



# Configuring 400G Digital Coherent Optics

**Table 1: Feature History Table**

Feature Name	Release Information	Description
Support for DP04QSDD-ULH-A1 optical module	Release 25.2.1	<p>This release introduces support for the Cisco 400G QSFP-DD Ultra Long-Haul (ULH) coherent optical module on these line cards:</p> <ul style="list-style-type: none"> <li>• 88-LC0-36FH</li> <li>• 88-LC0-36FH-M</li> </ul> <p>The 400G QSFP-DD ULH optics are supported on even-numbered ports only. The supported port numbers are: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34.</p>
Extended Support for QDD-400G-ZR-S and QDD-400G-ZRP-S Optical Module	Release 25.1.1	<p>This release introduces support for the QDD-400G-ZR-S and QDD-400G-ZRP-S optical module on these line cards:</p> <ul style="list-style-type: none"> <li>• 88-LC1-12TH24FH-E</li> <li>• 88-LC1-36EH</li> </ul>
Extended Support for DP04QSDD-ER1 Optical Module	Release 24.4.1	<p>This release introduces support for the Cisco 400G Quad Small Form-Factor Pluggable Double Density (QSFP-DD) optical module DP04QSDD-ER1 on these routers and line cards:</p> <p>Routers:</p> <ul style="list-style-type: none"> <li>• Cisco 8201-32FH</li> <li>• Cisco 8201-24H8FH</li> <li>• Cisco 8608</li> </ul> <p>Line cards:</p> <ul style="list-style-type: none"> <li>• 88-LC1-36EH</li> </ul>

Feature Name	Release Information	Description
Extended Support for DP04QSDD-HE0 Optical Module	Release 24.4.1	This release introduces support for the Cisco 400G QSFP-DD High-Power (Bright) Optical Module DP04QSDD-HE0, Ethernet Variant on these line card: <ul style="list-style-type: none"> <li>• 88-LC1-36EH</li> </ul>
Added Support for DP04QSDD-ER1 and DP01QSDD-ZF1 Optical Modules	Release 24.3.1	This release introduces support for the following Optical Modules on the Cisco 8711-32FH-M router: <ul style="list-style-type: none"> <li>• DP04QSDD-ER1 - Cisco 400G Quad Small Form-Factor Pluggable Double Density (QSFP-DD)</li> <li>• DP01QSDD-ZF1 - Cisco 100G Quad Small Form-Factor Pluggable Double Density (QSFP-DD)</li> </ul>
Extended Support for DP04QSDD-HE0 Optical Module	Release 24.1.1	This release introduces support for the Cisco 400G QSFP-DD High-Power (Bright) Optical Module DP04QSDD-HE0, Ethernet Variant on these routers and line cards: <p>Routers:</p> <ul style="list-style-type: none"> <li>• Cisco 8201</li> <li>• Cisco 8202</li> </ul> <p>Line cards:</p> <ul style="list-style-type: none"> <li>• 8800-LC-36FH</li> <li>• 88-LC0-36FH-M</li> </ul>
Extended Support for DP04QSDD-HE0 Optical Module	Release 7.10.2	From this release, the DP04QSDD-HE0 optical module is supported on these router and line cards: <p>Router:</p> <ul style="list-style-type: none"> <li>• Cisco 8202-32FH-M</li> </ul> <p>Line cards:</p> <ul style="list-style-type: none"> <li>• 88-LC0-36FH</li> </ul>
Extended Support for DP04QSDD-HE0 Optical Module	Release 7.10.1	This release introduces support for the Cisco 400G QSFP-DD High-Power (Bright) Optical Module DP04QSDD-HE0, Ethernet Variant on the Cisco 8608 router.

Feature Name	Release Information	Description
oFEC Traffic Configuration for QDD-400G-ZRP-S	Release 7.9.1	<p>New Modulation and DAC Rate traffic configurations are supported on QDD-400G-ZRP-S optical module:</p> <ul style="list-style-type: none"> <li>• 400G-TXP-1x1-16 QAM</li> <li>• 4x100G-MXP-1x1-16 QAM</li> <li>• 3x100G-MXP-1x1-8 QAM</li> <li>• 2x100G-MXP-1x1-QPSK</li> <li>• 2x100G-MXP-1x1.25-16 QAM</li> </ul> <p>This increases the interoperability of the QDD-400G-ZRP-S optical module across network components supporting these formats.</p>
Support for DP04QSDD-HE0 Optical Module	Release 7.9.1	<p>The Cisco 400G QSFP-DD High-Power (Bright) Optical Module is an enhanced version of the currently available QSFP-DD ZR+ Optical Module. It leverages the same operational modes but provides a major enhancement by increasing the Tx Optical Power up to +1dBm.</p> <p>From this release, the DP04QSDD-HE0 optical module is supported on the Cisco 8201-32FH and Cisco 8201-24H8FH routers.</p>
Support for QDD-400G-ZRP-S Optical Module	Release 7.9.1	<p>This release introduces support for the Cisco 400G QSFP-DD-ZRP-S Ethernet Variant on the Cisco 88-LC0-34H14FH line card.</p>

Cisco offers a range of the new 400G Digital Coherent QSFP-DD optical modules. The optical modules that are available are:

- QDD-400G-ZR-S
- QDD-400G-ZRP-S
- DP04QSDD-HE0
- DP04QSDD-HE0-A1
- DP04QSDD-ER1
- DP01QSDD-ZF1
- DP04QSDD-ULH

For more information about the optic module portfolio, see the [Cisco 400G Digital Coherent Optics QSFP-DD Optical Modules Data Sheet](#).

The 400ZR-ULH modules support C-band and L-band operation and are managed entirely via OpenConfig, YANG models. You can configure and monitor modules using gNMI/gNOI protocols.

This chapter describes various optical modules and their supported configurations. The following fixed-port routers, line cards, from the indicated Cisco IOS XR software releases, support these optical modules.

**Table 2: Fixed-port routers and optical modules support by Cisco IOS XR Release**

Fixed-Port Routers	Optics PID	Minimum IOS XR Software Release
Cisco 8201	QDD-400G-ZR-S	Release 7.3.15
	QDD-400G-ZRP-S	
	DP04QSDD-HE0	Release 24.1.1
	DP04QSDD-HE0-A1	Release 24.2.11
Cisco 8202	QDD-400G-ZR-S	Release 7.3.15
	QDD-400G-ZRP-S	
	DP04QSDD-HE0	Release 24.1.1
	DP04QSDD-HE0-A1	Release 24.2.11
Cisco 8711-32FH-M	DP04QSDD-ER1	Release 24.3.1
	DP01QSDD-ZF1	
Cisco 8101-32FH	QDD-400G-ZR-S	Release 7.3.2
	QDD-400G-ZRP-S	
Cisco 8201-32FH	DP04QSDD-HE0	Release 7.9.1
	DP04QSDD-HE0-A1	Release 24.2.11
Cisco 8201-24H8FH	DP04QSDD-HE0	Release 7.9.1
	DP04QSDD-HE0-A1	Release 24.2.11
Cisco 8608	DP04QSDD-HE0	Release 7.10.1
Cisco 8202-32FH-M	DP04QSDD-HE0	Release 7.10.2
	DP04QSDD-HE0-A1	Release 24.2.11
Cisco 8212-48FH-M	DP04QSDD-HE0-A1	Release 24.2.11
	DP04QSDD-HE0	Release 24.3.1

