB
Configured DGD Higher Threshold = 80.00 ps
Baud Rate = 59.8437500000 GBd
Modulation Type: 16QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -4000 ps/nm CD-MAX 4000 ps/nm
Second Order Polarization Mode Dispersion = 5.00 ps^2
Optical Signal to Noise Ratio = 36.30 dB
Polarization Dependent Loss = 0.40 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 4.00 ps
Temperature = 54.00 Celsius
Voltage = 3.37 V
Transceiver Vendor Details
Form Factor      : QSFP-DD
Optics type      : QSFPDD 400G ZR
Name             : CISCO-ACACIA
OUI Number       : 7c.b2.5c
Part Number      : DP04QSDD-E20-19E
Rev Number       : 10
Serial Number    : ACA2447003L
PID              : QDD-400G-ZR-S
VID              : ES03
Firmware Version : 61.12
Date Code(yy/mm/dd) : 20/12/02

```

## Configuring Optical Transmit Power

You can set the transmit power of the optical signal.

Each 400G Digital Coherent QSFP-DD optical module has its own optical transmit (TX) power range. User can change the optical transmit (TX) power value based on the module capability. For "Transmitter specifications", see the following data sheets:

- [Cisco 400G Digital Coherent Optics QSFP-DD Optical Modules Data Sheet](#)

**Table 6: Optical Transmit Power Values**

| Optical Module | Trunk Speed | Optical Transmit Power (Tx) Shaping | Interval | Supported Range of Optical Transmit Power (Tx) Values (in units of 0.1dBm) <sup>1</sup> |                         |                            |
|----------------|-------------|-------------------------------------|----------|-----------------------------------------------------------------------------------------|-------------------------|----------------------------|
|                |             |                                     |          | Minimum Value                                                                           | Maximum Value - Typical | Maximum Value - Worst Case |
| QDD-400G-ZR-S  | 400G        | No                                  | 1        | -150                                                                                    | -100                    | -100                       |

| Optical Module | Trunk Speed | Optical Transmit Power (Tx) Shaping | Interval | Supported Range of Optical Transmit Power (Tx) Values (in units of 0.1dBm) <sup>1</sup> |                         |                            |
|----------------|-------------|-------------------------------------|----------|-----------------------------------------------------------------------------------------|-------------------------|----------------------------|
|                |             |                                     |          | Minimum Value                                                                           | Maximum Value - Typical | Maximum Value - Worst Case |
| QDD-400G-ZRPS  | 400G        | Yes                                 | 1        | -150                                                                                    | -110                    | -130                       |
|                | 300G        |                                     |          | -150                                                                                    | -104                    | -119                       |
|                | 200G        |                                     |          | -150                                                                                    | -90                     | -105                       |
|                | 100G        |                                     |          | -150                                                                                    | -59                     | -75                        |
| DP04QSDD-HE0   | 400G        | Yes                                 | 1        | -100                                                                                    | 20                      | 10                         |
|                | 300G        |                                     |          |                                                                                         |                         |                            |
|                | 200G        |                                     |          |                                                                                         |                         |                            |
|                | 100G        |                                     |          |                                                                                         |                         |                            |

1. The default optical transmit power (Tx) value is -10 dBm, however with TX shaping enabled the maximum power in 1x400G, 4x100G, 3x100G, 2x100G, and 1x100G modes may be less than -10 dBm.

### Transmitting Power Configuration Example

The following example shows how to configure the optical transmit (TX) power on the optics controller:

```
Router#config
Router(config)#controller optics 0/2/0/16
Router(config-Optics)#transmit-power -125
Router(config-Optics)#commit
Router(config-Optics)#exit
Router(config)#exit
```

### Running Configuration

This example shows the running configuration for the optics controller:

```
Router#show run controller optics 0/2/0/16
Thu May 13 12:52:35.020 UTC
controller Optics0/0/0/1
  cd-min -4000
  cd-max 4000
  transmit-power -125
!
```

### Verification

This example shows how to verify the configured optical transmit power for the optics controller:

```
Router#show controller optics 0/2/0/16
Fri May 28 02:52:06.182 UTC
Controller State: Up
Transport Admin State: In Service
Laser State: Off
LED State: Off
FEC State: FEC ENABLED
Optics Status
  Optics Type: QSPDD 400G ZRP
```

DWDM carrier Info: C BAND, MSA ITU Channel=80, Frequency=192.15THz,  
Wavelength=1560.200nm

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 mA

Actual TX Power = -40.00 dBm

RX Power = -40.00 dBm

RX Signal Power = -40.00 dBm

Frequency Offset = 0 MHz

Laser Temperature = 0.00 Celsius

Laser Age = 0 %

DAC Rate = 1x1.25

Performance Monitoring: Enable

THRESHOLD VALUES

-----

| Parameter                 | High Alarm | Low Alarm | High Warning | Low Warning |
|---------------------------|------------|-----------|--------------|-------------|
| Rx Power Threshold(dBm)   | 13.0       | -24.0     | 10.0         | -22.0       |
| Tx Power Threshold(dBm)   | 0.0        | -16.0     | -2.0         | -14.0       |
| LBC Threshold(mA)         | 0.00       | 0.00      | 0.00         | 0.00        |
| Temp. Threshold(celsius)  | 80.00      | -5.00     | 75.00        | 0.00        |
| Voltage Threshold(volt)   | 3.46       | 3.13      | 3.43         | 3.16        |
| LBC High Threshold = 98 % |            |           |              |             |

**Configured Tx Power = -12.50 dBm**

Configured CD High Threshold = -5000 ps/nm

Configured CD lower Threshold = -5000 ps/nm

Configured OSNR lower Threshold = 9.00 dB

Configured DGD Higher Threshold = 80.00 ps

Baud Rate = 60.1385459900 GBd

Modulation Type: 16QAM

Chromatic Dispersion 0 ps/nm

Configured CD-MIN -4000 ps/nm CD-MAX 4000 ps/nm

Second Order Polarization Mode Dispersion = 0.00 ps<sup>2</sup>

Optical Signal to Noise Ratio = 0.00 dB

Polarization Dependent Loss = 0.00 dB

Polarization Change Rate = 0.00 rad/s

Differential Group Delay = 0.00 ps

Temperature = 20.00 Celsius

Voltage = 3.41 V

Transceiver Vendor Details

|                     |                    |
|---------------------|--------------------|
| Form Factor         | : QSFP-DD          |
| Optics type         | : QSFPDD 400G ZRP  |
| Name                | : CISCO-ACACIA     |
| OUI Number          | : 7c.b2.5c         |
| Part Number         | : DP04QSDD-E30-19E |
| Rev Number          | : 10               |
| Serial Number       | : ACA244900GN      |
| PID                 | : QDD-400G-ZRP-S   |
| VID                 | : ES03             |
| Firmware Version    | : 161.06           |
| Date Code(yy/mm/dd) | : 20/12/08         |

# Configuring Muxponder Mode

By default, the Cisco IOS XR software configures the 400G Digital Coherent QSFP-DD optical modules in the 400G transponder mode.

However, you can configure muxponder mode on optics controllers. Based on the muxponder mode, you can choose the modulation.

**Table 7: Supported Ports and Command for Configuring Muxponder Mode**

| Platforms with 400G Direct Ports    | Direct Ports (n) with 400G         | ZR/ZRP   | Bright ZRP | Mode   | Command                                                                                    |
|-------------------------------------|------------------------------------|----------|------------|--------|--------------------------------------------------------------------------------------------|
| NC57-24DD                           | n = 0,2,4,6,8,10,12,14,16,18,20,22 | 732/75.1 | —          | 400G   | <i>Default</i>                                                                             |
| NC57-18DD-SE                        | n = 18,20,22                       | 732/75.1 | —          | 4x100G | <b>controller optics</b> 0/x/0/n<br><b>breakout</b> 4x100                                  |
| NCS-57B1-6D24H-S                    | n = 24,25,26,27,28,29              | 732/75.1 | —          | 1x100G | <b>controller optics</b> 0/x/0/n<br><b>breakout</b> 1x100                                  |
| NCS-57B1-5D24H-SE                   | n = 24,25,26,27,28                 | 732/75.1 | —          |        |                                                                                            |
| NCS-57C1-48Q6D-S                    | n = 0,2,4                          | 7.5.2    | —          |        |                                                                                            |
| Platforms with Flex Port Pairs      | Port Pairs (n,n+1) sharing 400G    | ZR/ZRP   | Bright ZRP | Mode   | Command                                                                                    |
| NC57-18DD-SE<br>(max 6 ZR or 3 ZRP) | n = 0,2,4,6,8,10,12,14,16,24,26,28 | 732/75.1 | —          | 400G   | <b>hw-module port-range</b><br>n n+1 <b>location</b> 0/x/CPU0<br><b>mode</b> 400           |
| NC57-36H6D-S                        | n = 24,26,28,30,32,34              | 732/75.1 | —          | 4x100G | <b>hw-module port-range</b><br>n n+1 <b>location</b><br>0/x/CPU0 <b>mode</b> 4x100         |
|                                     |                                    |          |            | 3x100G | <b>hw-module port-range</b><br>n n+1 <b>location</b><br>0/x/CPU0 <b>mode</b> 3x100         |
|                                     |                                    |          |            | 2x100G | <b>hw-module port-range</b><br>n n+1 <b>location</b><br>0/x/CPU0 <b>mode</b><br>2x100-pam4 |
|                                     |                                    |          |            | 1x100G | <b>hw-module port-range</b><br>n n+1 <b>location</b><br>0/x/CPU0 <b>mode</b> 1x100         |

Table 8: Other Platform Combinations: Supported Ports and Commands for Configuring Muxponder Mode

| Platforms with NC57-MPA-2D4H-S in 400G mode, (0,1,2,3) sharing 400G | MPA Slots | ZR/ZRP | Bright ZRP | Mode   | Command                                                                 |
|---------------------------------------------------------------------|-----------|--------|------------|--------|-------------------------------------------------------------------------|
| NCS55A2MOD(SSESSEHSHDSHXs)                                          | m = 1,2   | 7.5.1  | —          | 3x100G | <b>hw-module port-range 0 2 instance m location 0/x/CPU0 mode 3x100</b> |



**Note** The following line cards do not support CVR-QSFP-SFP10G and any 1Gbps optics:

- NCS-57B1-6D24-SYS
- NCS-57B1-5DSE-SYS
- NC57-24DD
- NC57-18DD-SE
- NC57-36H-SE
- NC57-36H6D
- NC57-MOD-S

Muxponder mode options available for QDD-400G-ZR-S are:

- 4x100

Muxponder mode options available for QDD-400G-ZRP-S are:

- 4x100
- 3x100
- 2x100 (or 2x100-PAM4)
- 1x100

See the following tables for the modulation values, based on the muxponder mode:

- [Table 3: QDD-400G-ZR-S Transponder and Muxponder Configuration Values, on page 3](#)
- [Table 4: QDD-400G-ZRP-S Transponder and Muxponder Configuration Values, on page 4](#)
- [#unique\\_38 unique\\_38\\_Connect\\_42\\_section\\_agy\\_yc2\\_jxb](#)

Using the **no breakout muxponder mode** command, you can switch from the muxponder mode to the transponder mode, on optics controllers.

### Muxponder Mode Configuration Example

The following example shows how to configure muxponder mode on the optics controller:

```
Router#config
Router(config)#controller optics 0/0/0/13
```

```
Router(config-Optics) #breakout 4x100
Router(config-Optics) #commit
Router(config-Optics) #exit
Router(config) #exit
```



**Note** In the above example, the Cisco IOS XR software creates four Ethernet clients with 100GE speed, which can be verified using the **show interfaces brief | include R/S/I/P** command.

### Running Configuration

This example shows the running configuration for the optics controller:

```
Router#show run controller optics 0/0/0/13
Thu May 13 12:24:42.353 UTC
controller Optics0/0/0/13
  cd-min -4000
  cd-max 4000
  breakout 4x100
  !
```

### Verification

This example shows how to verify the muxponder mode configuration:

```
Router#show interfaces brief | include 0/0/0/13
Hu0/0/0/13/0      up      up      ARPA  1514  100000000
Hu0/0/0/13/1      up      up      ARPA  1514  100000000
Hu0/0/0/13/2      up      up      ARPA  1514  100000000
Hu0/0/0/13/3      up      up      ARPA  1514  100000000
```

### Transponder Mode Configuration Example

The following example shows how to switch to the transponder mode, on the optics controller:

```
Router#config
Router(config) #controller optics 0/0/0/13
Router(config-Optics) #no breakout 4x100
Router(config-Optics) #commit
Router(config-Optics) #exit
Router(config) #exit
```



**Note** The Cisco IOS XR software creates a single 400GE interface, which can be verified using the **show interfaces brief | include R/S/I/P** command.

### Running Configuration

This example shows the running configuration for the optics controller. The breakout configuration is absent in the running configuration.

```
Router#show run controller optics 0/0/0/13
Thu May 13 13:51:20.330 UTC
controller Optics0/0/0/13
  cd-min -4000
  cd-max 4000
  transmit-power -100
  !
```

### Verification

This example shows how to verify the transponder mode configuration:

```
Router#show interfaces brief | include 0/0/0/13
FH0/0/0/13          up          up          ARPA  1514  400000000
```

## Configuring Modulation

You can configure modulation on optics controllers. Based on the muxponder mode, you can choose the modulation.



**Note** The system accepts any modulation value that is entered. However, if the modulation value is outside the supported range, it is not configured on the optical module. Instead, the optical module is auto-configured with a valid modulation value. To view this value, use the **show controller optics R/S/I/P** command.

See the following tables for the supported modulation values:

- [Table 3: QDD-400G-ZR-S Transponder and Muxponder Configuration Values, on page 3](#)
- [Table 4: QDD-400G-ZRP-S Transponder and Muxponder Configuration Values, on page 4](#)

### Modulation Configuration Example

The following example shows how to configure modulation on the optics controller:

```
Router#config
Router(config)#controller optics 0/0/0/1
Router(config-Optics)#modulation 16Qam
Router(config-Optics)#commit
Router(config-Optics)#exit
Router(config)#exit
```

### Running Configuration

This example shows the running configuration:

```
Router#show run controller optics 0/0/0/1
controller Optics0/0/0/1
  cd-min -4000
  cd-max 4000
  transmit-power -100
  modulation 16Qam
!
```



**Note** Use the **show controller optics R/S/I/P** command to verify the modulation value of the optical module.

### Verification

This example shows how to verify the configured modulation value for the optics controller:

```
Router#show controller optics 0/0/0/1
Controller State: Up
Transport Admin State: In Service
Laser State: On
LED State: Green
FEC State: FEC ENABLED
```

## Optics Status

Optics Type: QSFPDD 400G ZR  
 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 = 35  
 WVL-OOL = 0                          MEA = 0

IMPROPER-REM = 0

TX-POWER-PROV-MISMATCH = 0

Laser Bias Current = 0.0 %

Actual TX Power = -7.87 dBm

RX Power = -8.27 dBm

RX Signal Power = -8.43 dBm

Frequency Offset = 130 MHz

Performance Monitoring: Enable

THRESHOLD VALUES

-----

| Parameter                | High Alarm | Low Alarm | High Warning | Low Warning |
|--------------------------|------------|-----------|--------------|-------------|
| Rx Power Threshold(dBm)  | 1.9        | -28.2     | 0.0          | -25.0       |
| Tx Power Threshold(dBm)  | 0.0        | -15.0     | -2.0         | -16.0       |
| LBC Threshold(mA)        | 0.00       | 0.00      | 0.00         | 0.00        |
| Temp. Threshold(celsius) | 80.00      | -5.00     | 75.00        | 15.00       |
| Voltage Threshold(volt)  | 3.46       | 3.13      | 3.43         | 3.16        |

LBC High Threshold = 98 %

Configured Tx Power = -6.00 dBm

Configured CD High Threshold = 80000 ps/nm

Configured CD lower Threshold = -80000 ps/nm

Configured OSNR lower Threshold = 9.00 dB

Configured DGD Higher Threshold = 80.00 ps

Baud Rate = 59.8437500000 GBd

**Modulation Type: 16QAM**

Chromatic Dispersion 0 ps/nm

Configured CD-MIN -4000 ps/nm CD-MAX 4000 ps/nm

Second Order Polarization Mode Dispersion = 5.00 ps^2

Optical Signal to Noise Ratio = 36.30 dB

Polarization Dependent Loss = 0.40 dB

Polarization Change Rate = 0.00 rad/s

Differential Group Delay = 4.00 ps

Temperature = 54.00 Celsius

Voltage = 3.37 V

## Transceiver Vendor Details

Form Factor : QSFP-DD  
 Optics type : QSFPDD 400G ZR  
 Name : CISCO-ACACIA  
 OUI Number : 7c.b2.5c  
 Part Number : DP04QSDD-E20-19E  
 Rev Number : 10  
 Serial Number : ACA2447003L  
 PID : QDD-400G-ZR-S  
 VID : ES03  
 Firmware Version : 61.12  
 Date Code(yy/mm/dd) : 20/12/02

# Configuring DAC Rate

You can set the DAC (digital to analog conversion) sampling rate on optics controllers. You can modify the DAC sampling rate only on the QDD-400G-ZRP-S optical modules.



**Note** QDD-400G-ZR-S supports 1x1 dac-rate in cFEC mode. QDD-400G-ZRP-S optical modules support 1x1 dac-rate in cFEC mode and 1x1.25 dac-rate in oFEC mode.

## DAC Rate Configuration Example

The following example shows how to set the DAC rate on the optics controller:

```
Router#config
Router(config)#controller optics 0/0/0/1
Router(config-Optics)#dac-rate 1x1
```

## Verification

This example shows the running configuration:

```
Router#show run controller optics 0/0/0/1
Thu May 13 12:52:35.020 UTC
controller Optics0/0/0/1
  cd-min -4000
  cd-max 4000
  transmit-power -100
  modulation 16Qam
  DAC-Rate 1x1
!
```

## Verification

This example shows how to verify the configured DAC rate for the optics controller:

```
Router#show controller optics 0/0/0/1
Controller State: Up
Transport Admin State: In Service
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status
  Optics Type: QSFPDD 400G ZR
  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 = 35
  WVL-OOL = 0              MEA = 0
  IMPROPER-REM = 0
  TX-POWER-PROV-MISMATCH = 0
  Laser Bias Current = 0.0 %
```

```

Actual TX Power = -7.87 dBm
RX Power = -8.27 dBm
RX Signal Power = -8.43 dBm
Frequency Offset = 130 MHz
DAC Rate = 1x1
Performance Monitoring: Enable
THRESHOLD VALUES
-----

```

| Parameter                | High Alarm | Low Alarm | High Warning | Low Warning |
|--------------------------|------------|-----------|--------------|-------------|
| Rx Power Threshold(dBm)  | 1.9        | -28.2     | 0.0          | -25.0       |
| Tx Power Threshold(dBm)  | 0.0        | -15.0     | -2.0         | -16.0       |
| LBC Threshold(mA)        | 0.00       | 0.00      | 0.00         | 0.00        |
| Temp. Threshold(celsius) | 80.00      | -5.00     | 75.00        | 15.00       |
| Voltage Threshold(volt)  | 3.46       | 3.13      | 3.43         | 3.16        |

```

LBC High Threshold = 98 %
Configured Tx Power = -6.00 dBm
Configured CD High Threshold = 80000 ps/nm
Configured CD lower Threshold = -80000 ps/nm
Configured OSNR lower Threshold = 9.00 dB
Configured DGD Higher Threshold = 80.00 ps
Baud Rate = 59.8437500000 GBd
Modulation Type: 16QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -4000 ps/nm CD-MAX 4000 ps/nm
Second Order Polarization Mode Dispersion = 5.00 ps^2
Optical Signal to Noise Ratio = 36.30 dB
Polarization Dependent Loss = 0.40 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 4.00 ps
Temperature = 54.00 Celsius
Voltage = 3.37 V
Transceiver Vendor Details
Form Factor      : QSFP-DD
Optics type      : QSFPDD 400G ZR
Name             : CISCO-ACACIA
OUI Number      : 7c.b2.5c
Part Number      : DP04QSDD-E20-19E
Rev Number       : 10
Serial Number    : ACA2447003L
PID              : QDD-400G-ZR-S
VID              : ES03
Firmware Version : 61.12
Date Code(yy/mm/dd) : 20/12/02

```

## Configuring FEC

You can configure forward error correction (FEC) only on optics controllers. You can modify FEC only on the QDD-400G-ZRP-S optical modules. FEC is a feature that is used for controlling errors during data transmission. This feature 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.



**Note** QDD-400G-ZR-S supports cFEC (concatenated forward error correction). QDD-400G-ZRP-S support cFEC and oFEC (open forward error correction).

### FEC Configuration Example

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

```
Router#configure
Router(config)#controller optics 0/0/0/13
Router(config-Optics)#fec CFEC
Router(config-Optics)#commit
Router(config-Optics)#exit
Router(config)#exit
```

### Running Configuration

This example shows the running configuration:

```
Router#show controllers optics 0/0/0/13
controller Optics0/0/0/1
  cd-min -4000
  cd-max 4000
  transmit-power -100
  fec CFEC
  modulation 16Qam
  DAC-Rate 1x1.25
!
```

### Verification

This example shows how to verify the FEC configuration for the optics controller:

```
Router#show controller coherentdsp 0/0/0/13
Thu May 27 17:28:51.960 UTC
Port                                     : CoherentDSP 0/0/0/13
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 = 6 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 = 5
Detected Alarms                           : LOS
Bit Error Rate Information
  PREFEC BER                             : 5.0E-01
  POSTFEC BER                            : 0.0E+00
  Q-Factor                               : 0.00 dB
  Q-Margin                               : -7.20dB
  OTU TTI Received

FEC mode                                  : C_FEC
```

## Configuring Loopback

You can configure internal or line loopback on coherent DSP controllers. Loopback can be performed only in the maintenance mode.

## Loopback Configuration Example

This example shows how to enable internal loopback configuration on coherent DSP controllers:

```
Router#config
Router(config)#controller coherentDSP 0/0/0/4
Router(config-CoDSP)#secondary-admin-state maintenance
Router(config-CoDSP)#loopback internal
Router(config-CoDSP)#commit
```

## Running Configuration

This example shows the running configuration on coherent DSP controllers:

```
Router#show run controller coherentdsp 0/0/0/4
Thu May 13 19:51:08.175 UTC
controller CoherentDSP0/0/0/4
  secondary-admin-state maintenance
  loopback internal
!
```

## Verification

This example shows how to verify the loopback configuration on coherent DSP controllers:

```
Router#show controller coherentdsp 0/0/0/4
Thu May 27 17:28:51.960 UTC
Port                                     : CoherentDSP 0/0/0/4
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 = 6 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 = 5
Detected Alarms                          : LOS
Bit Error Rate Information
PREFEC BER                               : 5.0E-01
POSTFEC BER                             : 0.0E+00
Q-Factor                                : 0.00 dB
Q-Margin                                : -7.20dB
OTU TTI Received
FEC mode                                : C_FEC
```

# Disable Auto-Squelching

Table 9: Feature History Table

| Feature Name            | Release Information | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Disable Auto-Squelching | Release 7.11.1      | <p>This release introduces support to disable Auto squelching. This helps to detect weak signals that are hidden within the laser source noise. By disabling Auto squelch, you can reduce the processing overhead in systems that have stable laser sources and minimal noise, helping you optimize the performance of your system. When the Auto squelch function is enabled, the optical module will generate a local fault signal on the host side if it detects a fault on the media side. By default, Auto squelch is enabled.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b>The following keyword has been introduced.</p> <ul style="list-style-type: none"> <li>• <b>host auto-squelch disable</b></li> </ul> <p><b>YANG DATA models:</b></p> <ul style="list-style-type: none"> <li>• New XPath for <code>Cisco-IOS-XR-controller-optics-cfg</code> (see <a href="#">Github</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul> |

This release introduces the support to disable auto-squelch functionality on the module on the host side. When enabled, the squelch function is activated on the module when no suitable media-side input signal from the remote end is available to be forwarded to the host-side output (example: Rx LOS is asserted). Auto squelching is commonly used to suppress unwanted noise from laser sources in communication systems. When disabled and no valid signal is detected on the module from the remote end, the module will generate a local fault towards the NPU. However, disabling auto-squelching provides you with expanded signal detection. This enables you to detect extremely weak signals that are embedded within the laser source noise. Also, by eliminating the need to continuously monitor and suppress unwanted noise, system resources can be allocated more efficiently, leading to improved performance.

In this feature, we introduced the **host auto-squelch disable** command to disable the auto-squelch functionality when there is an invalid input signal from the remote end. This feature provides you with the flexibility to customize the system's behavior according to your requirements.

### Disabling Laser Squelching Configuration Example

This example shows how to disable laser squelching for a host on controller optics:

```
router#conf
router(config)#controller 0/0/0/0
router(config-Optics)#host auto-squelch disable
router(config-Optics)#commit
```

### Verification

This example shows how to verify the laser squelching disabled configuration:

```
router#show controllers optics 0/0/0/0
Host Squelch Status: disable
```

## Configuring Performance Monitoring

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds for, and report performance data for early detection of problems. The user can retrieve both current and historical PM counters for the various controllers in 30-second, 15-minute, and 24-hour intervals.

Performance monitoring can be configured on optics controllers and coherent DSP controllers.

To stop performance monitoring on optics or coherent DSP controllers, use the **perf-mon disable** keyword.

## Configuring PM Parameters

The performance monitoring (PM) threshold and the threshold crossing alert (TCA) reporting status can be configured for optics controllers and coherent DSP controllers:

**Table 10: PM Thresholds and TCA Report Status for Optics Controllers**

| PM Parameters | Description                                                                               |
|---------------|-------------------------------------------------------------------------------------------|
| CD            | Sets the CD (chromatic dispersion) threshold or TCA reporting status.                     |
| DGD           | Sets the DGD (differential group delay) threshold or TCA reporting status.                |
| LBC           | Sets the LBC (laser bias current) threshold or TCA reporting status in mA.                |
| FREQ-OFF      | Sets the FREQ-OFF (low signal frequency offset) threshold or TCA reporting status in Mhz. |
| OPR           | Sets the OPR (optical power RX) threshold or TCA reporting status in uW or dbm.           |
| OPT           | Sets the OPT (optical power TX) threshold or TCA reporting status in uW or dbm.           |

| PM Parameters | Description                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------|
| OSNR          | Sets the OSNR (optical signal-to-noise ratio) threshold or TCA reporting status.              |
| PCR           | Sets the PCR (polarization change rate) threshold or TCA reporting status.                    |
| PDL           | Sets the PDL (polarization dependent loss) threshold or TCA reporting status.                 |
| RX-SIG        | Sets the RX-SIG (receiving signal power) threshold or TCA reporting status in uW or dbm.      |
| SNR           | Sets the SNR (signal-to-noise ratio) threshold or TCA reporting status.                       |
| SOPMD         | Sets the SOPMD (second order polarization mode dispersion) threshold or TCA reporting status. |

**Table 11: PM Thresholds TCA Report Status for Coherent DSP Controllers**

| PM Parameters | Description                                                                |
|---------------|----------------------------------------------------------------------------|
| Q             | Sets the Q threshold or TCA reporting status.                              |
| Q-margin      | Sets the Q margin threshold or TCA reporting status.                       |
| EC-BITS       | Sets the EC-BITS (error corrected bits) threshold or TCA reporting status. |
| PostFEC BER   | Sets the post-FEC BER threshold or TCA reporting status.                   |
| PreFEC BER    | Sets the pre-FEC BER threshold or TCA reporting status.                    |
| UC-WORDS      | Sets the UC-WORDS (uncorrected words) threshold or TCA reporting status.   |

### Performance Monitoring Configuration Example

This example shows how to enable performance monitoring and set PM thresholds on the optics controller:

```
Router#config
Router(config)#controller optics 0/2/0/16
Router(config-Optics)#perf-mon enable
Router(config-Optics)#pm 30-sec optics threshold cd max 100
Router(config-Optics)#pm 30-sec optics threshold cd min -100
Router(config-Optics)#commit
```

### Running Configuration

This example shows the running configuration on optics controllers:

```
Router#show run controller optics 0/2/0/16
Thu May 13 20:18:55.957 UTC
controller Optics0/2/0/16
```

```
pm 30-sec optics threshold cd max 100
pm 30-sec optics threshold cd min -100
perf-mon enable
!
```

### Verification

This example shows how to verify the PM parameters on optics controllers. Verify the configuration changes in the Configured Threshold fields:

```
Router#show controller optics 0/2/0/16 pm current 30-sec optics 1
```

```
Thu May 27 17:58:49.889 UTC
```

```
Optics in the current interval [17:58:30 - 17:58:49 Thu May 27 2021]
```

```
Optics current bucket type : Valid
```

|                         | MIN<br>Configured | AVG<br>TCA | MAX    | Operational | Configured<br>Threshold(min) | TCA<br>(min) | Operational<br>Threshold(max) |
|-------------------------|-------------------|------------|--------|-------------|------------------------------|--------------|-------------------------------|
| LBC[ $\mu$ A]           | : 0.0             | 0.0        | 0.0    | 0.0         | NA                           | NO           | 100.0                         |
| OPT[dBm]                | : -9.98           | -9.98      | -9.98  | -15.09      | NA                           | NO           | 0.00                          |
| OPR[dBm]                | : -40.00          | -40.00     | -40.00 | -30.00      | NA                           | NO           | 8.00                          |
| CD[ps/nm]               | : 0               | 0          | 0      | -80000      | -100                         | NO           | 100                           |
| DGD[ps]                 | : 0.00            | 0.00       | 0.00   | 0.00        | NA                           | NO           | 80.00                         |
| SOPMD[ps <sup>2</sup> ] | : 0.00            | 0.00       | 0.00   | 0.00        | NA                           | NO           | 2000.00                       |
| OSNR[dB]                | : 0.00            | 0.00       | 0.00   | 0.00        | NA                           | NO           | 40.00                         |
| PDL[dB]                 | : 0.00            | 0.00       | 0.00   | 0.00        | NA                           | NO           | 7.00                          |
| PCR[rad/s]              | : 0.00            | 0.00       | 0.00   | 0.00        | NA                           | NO           | 2500000.00                    |
| RX_SIG[dBm]             | : -40.00          | -40.00     | -40.00 | -30.00      | NA                           | NO           | 1.00                          |
| FREQ_OFF[Mhz]           | : 0               | 0          | 0      | -3600       | NA                           | NO           | 3600                          |
| SNR[dB]                 | : 0.00            | 0.00       | 0.00   | 7.00        | NA                           | NO           | 100.00                        |

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

### Performance Monitoring Configuration Example

This example shows how to enable performance monitoring and set PM thresholds and TCA reporting status on the coherent DSP controller:

```
Router#config
Router(config)#controller CoherentDSP0/2/0/16
Router(config-CoDSP)#perf-mon enable
Router(config-CoDSP)#pm 30-sec fec report Q max-tca enable
Router(config-CoDSP)#pm 30-sec fec report Q-margin max-tca enable
Router(config-CoDSP)#pm 30-sec fec report Q min-tca enable
Router(config-CoDSP)#pm 30-sec fec report Q-margin min-tca enable
Router(config-CoDSP)#pm 30-sec fec threshold Q max 1200
Router(config-CoDSP)#pm 30-sec fec threshold Q-margin max 500
Router(config-CoDSP)#pm 30-sec fec threshold Q min 900
Router(config-CoDSP)#pm 30-sec fec threshold Q-margin min 280
Router(config-CoDSP)#commit
```

### Running Configuration

This example shows the running configuration on coherent DSP controllers:

```
Router#show run controller coherentdsp 0/2/0/16
Thu May 13 19:56:09.136 UTC
controller CoherentDSP0/2/0/16
  pm 30-sec fec report Q max-tca enable
  pm 30-sec fec report Q-margin max-tca enable
  pm 30-sec fec report Q min-tca enable
  pm 30-sec fec report Q-margin min-tca enable
  pm 30-sec fec threshold Q max 1200
  pm 30-sec fec threshold Q-margin max 500
  pm 30-sec fec threshold Q min 900
  pm 30-sec fec threshold Q-margin min 280
  perf-mon enable
!
```

### Verification

This example shows how to verify the PM parameters on coherent DSP controllers. Verify the configuration changes in the highlighted fields:

```
Router#show controllers coherentdsp 0/2/0/16 pm current 30-sec fec
Thu May 27 23:04:54.167 UTC
g709 FEC in the current interval [23:04:30 - 23:04:54 Thu May 27 2021]
FEC current bucket type : Valid
  EC-BITS      : 0                      Threshold : 111484000000          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      0E-15      0E-15      0E-15      NO
0E-15          NO
PostFEC BER     : 0E-15      0E-15      0E-15      0E-15      NO
0E-15          NO
Q[dB]           : 0.00      0.00      0.00      9.00 YES 120.00 YES
Q_Margin[dB]    : 0.00      0.00      0.00      2.80 YES 5.00 YES
!
```

## Configuring Alarms Threshold

The alarms threshold can be configured for monitoring alarms on optics controllers:

**Table 12: Alarms Threshold Parameters for Optics Controllers**

| Alarm Threshold Parameters | Description                                                                                  |
|----------------------------|----------------------------------------------------------------------------------------------|
| CD                         | Sets the CD (chromatic dispersion) alarm threshold (cd-low-threshold and cd-high-threshold). |
| DGD                        | Sets the DGD (differential group delay) alarm threshold.                                     |
| LBC                        | Sets the LBC (laser bias current) threshold in mA.                                           |
| OSNR                       | Sets the OSNR (optical signal-to-noise ratio) alarm threshold.                               |

## Alarm Threshold Configuration Example

This example shows how to configure alarm threshold on the optics controller:

```
Router#config
Router(config)#controller optics 0/2/0/16
Router(config-Optics)#cd-low-threshold -2000
Router(config-Optics)#cd-high-threshold 2000
Router(config-Optics)#commit
```

## Running Configuration

This example shows the running configuration on the optics controller:

```
Router#show run controller optics 0/2/0/16
Thu May 13 20:18:55.957 UTC
controller Optics0/2/0/16
  cd-low-threshold 2000
  cd-high-threshold 2000
!
```

## Verification

This example shows how to verify the alarm threshold on optics controllers:

```
Router#show controller optics 0/2/0/16
Fri May 28 01:04:33.604 UTC
Controller State: Up
Transport Admin State: In Service
Laser State: Off
LED State: Off
FEC State: FEC ENABLED
Optics Status
  Optics Type: QSFPDD 400G ZRP
  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 mA
  Actual TX Power = -40.00 dBm
  RX Power = -40.00 dBm
  RX Signal Power = -40.00 dBm
  Frequency Offset = 0 MHz
  Laser Temperature = 0.00 Celsius
  Laser Age = 0 %
  DAC Rate = 1x1.25
  Performance Monitoring: Enable
  THRESHOLD VALUES
  -----
  Parameter                High Alarm  Low Alarm  High Warning  Low Warning
  -----
  Rx Power Threshold(dBm)   13.0       -24.0      10.0          -22.0
  Tx Power Threshold(dBm)   0.0        -16.0      -2.0          -14.0
  LBC Threshold(mA)         0.00       0.00      0.00          0.00
```