**Table 3: Line cards and optical modules support by Cisco IOS XR Release**

Line Cards	Optics PID	Minimum IOS XR Software Release
8800-LC-36FH	QDD-400G-ZR-S	Release 7.3.15
	QDD-400G-ZRP-S	
	DP04QSDD-HE0	Release 24.1.1
	DP04QSDD-HE0-A1	Release 24.2.11
88-LC0-36FH-M	QDD-400G-ZR-S	Release 7.3.15
	QDD-400G-ZRP-S	
	DP04QSDD-HE0	Release 24.1.1
	DP04QSDD-HE0-A1	Release 24.2.11
	DP04QSDD-ULH	Release 25.2.1
	88-LC0-36FH	QDD-400G-ZR-S
QDD-400G-ZRP-S		Release 7.3.2
DP04QSDD-HE0		Release 7.10.2
DP04QSDD-HE0-A1		Release 24.2.11
DP04QSDD-ULH		Release 25.2.1
88-LC1-36EH	DP04QSDD-HE0-A1	Release 24.2.11
	DP04QSDD-HE0	
	QDD-400G-ZR-S	Release 25.1.1
	QDD-400G-ZRP-S	Release 25.1.1
88-LC1-12TH24FH-E	DP04QSDD-HE0-A1	Release 24.2.11
	QDD-400G-ZR-S	Release 25.1.1
	QDD-400G-ZRP-S	Release 25.1.1
88-LC0-34H14FH	QDD-400G-ZRP-S	Release 7.9.1
	DP04QSDD-HE0-A1	Release 24.2.11

These restrictions apply to optics and routers:

**Table 4: Restrictions on optics and routers**

The...	not supported on...
QDD-400G-ZR-S and QDD-400G-ZRP-S optics are	Cisco 8102-64H fixed-port routers.
Tail Trace Identifier (TTI) feature is	QDD-400G-ZR-S and QDD-400G-ZRP-S optics.
QDD-400G-ZRP-S and DP04QSDD-HE0 optics are	odd-numbered ports of the following routers and line cards: <ul style="list-style-type: none"> <li>• Cisco 8201</li> <li>• Cisco 8202</li> <li>• 8800-LC-36FH</li> <li>• 88-LC0-36FH-M</li> </ul>

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 a 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 27](#)
  - [Configuring Muxponder Mode, on page 18](#)
  - [Configuring Modulation, on page 25](#)
  - [Configuring FEC, on page 29](#)
- Optical configuration – Comprises configuring frequency, chromatic dispersion, and optical transmit power. Applicable for optics controllers:
  - [Configuring Frequency, on page 12](#)
  - [Configuring Chromatic Dispersion, on page 14](#)
  - [Configuring Optical Transmit Power, on page 15](#)

- 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 34](#)
  - [Configuring PM Parameters, on page 35](#)
- Loopback configuration – Configures loopback. Applicable for coherent DSP controller:
  - [Configuring Loopback, on page 30](#)
- 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 39](#)
  - [Configuring FEC Alarm Threshold, on page 41](#)

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

**Table 5: 400G Digital Coherent QSFP-DD Traffic Capabilities and Example Settings**

	<b>Client Speed</b>	<b>Trunk Speed</b>	<b>Frequency</b>	<b>FEC</b>	<b>Modulation</b>	<b>DAC-Rate</b>	<b>Chromatic Dispersion (CD)</b>	<b>Transmitted (Tx) Power</b>
QDD-400G-ZR-S	1x400G, 4x100G	400G	C-Band, 196.1 To 191.3 THz	cFEC	16QAM	1x1	-2400 to +2400	Each optical module has its own Tx power optimal values. You can change the Tx power value based on the module capability.

	Client Speed	Trunk Speed	Frequency	FEC	Modulation	DAC-Rate	Chromatic Dispersion (CD)	Transmitted (Tx) Power
QDD-400G-ZRP-S	1x400G, 4x100G, 3x100G, 2x100G, 1x100G  <b>Note</b> Release 7.3.15 supports only 1x400 and 4x100 client speed.	400G, 300G, 200G, 1x100  <b>Note</b> Release 7.3.15 supports only 400G trunk speed.	C-Band, 196.1 To 191.3 THz	oFEC, cFEC	16QAM, 8QAM, QPSK  Release 7.3.15 supports only 16QAM.	1x1 (OIF, OpenZR+ Mode without Tx shaping),  1x1.25 (Cisco Mode with Tx shaping),  1x5 (OpenZR+ Mode with Tx shaping)	Release 7.3.15: -80000 to +80000  Release 7.3.2: -160000 to +160000	Each optical module has its own Tx power optimal values. You can change the Tx power value based on the module capability.
DP04QSDD-HE0	1x400G, 4x100G, 3x100G, 2x100G, 1x100G	400G, 300G, 200G, 100G	C-Band, 196.1 To 191.3 THz	oFEC, cFEC	16QAM, 8QAM, QPSK	1x1.25 (Cisco Mode),  1x5 (OIF, OpenZR+ Mode)	400G: -52000 to +52000  100G: -160000 to +160000	Each optical module has its own Tx power optimal values. You can change the Tx power value based on the module capability.
DP04QSDD-ER1	1x400G, 2x200G, 4x100G	400G	193.7THz	cFEC, oFEC	16QAM	1x1	-2400 to +2400	Fixed at maximum output around -9 dBm.
DP01QSDD-ZF1	1x100G	100G	193.7THz	oFEC	QPSK	1x1	-2400 to +2400	Fixed at maximum output around -6 dBm.

	Client Speed	Trunk Speed	Frequency	FEC	Modulation	DAC-Rate	Chromatic Dispersion (CD)	Transmitted (Tx) Power
DP04QSDD-HE0-A1	1x400G, 4x100G, 3x100G, 2x100G, 1x100G	400G, 300G, 200G, 100G	C-Band, 196.1 to 191.3 THz	cFEC, oFEC	16QAM, 8QAM, QPSK	1x1.25 (Cisco Mode), 1x5 (OIF, OpenZR+ Mode)	400G: -52000 to +52000 100G: -160000 to +160000	Each optical module has its own Tx power optimal values. You can change the Tx power value based on the module capability.
400G Transponder oFEC OpenZR+ Mode (example settings)	No need to configure 400G transponder mode	No setting required; tied to Client Speed	<b>cd-min</b> <i>10000</i> <b>cd-max</b> <i>1931000</i> <b>frequency</b> <i>1931000</i>	<b>fec</b> <i>OFEC</i> (default; can be omitted)	<b>modulation</b> <i>16Qam</i> (default; can be omitted)	<b>DAC-Rate</b> <i>1x1.5</i>	<b>cd-min</b> <i>-20000</i> <b>cd-max</b> <i>20000</i>	<b>transmit-power</b> <i>10 (+1 dBm)</i>
400G Muxponder oFEC Cisco Mode (example settings)	<b>breakout</b> <i>4x100</i>	No setting required; tied to Client Speed	<b>cd-min</b> <i>10000</i> <b>cd-max</b> <i>1931000</i> <b>frequency</b> <i>1931000</i>	<b>fec</b> <i>OFEC</i> (default; can be omitted)	<b>modulation</b> <i>16Qam</i> (default; can be omitted)	<b>DAC-Rate</b> <i>1x1.25</i> (default; can be omitted)	<b>cd-min</b> <i>-20000</i> <b>cd-max</b> <i>20000</i>	<b>transmit-power</b> <i>10 (+1 dBm)</i>

**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 6: 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 7: QDD-400G-ZRP-S Transponder and Muxponder Configuration Values**

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate	OpenZR+ Support
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	oFEC	1x1	
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 Client, 100G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1	
4x100G-MXP	4 clients, 100G speed	1 trunk, 400G speed	16 QAM	cFEC	1x1	
3x100G-MXP	3 clients, 100G speed	1 trunk, 400G speed	8 QAM	oFEC	1x1.25	
3x100G-MXP	3 Client, 100G speed	1 trunk, 400G speed	8 QAM	oFEC	1x1	
2x100G-MXP	2 clients, 100G speed	1 trunk, 200G speed	QPSK	oFEC	1x1.50	
2x100G-MXP	2 Client, 100G speed	1 trunk, 400G speed	QPSK	oFEC	1x1	
2x100G-MXP	2 Client, 100G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1.25	
1x100G-MXP	1 client, 100G speed	1 trunk, 100G speed	QPSK	oFEC	1x1.50	

The high optical performance DP04QSDD-HE0 QSFP-DD pluggable coherent optical module is developed for easy deployment in Reconfigurable Optical Add/Drop Multiplexer (ROADM) line systems.

### DP04QSDD-HE0/DP04QSDD-HE0-A1 Transponder and Muxponder Configuration Values

This table lists the possible Transponder and Muxponder configuration values for the DP04QSDD-HE0 and DP04QSDD-HE0-A1 optical modules.

Table 8: DP04QSDD-HE0/DP04QSDD-HE0-A1 Transponder and Muxponder Configuration Values

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate	MSA Support
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	1x1.5	400ZR
400G-TXP	1 client, 400G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1.5	OpenZR+
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	1x1.5	400ZR
4x100G-MXP	4 clients, 100G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1.5	OpenZR+
3x100G-MXP	3 clients, 100G speed	1 trunk, 300G speed	8 QAM	oFEC	1x1.25	
3x100G-MXP	3 clients, 100G speed	1 trunk, 300G speed	8 QAM	oFEC	1x1.5	OpenZR+
2x100G-MXP	2 clients, 100G speed	1 trunk, 200G speed	QPSK	oFEC	1x1.5	OpenZR+
2x100G-MXP	2 clients, 100G speed	1 trunk, 200G speed	8 QAM	oFEC	1x1.25	
2x100G-MXP	2 clients, 100G speed	1 trunk, 200G speed	16 QAM	oFEC	1x1.25	
1x100G-TXP	1 client, 100G speed	1 trunk, 100G speed	QPSK	oFEC	1x1.5	OpenZR+

- [Configuring Frequency, on page 12](#)
- [Configuring Chromatic Dispersion, on page 14](#)
- [Configuring Optical Transmit Power, on page 15](#)
- [Configuring Muxponder Mode, on page 18](#)
- [Configure 2x200G DACs with 2x200 Breakout, on page 20](#)
- [Configure 100G operating modes with 200G DAC, on page 22](#)
- [Configuring Modulation, on page 25](#)
- [Configuring DAC Rate, on page 27](#)
- [Configuring FEC, on page 29](#)
- [Configuring Loopback, on page 30](#)
- [Disable Auto-Squelching, on page 32](#)
- [Configuring Performance Monitoring, on page 34](#)

- [Configuring PM Parameters, on page 35](#)
- [Configuring Alarms Threshold, on page 39](#)
- [Configuring FEC Alarm Threshold, on page 41](#)
- [Enhanced SOP tolerance mode for ULH optics , on page 47](#)
- [Media Link-down PreFEC Degrade Enablement, on page 50](#)
- [Application select code provisioning, on page 53](#)
- [Alarms Troubleshooting, on page 59](#)

## 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: 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 = -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 9: 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

## 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 QDD-400G-ZR-S and QDD-400G-ZRP-S optical module has its own optical transmit (TX) power range. You can change the optical transmit (TX) power value based on the module capability. For "Transmitter specifications", see the [Cisco 400G Digital Coherent Optics QSFP-DD Optical Modules Data Sheet](#).

**Table 10: Optical Transmit Power Values**

Optical Module	Trunk Speed <sup>1,3</sup>	Optical Transmit Power (Tx) Shaping	Interval	Supported Range of Optical Transmit Power (Tx) Values (in units of 0.1dBm) <sup>2</sup>		
				Minimum Value	Maximum Value - Typical	Maximum Value - Worst Case
DP04QSDD-ULH	400G	Yes	1	depends on the appsel configuration	depends on the appsel configuration	depends on the appsel configuration
QDD-400G-ZR-S	400G	No	1	-150	-100	-100
QDD-400G-ZRP-S	400G	Yes	1	-150	-110	-130
	300G			-150	-104	-119
	200G			-150	-90	-105
	100G			-150	-59	-75
DP04QSDD-HE0, DP04QSDD-HE0-A1	400G	Yes	1	-100	20	10
	300G					
	200G					
	100G					

<sup>1</sup>. Release 7.3.15 supports 4x100G muxponder mode or trunk speed.

<sup>2</sup>. 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.

<sup>3</sup>. Release 7.3.2 and future releases support 3x100G, 2x100G, and 1x100G muxponder modes or trunk speed.

### 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: 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 = -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^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 = 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 QDD-400G-ZR-S and QDD-400G-ZRP-S optical modules in the 400G transponder mode.

Using the **breakout muxponder mode** command, you can configure muxponder mode on optics controllers. Based on the muxponder mode, you can choose the modulation.

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

- 4x100

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

- 4x100
- 3x100
- 2x100




---

**Note** Release 7.3.15 supports only 4x100 muxponder mode.

---

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

- [QDD-400G-ZR-S Transponder and Muxponder Configuration Values, on page 9](#)
- [QDD-400G-ZRP-S Transponder and Muxponder Configuration Values, on page 10](#)

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/IP** 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/IP** 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
```

## Configure 2x200G DACs with 2x200 Breakout

The 2x200G DAC Cable with 2x200G Breakout CLI feature allows you to manually configure 2x200G breakout interfaces when using 2x200G modules.

**Table 11: Feature History Table**

Feature Name	Release Information	Feature Description
Configure 2x200G DACs with 2x200 Breakout	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*)  *This feature is supported on the Cisco 8011-32Y8L2H2FH routers.

Feature Name	Release Information	Feature Description
Configure 2x200G DACs with 2x200 Breakout	Release 25.2.1	<p>Introduced in this release on: Fixed Systems (8200 [ASIC: Q200](select variants only*), Modular Systems (8800 [LC ASIC: Q200]) (select variants only*)</p> <p>This feature enables support for configuring 2x200G DAC (Direct Attach Copper) cables with a 2x200G breakout. It addresses the issue where certain 2x200G DAC cables are incorrectly detected as 400G cables and allows you to explicitly configure the 2x200G breakout using the CLI (Command-Line Interface).</p> <p>*The feature is supported on:</p> <ul style="list-style-type: none"> <li>• 88-LC0-36FH</li> <li>• 88-LC0-36FH-M</li> <li>• 8201-32FH</li> <li>• 8202-32FH-M</li> </ul> <p>This feature introduces these changes:</p> <p>CLI:</p> <p>The <b>breakout</b> keyword is enhanced to include 2x200 option in the <a href="#">controller optics</a> command</p>

The 2x200G DAC Cable with 2x200G Breakout feature allows you to manually configure 2x200G breakout interfaces when using 2x200G modules. By default, the system might detect these modules as 400G and create 400G interfaces. This feature provides a CLI command to explicitly set the breakout configuration to 2x200G, creating the correct interfaces. The CLI command is implemented under the existing [controller optics](#) command.



**Note** Starting from Cisco IOS XR Release 25.2.1, the 2x200 implicit breakout is deprecated. To operate 2x200G modules in 2x200 mode, you must explicitly apply the breakout configuration.

## Configuring 2x200G DACs with 2x200 Breakout

### Before you begin

- Associated line cards should be operational.

- Supported 2x200G modules should be inserted.

### Procedure

---

**Step 1** Configure 2x200G DAC with 2x200G breakout.

**Example:**

This example shows how to configure 2x200G DAC with 2x200G breakout.

**Example:**