```

Temp. Threshold(celsius)      80.00      -5.00      75.00      0.00
Voltage Threshold(volt)       3.46      3.13      3.43      3.16
LBC High Threshold = 98 %
Configured Tx Power = -10.00 dBm
Configured CD High Threshold = -5000 ps/nm
Configured CD lower Threshold = -5000 ps/nm
Configured OSNR lower Threshold = 9.00 dB
Configured DGD Higher Threshold = 80.00 ps
Baud Rate = 60.1385459900 GBd
Modulation Type: 16QAM
Chromatic Dispersion 0 ps/nm
Configured CD-MIN -26000 ps/nm CD-MAX 26000 ps/nm
Second Order Polarization Mode Dispersion = 0.00 ps^2
Optical Signal to Noise Ratio = 0.00 dB
Polarization Dependent Loss = 0.00 dB
Polarization Change Rate = 0.00 rad/s
Differential Group Delay = 0.00 ps
Temperature = 21.00 Celsius
Voltage = 3.42 V
Transceiver Vendor Details
Form Factor      : QSFP-DD
Optics type      : QSFPDD 400G ZRP
Name             : CISCO-ACACIA
OUI Number       : 7c.b2.5c
Part Number      : DP04QSDD-E30-19E
Rev Number       : 10
Serial Number    : ACA244900GN
PID              : QDD-400G-ZRP-S
VID              : ES03
Firmware Version : 161.06
Date Code(yy/mm/dd) : 20/12/08
!

```

## Alarms Troubleshooting

This section contains the procedures for troubleshooting alarms.

### CD Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The Chromatic Dispersion (CD) alarm is raised when the detected chromatic dispersion value is above or below the configured threshold values.

### Clear the CD Alarm

#### Procedure

---

Configure threshold value within range if CD value is not within the threshold range.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## DGD Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The Differential Group Delay (DGD) alarm is raised when the value of the differential group delay read by the pluggable port module exceeds the configured threshold value.

## Clear the DGD Alarm

### Procedure

---

Configure the threshold value within range if DGD value is not within the threshold range.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## FLEXO\_LOF

Default Severity: Critical

Logical Object: OTN

Flexo LOF alarm is raised when loss of alignment is detected on the Flexo frame for more than 3ms.

## Clear the FLEXO\_LOF Alarm

### Procedure

---

Identify and correct the underlying cause of mis-alignment. The Flexo LOF (Loss of Frame) alarm is cleared when good alignment is detected on the Flexo frame for more than 3ms.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## FLEXO\_LOM

Default Severity: Critical

Logical Object: OTN

Flexo LOM (Loss of Multi-Frame) is raised when loss of multi-frame alignment is detected on the Flexo multi-frame for more than 10ms

## Clear the FLEXO\_LOM Alarm

### Procedure

---

Identify and correct the underlying cause of mis-alignment. The Flexo LOM alarm is cleared when good multi-frame alignment is detected on the Flexo multi-frame.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-LASERBIAS Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The HI-LASERBIAS alarm is raised when the physical pluggable port laser detects a laser bias value beyond the configured high threshold.

## Clear the HI-LASERBIAS Alarm

### Procedure

---

Configure the threshold value within range if high laser bias threshold value is not within the threshold range.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-RXPOWER Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The HI-RXPOWER alarm occurs on the client optics controller when the measured individual lane optical signal power of the received signal exceeds the default threshold. The HI-RXPOWER alarm occurs on the trunk optics controller when the total optical signal power of the received signal exceeds the default threshold.

## Clear the HI-RXPOWER Alarm

### Procedure

---

Physically verify by using a standard power meter that the optical input power is overcoming the expected power threshold. Connect an attenuator accordingly.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-RXPOWER Warn

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Software

The HI-RXPOWER warning occurs on the client optics controller when the measured individual lane optical signal power of the received signal exceeds the default threshold. The HI-RXPOWER warning occurs on the trunk optics controller when the total optical signal power of the received signal exceeds the default threshold.

## Clear the HI-RXPOWER Warn Alarm

### Procedure

---

Physically verify by using a standard power meter that the optical input power is overcoming the expected power threshold. Connect an attenuator accordingly.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-TEMP Alarm

Default Severity: Critical

Logical Object: Software

The HI-TEMP alarm occurs when the optical module temperature exceeds the default threshold.

## Clear the HI-TEMP Alarm

### Procedure

---

Verify the fan is intact and empty slots are blocked for cooling.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-TEMP Warn

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Software

The HI-TEMP warning occurs when the optical module temperature exceeds the default threshold.

### Clear the HI-TEMP Warn Alarm

#### Procedure

---

Verify the fan is intact and empty slots are blocked for cooling

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-TXPOWER Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The HI-TXPOWER alarm occurs on the client optics controller when the measured individual lane optical signal power of the transmitted signal exceeds the default threshold. The HI-TXPOWER alarm occurs on the trunk optics controller when the total optical signal power of the transmitted signal exceeds the default threshold.

### Clear the HI-TXPOWER Alarm

#### Procedure

---

Physically verify by using a standard power meter that the optical output power is overcoming the expected power threshold.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## HI-TXPOWER Warn

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Software

The HI-TXPOWER warning occurs on the client optics controller when the measured individual lane optical signal power of the transmitted signal exceeds the default threshold. The HI-TXPOWER warning occurs on the trunk optics controller when the total optical signal power of the transmitted signal exceeds the default threshold.

### Clear the HI-TXPOWER Warn Alarm

#### Procedure

---

Physically verify by using a standard power meter that the optical output power is overcoming the expected power threshold.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## IMPROPER-REM

Default Severity: Critical

Logical Object: Software

The Improper Removal alarm is raised when a physical pluggable is not present on a service-provisioned port.

### Clear the IMPROPER-REM Alarm

#### Procedure

---

Insert the appropriate QSFP.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LOF

Default Severity: Critical

Logical Object: OTN

Flexo LOF alarm is raised when loss of alignment is detected on the Flexo frame for more than 3ms.

## Clear the LOF Alarm

### Procedure

---

Identify and correct the underlying cause of mis-alignment. The Flexo LOF (Loss of Frame) alarm is cleared when good alignment is detected on the Flexo frame for more than 3ms.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LOL

Default Severity: Major

Logical Object: Software