```
Router#configure
Router(config)#controller optics 0/0/1/1
Router(config-if)# breakout 2x200
Router(config-if)#commit
```

**Step 2** Configure autonegotiation on the connected interfaces.

You must enable auto negotiation on the connected interfaces after applying the 2x200G breakout configuration for the DACs.

**Example:**

```
Router#configure
Router(config)#interface TwoHundredGigE 0/0/1/1/0
Router(config-if)# negotiation auto
Router(config-if)#commit
```

---

## Configure 100G operating modes with 200G DAC

The configuration of 100G operating modes with 200G DAC is a process that

- allows devices to operate at various speeds and lane combinations, and

- provides high-bandwidth links between networking devices using 200G QSFP56 DAC and 4x100 DAC.

**Table 12: Feature History Table**

Feature Name	Release Information	Feature Description
Configure 100G operating modes with 200G DAC	Release 25.3.1	<p>Introduced in this release on: Fixed Systems (8010 [ASIC: A100], 8200 [ASIC: Q200]) (select variants only*)</p> <p>The feature addresses the need for flexible speed configuration, particularly for connecting to custom servers that support specific speed and lane modes, and to prevent alarms when optics with different speeds are inserted.</p> <p>You will have 100G operating modes with 200G QSFP56 DAC, that allows to configure multi-rate optics and passive copper cables to operate at various speeds and lane combinations.</p> <p>*This feature is supported on:</p> <ul style="list-style-type: none"> <li>• 8201-32FH</li> <li>• 8101-32FH</li> </ul> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <b>speed</b> keyword is included along with the 100G [ <i>host-lanes</i> &lt; 4 / 2 &gt; ] option in the <b>controller optics</b> command.</p>

**Flexible 100G modes configuration for 200G DAC**

The configuration for 100G operating modes with 200G DAC feature allows you to manually configure the speed of the port as 100G when using 200G DAC modules. This feature provides a CLI command to explicitly set the speed configuration to 100G operating modes and optionally specify the number of host lanes. The CLI command is implemented under the existing **controller optics** command which allows users to configure the speed of a port and optionally specify the number of host lanes.

### Benefits of the 100G modes in 200G DAC

- Allows the users to use the same 200G QSFP56 DAC for different speeds based on the speed support of peer device. This means a single cable type can serve multiple connectivity needs, reducing the variety of hardware required.
- The feature allows setting the unused port to a speed that suits the system, even if a different speed optics is inserted, thereby avoiding false alarms and streamlining operations.

## Configure 100G operational modes with 200G and 4x100 DAC

### Procedure

**Step 1** Configure 100G operational modes with 200G and 4x100 DAC.

#### Example:

This example shows how to configure the speed of port as 100G with host lane valuse as 2. The supported host lanes for 100G speed are 2 and 4.

#### Example:

```
Router#configure
      Router(config)#controller optics 0/0/0/0
      Router(config-Optics)# speed 100g host-lanes 2
      Router(config-Optics)#commit
```

**Step 2** Run the **show running-config controller optics** CLI command to verify the running configuration of the speed port.

#### Example:

```
Router#show running-config controller optics 0/0/0/0
Thu Aug 14 01:16:52.946 UTC
controller Optics0/0/0/0
  speed 100g host-lanes 2
```

**Step 3** *Optional:* Run the **show configuration failed** CLI command to verify if the speed port configuration is failed.

#### Example:

This example shows the failure scenario, when the breakout is configured on the same port.

```
Router#show config failed
Tue Oct 29 13:07:55.478 UTC
!! SEMANTIC ERRORS: This configuration was rejected by
!! the system due to semantic errors. The individual
!! errors with each failed configuration command can be
!! found below.

Controller Optics0/0/0/0
  speed 100g host-lanes 2
!!% Breakout is configured on this port, please remove breakout configuration before apply port speed
  configuration
!
end
```

#### Example:

This example shows the failure scenario, when the unsupported host lanes are configured.

```

Router# :ios(config)#show config failed
Tue Oct 29 13:07:55.478 UTC
!! SEMANTIC ERRORS: This configuration was rejected by
!! the system due to semantic errors. The individual
!! errors with each failed configuration command can be
!! found below.

controller Optics0/0/0/0
  speed 100g host-lanes 3
!!% The list of supported host lanes for speed 100g is 2, 4
!
end

```

**Note**

After the CLI is verified, the alarm is raised when the optics is present and optics driver cannot configure the optics in such speed or host lanes:

```

Router# :Oct 29 12:25:42.808 UTC: optics_driver[274]: %PKT_INFRA-FM-3-
FAULT_MAJOR : ALARM_MAJOR : MODULE AND SPEED CONFIG MISMATCH :DECLARE
:0/RP0/CPU0: Optics0/0/0/18

```

If you remove the module, the alarm is cleared. Similarly, when a new module is inserted, the same alarm is triggered if the module does not support the configured speed.

---

## 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:

- [QDD-400G-ZR-S Transponder and Muxponder Configuration Values, on page 9](#)
- [QDD-400G-ZRP-S Transponder and Muxponder Configuration Values, on page 10](#)

**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
  WV-L-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 and DP04QSDD-HE optical module.



**Note** QDD-400G-ZR-S supports 1x1 dac-rate in cFEC mode. QDD-400G-ZRP-S and DP04QSDD-HE supports 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
  WV-LOL = 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 = 59.843750000 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 and DP04QSDD-HE optical module. 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 and DP04QSDD-HE supports 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 media loopback and host loopback on optics controllers. Loopback can be performed only in the maintenance mode.



**Note** Line loopback mode is supported only on Cisco 8000 series line cards and fixed-port routers based on Q100 and Q200 silicon.

### Loopback Configuration Example

This example shows how to enable loopback configuration on optics controllers.

Use `show controllers optics R/S/I/P information loopback` command to check the supported loopback types.

```

Router#show controllers optics 0/0/0/4 information loopback
Supported Loopback Types :
=====

```

```

[1.] Media Line
[2.] Host Internal

```

```

Unsupported Loopback Types :
=====

```

```

[1.] Media Internal
[2.] Host Line
[3.] Host Per Lane
[4.] Media Per Lane
[5.] Simultaneous Media Host
Media Configured Loopback : Media Loopback None
Media Applied Loopback    : Media Loopback None

```

```

Host Configured Loopback : Host Loopback None
Host Applied Loopback    : Host Loopback None

```

Use `loopback` and `host loopback` commands in `config-optics` sub mode to configure the media and host loopback modes respectively. Loopback mode for both media and host can be configured to either internal or line, depending on the supported loopback types.

```

Router#config
Router(config)#controller optics 0/0/0/4
Router(config-Optics)#sec-admin-state maintenance
Router(config-Optics)#loopback line /* configures the media loopback to line */

```

```
Router(config-Optics)#host loopback internal /* configures the host loopback to internal
*/
Router(config-Optics)#commit
```

### Running Configuration

This example shows the running configuration on optics controllers.

```
Router#show run controller optics 0/0/0/4
Thu May 13 19:51:08.175 UTC
controller Optics0/0/0/4
  loopback line
  host loopback internal
  sec-admin-state maintenance
!
```

### Verification

This example shows how to verify the loopback configuration on optics controllers.

```
Router#show controllers optics 0/0/0/4
Controller State: Up
Transport Admin State: In Service
Laser State: On
Host Squelch Status: Enable
Media linkdown preFEC degrade : Disabled
LED State: Yellow
FEC State: FEC ENABLED
Power Mode: High
Dom Data Status: Ready
Last link flapped: 00:02:32
Optics Status
  Optics Type: QSPDD 400G ZR
  DWDM carrier Info: C BAND, MSA ITU Channel=1, Frequency=196.10THz,
  Wavelength=1528.773nm
  Loopback Host : Internal
  Loopback Media : Line

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

  LOS/LOL/Fault Status:
  ...

Router#show controllers optics 0/0/0/4 information loopback
Supported Loopback Types :
=====
[1.] Media Line
[2.] Host Internal

Unsupported Loopback Types :
=====

[1.] Media Internal
[2.] Host Line
[3.] Host Per Lane
[4.] Media Per Lane
[5.] Simultaneous Media Host
Media Configured Loopback : Media Loopback Line
Media Applied Loopback   : Media Loopback Line

Host Configured Loopback : Host Loopback Internal
Host Applied Loopback   : Host Loopback Internal
```

# Disable Auto-Squelching

Table 13: Feature History Table

Feature Name	Release Information	Description
Disable Auto-Squelching	Release 25.1.1	<p>Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*)</p> <p>*This feature is supported on:</p> <ul style="list-style-type: none"> <li>• 8712-MOD-M</li> <li>• 8011-4G24Y4H-I</li> </ul>
Disable Auto-Squelching	Release 24.4.1	<p>Introduced in this release on: Fixed Systems (8200 [ASIC: P100], 8700 [ASIC: P100])(select variants only*); Modular Systems (8800 [LC ASIC: P100])(select variants only*)</p> <p>*This feature is now supported on:</p> <ul style="list-style-type: none"> <li>• 8212-48FH-M</li> <li>• 8711-32FH-M</li> <li>• 88-LC1-12TH24FH-E</li> <li>• 88-LC1-36EH+A8:B12</li> <li>• 88-LC1-52Y8H-EM</li> </ul>

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 added.</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#config
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

Feature Name	Release Information	Description
New Parameters for Performance Monitoring	Release 24.2.11	<p>In this release, we've added two new parameters for performance monitoring. These parameters allow you to check the quality of electrical signals between an ASIC or NPU and the 400G Digital Coherent QSFP-DD optical modules periodically. This helps to detect errors occurring during data transmission and link initialization.</p> <p>This feature introduces new parameters <b>Host-Intf-{n}-FEC-BER</b> and <b>Host-Intf-{n}-FEC-FERC</b> in the <a href="#">show controllers coherentdsp</a> command.</p>

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.

Release 24.2.11 introduces the following host PM parameters:

- **Host-Intf-{n}-FEC-BER**
- **Host-Intf-{n}-FEC-FERC**

The following table lists the details of the host PM parameters:

Table 14: Performance Monitoring Parameters

PM Parameter	Mode Type	Number of Host Interfaces	Description
<b>Host-Intf-{n}-FEC-BER</b>	Transponder	1	$n=0$ For example, Host-Intf-0-FEC-BER
	Muxponder	4	$n = 0, 1, 2, \text{ and } 3.$ For example: <ul style="list-style-type: none"> <li>• Host-Intf-0-FEC-BER</li> <li>• Host-Intf-1-FEC-BER</li> <li>• Host-Intf-2-FEC-BER</li> <li>• Host-Intf-3-FEC-BER</li> </ul>
<b>Host-Intf-{n}-FEC-FERC</b>	Transponder	1	$n=0$ For example, Host-Intf-0-FEC-FERC
	Muxponder	4	$n = 0, 1, 2, \text{ and } 3$ For example: <ul style="list-style-type: none"> <li>• Host-Intf-0-FEC-FERC</li> <li>• Host-Intf-1-FEC-FERC</li> <li>• Host-Intf-2-FEC-FERC</li> <li>• Host-Intf-3-FEC-FERC</li> </ul>

These parameters check the quality of electrical signals between an ASIC or NPU and the 400G Digital Coherent QSFP-DD optical modules. The Cisco IOS XR software installed on the router collects Bit Error Rate (BER) and Frame Error Counters (FERC) information from the optical modules and maintains history for 30-sec, 15-minute, and 24-hours intervals.



**Note** You can check these signals for host interfaces in both transponder and muxponder mode.

## 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 15: PM Thresholds and TCA Report Status for Optics Controllers**

<b>PM Parameters</b>	<b>Description</b>
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.
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 16: PM Thresholds TCA Report Status for Coherent DSP Controllers**

<b>PM Parameters</b>	<b>Description</b>
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.

PM Parameters	Description
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.
Host-Intf-0-FEC-BER	Sets the Host-Intf-0-FEC-BER threshold or TCA reporting status, where: <ul style="list-style-type: none"> <li>• AVG - specifies the number of corrected bits received from the host interface prior to a PM interval.</li> <li>• MIN - specifies the minimum number of corrected bits received from the host interface over a sub-interval and prior to a PM interval.</li> <li>• MAX - specifies the maximum number of corrected bits received from the host interface over a sub-interval and prior to a PM interval.</li> </ul>
Host-Intf-0-FEC-FERC	Sets the Host-Intf-0-FEC-FERC threshold or TCA reporting status, where: <ul style="list-style-type: none"> <li>• AVG - specifies the number of frames received from the host interface during a sub-interval.</li> <li>• MIN - specifies the minimum number of frames received from the host interface with uncorrected errors over a sub-interval and prior to a PM interval.</li> <li>• MAX - specifies the maximum number of frames received from the host interface with uncorrected errors over a sub-interval and prior to a PM interval.</li> </ul>

### 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 Configured	AVG TCA	MAX	Operational	Configured Threshold (min)	TCA (min)	Operational Threshold (max)
LBC[mA]	: 0.0 NA	0.0 NO	0.0	0.0	NA	NO	100.0
OPT[dBm]	: -9.98 NA	-9.98 NO	-9.98	-15.09	NA	NO	0.00
OPR[dBm]	: -40.00 NA	-40.00 NO	-40.00	-30.00	NA	NO	8.00
CD[ps/nm]	: 0 100	0 NO	0	-80000	-100	NO	100
DGD[ps]	: 0.00 NA	0.00 NO	0.00	0.00	NA	NO	80.00
SOPMD[ps^2]	: 0.00 NA	0.00 NO	0.00	0.00	NA	NO	2000.00
OSNR[dB]	: 0.00 NA	0.00 NO	0.00	0.00	NA	NO	40.00
PDL[dB]	: 0.00 NA	0.00 NO	0.00	0.00	NA	NO	7.00
PCR[rad/s]	: 0.00 NA	0.00 NO	0.00	0.00	NA	NO	2500000.00
RX_SIG[dBm]	: -40.00 NA	-40.00 NO	-40.00	-30.00	NA	NO	1.00
FREQ_OFF[Mhz]	: 0 NA	0 NO	0	-3600	NA	NO	3600
SNR[dB]	: 0.00 NA	0.00 NO	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 17: 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
    
```