LOL alarm is raised when loss of lock is detected on the receive side of the CDR (Clock and Data Recovery)

## Clear the LOL Alarm

### Procedure

---

Verify the fiber and power levels.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LOM

Default Severity: Critical

Logical Object: OTN

Flexo LOM (Loss of Multi-Frame) is raised when loss of multi-frame alignment is detected on the Flexo multi-frame for more than 10ms

## Clear the LOM Alarm

### Procedure

---

Identify and correct the underlying cause of mis-alignment. The Flexo LOM alarm is cleared when good multi-frame alignment is detected on the Flexo multi-frame.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LO-RXPOWER Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The LO-RXPOWER alarm is raised on the client or trunk optics controller when the measured individual lane optical signal power of the received signal falls below the default threshold.

### Clear the LO-RXPOWER Alarm

#### Procedure

---

Verify that the trunk-rx port is cabled correctly and clean the fiber connecting the faulty TXP/MXP card to the drop port of the DWDM card.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LO-RXPOWER Warn

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Software

The LO-RXPOWER warning is raised on the client or trunk optics controller when the measured individual lane optical signal power of the received signal falls below the default threshold.

### Clear the LO-RXPOWER Warn Alarm

#### Procedure

---

Verify that the trunk-rx port is cabled correctly and clean the fiber connecting the faulty TXP/MXP card to the drop port of the DWDM card.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LOS

Default Severity: Major

Logical Object: Software

This alarm occurs when there is a loss of signal

### Clear the LOS Alarm

#### Procedure

---

Identify and correct the underlying cause of signal LOS. The alarm is cleared when signal is improved.

If the alarm does not clear, log into the Technical Support Website at

<http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LOS-P

Default Severity: Minor

Logical Object: OTN

This alarm occurs when there is a loss of signal.

### Clear the LOS-P Alarm

#### Procedure

---

Identify and correct the underlying cause of signal LOS. The alarm is cleared when signal is improved.

If the alarm does not clear, log into the Technical Support Website at

<http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LO-TXPOWER Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The LO-TXPOWER alarm is raised on the client or trunk optics controller when the measured individual lane optical signal power of the transmitted signal falls below the default threshold.

## Clear the LO-TXPOWER Alarm

### Procedure

---

Verify the optics detection and any failures.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## LO-TXPOWER Warn

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Software

The LO-TXPOWER warning is raised on the client or trunk optics controller when the measured individual lane optical signal power of the transmitted signal falls below the default threshold.

## Clear the LO-TXPOWER Warn Alarm

### Procedure

---

Verify the optics detection and any failures.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## OOR\_CD

Default Severity: Minor

Logical Object: Controller

This alarm occurs when the Chromatic Dispersion is out of range

## Clear the OOR\_CD Alarm

### Procedure

---

Configure threshold value within range if CD value is not within the threshold range.

If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).

---

## OSNR Alarm

Default Severity: Minor (MN), Non-Service-Affecting (NSA)

Logical Object: Controller

The Optical Signal Noise Ratio (OSNR) alarm occurs when the measured OSNR falls below the threshold.

### Clear the OSNR Alarm

#### Procedure

- 
- |               |                                                                                                                                                                                                                                                                                                                                    |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | Verify the value of the minimum acceptable OSNR value of NCS 5500 using the show controller optics R/S/I/P command.                                                                                                                                                                                                                |
| <b>Step 2</b> | If the value is not within the OSNR threshold range, configure the minimum acceptable OSNR value using the controller optics R/S/I/P osnr-low-threshold command in the config mode. The range is 0–4000 (in units of 01db).                                                                                                        |
| <b>Step 3</b> | If the value is within the range of the minimum acceptable OSNR, contact TAC.<br><br>If the alarm does not clear, log into the Technical Support Website at <a href="http://www.cisco.com/c/en/us/support/index.html">http://www.cisco.com/c/en/us/support/index.html</a> for more information or call Cisco TAC (1 800 553-2447). |
- 

## UNC-WORD Alarm

Default Severity: Not Reported (NR), Not-Alerted, Non-Service-Affecting (NSA)

Logical Object: OTN

The Uncorrected FEC Word (UNC-WORD) condition is raised when the FEC is unable to correct the frame.

### Clear the UNC-WORD Alarm

#### Procedure

- 
- |               |                                                                                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | Ensure that the fiber connector for the card is completely plugged in.                                                                                                                                                                        |
| <b>Step 2</b> | Ensure that the ports on the far end and near end nodes have the same port rates and FEC settings.                                                                                                                                            |
| <b>Step 3</b> | If the BER threshold is correct and at the expected level, use an optical test set to measure the power level of the line to ensure it is within guidelines. For specific procedures to use the test set equipment, consult the manufacturer. |
| <b>Step 4</b> | If the optical power level is good, verify that the optical receive levels are within the acceptable range.                                                                                                                                   |

- Step 5** If receive levels are good, clean the fibers at both ends.
- Step 6** If the condition does not clear, verify that a single-mode fiber is used.
- If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).
- 

## WVL-00L

Default Severity: Major

Logical Object: Controller

The Wavelength Out of Lock alarm is raised when the port detects the optical input frequency to be out of range.

### Clear the WVL-00L Alarm

#### Procedure

- 
- Step 1** Verify the wavelength configuration.
- Step 2** Verify whether the pluggable is inserted properly.
- If the alarm does not clear, log into the Technical Support Website at <http://www.cisco.com/c/en/us/support/index.html> for more information or call Cisco TAC (1 800 553-2447).
-