## Configuring FEC Alarm Threshold

Table 18: Feature History Table

Feature Name	Release Information	Description
Configurable FDD and FED Alarm Threshold Values	Release 25.1.1	<p>Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*)</p> <p>*This feature is supported on:</p> <ul style="list-style-type: none"> <li>• 8712-MOD-M</li> <li>• 8011-4G24Y4H-I</li> </ul>

Feature Name	Release Information	Description
Configurable FDD and FED Alarm Threshold Values	Release 24.4.1	<p>Introduced in this release on: Fixed Systems (8200 [ASIC: P100], 8700 [ASIC: P100])(select variants only*); Modular Systems (8800 [LC ASIC: P100])(select variants only*)</p> <p>*This feature is now supported on:</p> <ul style="list-style-type: none"> <li>• 8212-48FH-M</li> <li>• 8711-32FH-M</li> <li>• 88-LC1-12TH24FH-E</li> <li>• 88-LC1-36EH+A8:B12</li> <li>• 88-LC1-52Y8H-EM</li> </ul>

Feature Name	Release Information	Description
Configurable FDD and FED Alarm Threshold Values	Release 24.1.1	

Feature Name	Release Information	Description
		<p>We now ensure that you have accurate data to initiate proactive maintenance for non-critical FEC errors or take prompt action to prevent potential optical link data loss in your network. This is made possible because we've enabled the configuration of FEC (Forward Error Correction) Detected Degrade (FDD) alarm threshold values for non-critical FEC errors and FEC Excessive Degrade (FED) alarm threshold values for critical FEC errors. You can configure or clear these values for QDD-400G-ZR, QDD-400G-ZRP, and DP04QSDD-HE0 optical modules.</p> <p>Prior to this release, the router would automatically generate FEC alarms based on default threshold values.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>Modified the <a href="#">controller optics</a> command by adding the following keywords:</p> <ul style="list-style-type: none"> <li>• <b>host fec-threshold excess-degrade raise</b></li> <li>• <b>media fec-threshold excess-degrade raise</b></li> <li>• <b>host fec-threshold excess-degrade clear</b></li> <li>• <b>media fec-threshold excess-degrade clear</b></li> <li>• <b>host fec-threshold detected-degrade raise</b></li> <li>• <b>media fec-threshold detected-degrade raise</b></li> <li>• <b>host fec-threshold detected-degrade clear</b></li> <li>• <b>media fec-threshold detected-degrade clear</b></li> </ul>

Feature Name	Release Information	Description
		<p>The <b>fec-thresholds</b> keyword is added to the <a href="#">show controller optics</a> command.</p> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPaths for <ul style="list-style-type: none"> <li>Cisco-IOS-XR-controller-optics-oper.yang</li> <li>Cisco-IOS-XR-controller-optics-fec-thresholds.yang</li> </ul> </li> </ul>

Forward Error Correction (FEC) is used to control errors during data transmission. FEC works by adding data redundancy to the transmitted message. This redundancy allows the receiver to detect and correct a limited number of errors occurring anywhere in the message, instead of the transmitter resending the entire message. For additional information on FEC, see [Understanding FEC and Its Implementation](#).

There are two types of FEC alarms:

- **FEC Detected Degrade (FDD) alarm:** The FDD alarm is raised when the link degradation is within the permissible limit and does not cause traffic disruption. This alarm indicates the system is working harder than usual to maintain data transmission. Link degradation could be due to issues in the cable, network congestion, or other hardware failure.
- **FEC Excessive Degrade (FED) alarm:** The FED alarm is raised when the link degradation exceeds beyond the permissible limit and causes traffic disruption. This alarm indicates the system is working harder than usual to maintain data transmission. Without corrective measures, network performance deteriorates further and eventually results in traffic loss. Link degradation could be due to issues in the cable, network congestion, or other hardware failure.

The FEC alarms threshold values can now be configured to control alarms (raise and clear FEC alarms) on both media and host side of the optical transceiver. The optical transceiver is divided into two sides, the host side, which is positioned towards the router, and the media side, which is positioned towards the wire or cable media.

When the average bit error rate (BER) exceeds the **raise threshold value**, the FEC alarm is raised (or asserted). Similarly, when the BER drops below the **clear threshold value**, then the alarm is cleared (or de-asserted).

## Guidelines and Restrictions for Setting the FEC Alarm Thresholds

- The **raise threshold value** must always be greater than the **clear threshold value** for both FDD and FED alarms.
- The **raise** or **clear threshold value** of FED alarm must always be greater than the **raise** or **clear threshold value** of the FDD alarm.
- While the router configuration permits a range of 1 to 18446744073709551615, the router only supports a range of 1 to 204600000000000000. The threshold value provided by users is converted from a 64 bit number to a 16 bit number. As a result, there is minor variation between the user provided value (configured value) and the programmed value. The user input (threshold value) is appended with exponents relative to E-18.

Table 19:

Configured Value	Programmed Value (Displayed using the Show CLI command)	Pattern	
1, 2, 3, .....,10	0, 1, 2,.....,9	1<ConfiguredValue< 10, show command value = ConfiguredValue - 1	1->>>0.9999, displayed as 0 and so on
11,12,13,.....,99	1.0, 1.1, 1.2,...9.8	10<ConfiguredValue<99, show command value = ConfiguredValue - 0.1	
111,222,333...999	1.10, 2.21, 3.32	100<ConfiguredValue<999, show command value = ConfiguredValue - 0.01	
1111,1112,1113 upto 2047	1.110, 1.111, 1.112...	1000<ConfiguredValue< 2047 show command value = ConfiguredValue - 0.001	
2050, 12345, 23456,65432,...	2.0500, 1.2300, 2.3400,6.5400...	2047<ConfiguredValue<maximum- range show command value = first 3 digits appended by 0s	

## Configuration Examples to Set FEC Alarm Threshold

Examples to configure FEC alarm threshold:

- [Configuring FED Alarm Thresholds, on page 47](#)
- [Configuring FDD Alarm Thresholds, on page 46](#)

### Configuring FDD Alarm Thresholds

#### FDD Configuration Example

This example shows how to set FDD clear and raise alarm thresholds on the optics controller:

```
Router#config
Router(config)#controller optics 0/0/0/10
Router(config-Optics)#host fec-threshold detected-degrade clear 12000
Router(config-Optics)#host fec-threshold detected-degrade raise 22000
Router(config-Optics)#commit
Router(config-Optics)#end
```

#### Running Configuration

This example shows the running configuration on the optics controller:

```
Router#show running-config controller optics 0/0/0/10
Sat Feb 3 06:01:56.354 UTC
controller Optics0/0/0/10
host fec-threshold detected-degrade raise 22000
host fec-threshold detected-degrade clear 12000
!
!
```

### Verification

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

```
Router#show controller optics 0/0/0/10 fec-thresholds
FEC Threshold Information
```

	Raise	Clear
Media FEC excess degrade	1.2600E-02	1.2100E-02
Media FEC detected degrade	1.1700E-02	1.1300E-02
Host FEC excess degrade	2.4000E-02	2.4000E-03
<b>Host FEC detected degrade</b>	<b>2.2000E-14</b>	<b>1.1989E-14</b>

## Configuring FED Alarm Thresholds

### FED Configuration Example

This example shows how to set FED raise and clear alarm thresholds on the optics controller:

```
Router#config
Router(config)#controller optics 0/0/0/12
Router(config-Optics)#host fec-threshold excess-degrade clear 14000
Router(config-Optics)#host fec-threshold excess-degrade raise 24000
Router(config-Optics)#commit
Router(config-Optics)#end
```

### Running Configuration

This example shows the running configuration on the optics controller:

```
Router#show running-config controller optics 0/0/0/12
Sat Feb 3 06:02:00.153 UTC
controller Optics0/0/0/12
host fec-threshold excess-degrade raise 24000
host fec-threshold excess-degrade clear 14000
!
```

### Verification

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

```
Router#show controller optics 0/0/0/12 fec-thresholds
FEC Threshold Information
```

	Raise	Clear
Media FEC excess degrade	1.2600E-02	1.2100E-02
Media FEC detected degrade	1.1700E-02	1.1300E-02
<b>Host FEC excess degrade</b>	<b>2.3900E-14</b>	<b>1.3999E-14</b>
Host FEC detected degrade	9.0000E-03	9.0000E-04

## Enhanced SOP tolerance mode for ULH optics

An enhanced SOP tolerance mode is an optical module feature that

- increases resilience to rapid state of polarization (SOP) fluctuations,

- enables stable ultra long-haul (ULH) coherent signal transmission over challenging fiber environments, and
- actively compensates for polarization impairments using advanced DSP techniques.

Table 20: Feature History Table

Feature Name	Release info	Description
Enhanced SOP support for ULH optics	Release 25.2.1	<p>Introduced in this release on: Modular Systems (8800 [LC ASIC: Q100, Q200, P100])(select variants only*)</p> <p>This feature helps to improve the coherent optics' ability to handle fluctuations in the light's State of Polarization (SOP). It achieves this by enhancing the Digital Signal Processing (DSP) to track and compensate for rapid SOP rotation. The capability ultimately ensures more reliable data transmission, maintains high signal quality, and increases network stability, especially in long-distance and dynamic optical deployments.</p> <p>This feature is applicable on:</p> <ul style="list-style-type: none"> <li>• 88-LC0-36FH</li> <li>• 88-LC0-36FH-M</li> </ul> <p>CLI:</p> <p>The <b>enh-sop-tol-mode</b> keyword is added to the <b>controller optics</b> command.</p>

## Benefits of SOP tolerance mode for ULH optics

Enhanced SOP tolerance mode provides several benefits.

- Improved performance: Digitally compensates for dynamic SOP changes to maintain high signal quality and network stability in challenging fiber conditions.
- Increased robustness: Offers greater resilience to polarization-related impairments, especially crucial for long-haul and subsea optical deployments.

### Supported hardware variants

Enhanced SOP tolerance mode is supported on these line cards:

- 88-LC0-36FH
- 88-LC0-36FH-M

## Configure enhanced SOP tolerance mode

Enable enhanced SOP tolerance mode on a coherent optics controller to improve performance under polarization fluctuations. By default, the enhanced SOP tolerance mode is disabled.

Use this task when optical signal quality is affected by polarization changes and enhanced tolerance is required.

### Procedure

**Step 1** Enable enhanced SOP tolerance mode.

#### Example:

```
Router# config
Router(config)# controller optics 0/0/0/14
Router(config-Optics)# enh-sop-tol-mode 1
Router(config-Optics)# commit
```

The possible values for enhanced SOP tolerance mode are *1* or *no enh-sop-tol-mode*.

**Step 2** Verify that enhanced SOP tolerance mode is enabled.

#### Example:

```
Router# show run 0/0/0/14
!! Building configuration...
!! IOS XR Configuration 25.2.2.09I
!! Last configuration change at Mon Jul 28 18:56:00 2025 by cisco
!
hostname abc
username cisco
  group root-lr
  group cisco-support
  secret 10
$6$g8TGE1mb2o7/BE1.$X1wz3z0fTKp6E0utoKvS6H4CFT0B0mM8PGt6M5Mndzrjnm/gJk.NwgOf5n3SZm2.qaPeRrZar7VQTtNnT16b1
!
line console
  exec-timeout 0 0
!
interface MgmtEth0/RP0/CPU0/0
  ipv4 address dhcp
!
controller Optics0/0/0/14
  enh-sop-tol-mode 1
!
interface FourHundredGigE0/0/0/0
  description AOC
  shutdown
```

# Media Link-down PreFEC Degrade Enablement

Table 21: Feature History Table

Feature Name	Release Information	Description
Media Link-down PreFEC Degrade Enablement	Release 25.1.1	<p>Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*)</p> <p>*This feature is supported on:</p> <ul style="list-style-type: none"> <li>• 8712-MOD-M</li> <li>• 8011-4G24Y4H-I</li> </ul>
Media Link-down PreFEC Degrade Enablement	Release 24.3.1	<p>Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100]); Centralized Systems (8600 [ASIC: Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100])</p> <p>The Media Link-down PreFEC Degrade functionality can be used to protect the media side of the optical transceiver during transmission errors.</p> <p>By using this feature, you can proactively switch the traffic to standby path when the BER counter crosses the threshold value. This feature helps to avoid further traffic impact when the optical network reaches more noise or error.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>Modified the <code>controller optics</code> command by adding the <code>media link-down prefec-degrade</code> keyword.</p> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPaths for <code>Cisco-IOS-XR-controller-optics-oper.yang</code></li> <li>• New XPaths for <code>Cisco-IOS-XR-um-cont-optics-fec-threshold-cfg.yang</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>

The Media Link-down PreFEC Degrade functionality can be used to protect the media side of the optical transceiver during transmission errors, such as errors due to noise, or data transmission errors. This feature is disabled by default. You can enable this feature by using the `media link-down prefec-degrade` command.

## Prerequisites for using Media Link-down PreFEC Degrade Functionality

To use the Media Link-down PreFEC Degrade functionality, you must configure the FEC Alarm Threshold. For information on configuring FEC alarms threshold, see [Configuring FEC Alarm Threshold](#).

### About Media Link-down PreFEC Degrade Functionality

Prior to this release, the FEC Alarm Threshold functionality enabled you to configure the FEC alarms threshold values to control alarms (raise and clear FEC alarms) on media and host side of the optical transceiver. Using the FEC Alarm Threshold functionality, you can configure the FDD and FED alarm threshold values and set the **raise threshold value** and **clear threshold value** values to control alarms.

After you configure FEC Alarm Threshold and enable Media Link-down PreFEC Degrade functionality, you get the alarm notification when the average bit error rate (BER) exceeds the threshold value. This triggers link-down and enables switchover functionality automatically. The traffic is switched to standby path, and remains in the standby path until the alarm is cleared or based on the settings done by the network operator.



**Note** In Cisco IOS XR Release 24.3.1, the Link-down PreFEC Degrade feature is supported only on the media side of the optical transceiver.

## Configure Media Link-down PreFEC Degrade

The purpose of this task is to enable the media link-down preFEC degrade functionality to proactively switch the traffic to standby path.

### Procedure

**Step 1** Execute the **media link-down prefec-degrade** command to configure link-down preFEC degrade on the media side of the optics controller.

#### Example:

```
Router#config
Router(config)#controller optics 0/2/0/16
Router(config-Optics)#media link-down prefec-degrade
Router(config-Optics)#commit
```

**Step 2** Execute the **show running-config controller optics R/S/I/P** command to view the running configuration on the optics controller.

#### Example:

```
Router#show running-config controller optics 0/2/0/16
Thu May 13 20:18:55.957 UTC
controller Optics0/2/0/16
  media link-down prefec-degrade
!
```

**Step 3** Execute the **show controller optics R/S/I/P** command to verify link-down preFEC degrade feature on optics controllers.

#### Example:

```
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: On
Media linkdown prefec degrade : Enabled
LED State: Green
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  
 WV-LOL = 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<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 = 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

!

## Application select code provisioning

Application select code, also known as AppSel code, is a feature that:

- allows the host device to choose the operating mode of a QDD module
- allows you to configure the media code, and
- specifies how to configure the optical side of a module.

**Table 22: Feature History Table**

Feature Name	Release Information	Feature Description
Application select code provisioning	Release 25.2.1	<p>You can now configure application select codes directly on a QDD module by using a CLI. This simplifies provisioning by allowing the selection of advertised application modes such as 400ZR, OpenZR+ and others. The router activates the selected code to ensure compatibility and reduce configuration complexity.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>appsel simple code</b> keyword is introduced in the <a href="#">Controller optics</a> command.</li> <li>• The <b>appsel</b> keyword is introduced in the <a href="#">Show controller optics</a> command.</li> </ul>

The Common Management Interface Specification (CMIS) specifications set rules for how QDD modules work and how a host device sets them up. CMIS provides a consistent way for host devices, such as routers or switches, to communicate with and control optical modules, regardless of the module manufacturer.

Each QDD module can work in different modes, and these modes are identified by a special code called an AppSel code. This code acts like a unique ID for each mode. Each mode has an application descriptor, which explains how the module handles data. It describes how signals are processed between the connections on the host side and the optical side. The optical side is also known as the media side of the module. The AppSel code also includes a media code, which tells the module how to set up its optical side. The host software uses

this media code to control the module's optical interface. The host software also sets up other components, like the physical layer (PHY), SerDes, and MacPort, to complete the data path.

Modules store a list of the AppSel codes they support in their EEPROM memory. This helps the host system or device know which settings the module can use. Some codes, like 400G-OIF-ZR and 400G-OpenZR+, are standard and follow industry rules. Other codes are custom, made by third-party vendors to give users more options with one module. However, these custom codes can cause problems. For example, Cisco routers may not work well with modules using custom codes if the host system doesn't recognize them.

This feature allows users to select application modes advertised by the optical module. You can choose all application modes a module supports.

AppSel supports operation modes based on these parameters:

- Data rate, such as 100GbE or 400GbE
- Signal type
- Signal processing between host side and media side
- Optical configuration, based on the media code, which is part of the AppSel code.

### Benefits of AppSel code provisioning

These are the benefits of provisioning AppSel code:

- Enables you to choose any application mode supported by the optical module for greater flexibility.
- Enables direct configuration of the NPU, PHY, and optics to match the selected application's datapath.
- Removes the need for Cisco IOS XR software to implement new proprietary modes for each vendor, simplifying software requirements.
- Allows you to directly specify the desired AppSel code, enabling straightforward configuration without requiring Cisco IOS XR software to interpret the mode.
- Eliminates the extra step of mapping custom vendor codes, reducing delays in supporting new module vendors.

## Configuration guidelines and restrictions for AppSel code provisioning

### Configuration guidelines for AppSel code provisioning

These configurations apply for AppSel code provisioning:

- This feature is not enabled by default. You must configure it to take effect.
- If you configure a non-default application ID and later remove the configuration, the selected application ID falls back to the default.
- If you configure a non-default application ID and later overwrite it with an invalid application ID, the selected application ID falls back to default. The system raises an alarm indicating the invalid configuration.
- The maximum number of applications supported depends upon the module as advertised in the AppSel list.

## Restrictions for AppSel code provisioning

These restrictions apply to AppSel code provisioning:

- The Cisco 8000 series routers do not support In Service Software Upgrade (ISSU) or In Service Software Downgrade (ISSD).
- Optical Transport Network (OTN) is not supported.

## How AppSel code provisioning works

The key components that are involved in the AppSel code provisioning are:

- **Optical side:** The optical side or the media side refers to the part of a pluggable module, such as a QDD or other optical transceiver that connects to and communicates with the optical network. It is the interface responsible for converting electrical signals, from the host device, into optical signals for transmission over fiber optic cables, and vice versa for receiving signals.
- **Host side:** The host side refers to the part of a pluggable module, such as a QDD or other optical transceiver that interfaces with the host device. A host device is typically a network device like a router, switch, or server. It is responsible for handling and processing electrical signals exchanged between the module and the host device.
- **Optics Driver:** The entity that collects all supported application codes from the module. Users can see all supported application codes and select any one of the supported application codes. The optics driver programs the valid application code to the module.
- **Application Codes:** The unique codes that represent operational modes of the optical module.
- **Optics Management Agent (MA):** The entity that sends the default configuration to the optics driver if no user configuration is provided. It also manages fallback behavior when no application code is selected.

### Workflow

These stages describe how AppSel code provisioning process works.

1. AppSel code identifies the optical module modes when the modules are plugged into a router.
2. AppSel code points to application descriptor. In this stage, the AppSel code acts as a sequence number for an application descriptor.
3. The application descriptor defines the configuration. In this stage, the application descriptor describes a functional transmission configuration, including signal processing between host lanes and media lanes.
4. The AppSel code that contains the media code configure the media side of the optical module.
5. The router software or the host software applies the media code to configure the optical interface of the optical module.
6. Based on the module's host side interface, you can configure PHY, NPU SerDes, and MacPort.
7. The host side and media side configurations complete, establishing the datapath.

**Result**

The router enables AppSel code provisioning as the datapath is complete between the host side and media side. This ensures that the optical module operates correctly and efficiently in the desired mode, with proper coordination between the host side interface and the media side.

## Configure an AppSel code on an optical module

Configure the AppSel code to enable the optical module to operate in a specific application mode, such as 400ZR or OpenZR+.

AppSel codes are advertised by the module and must be validated before configuration. This ensures compatibility between the host and the module.

**Before you begin**

Ensure the router is running Cisco IOS XR Software Release 25.2.1 or later.

**Procedure**

**Step 1** Identify the AppSel code that needs to be configured on a particular port from the list of available appcodes.

**Example:**

```
Router# show controllers optics 0/0/0/0 appsel advertised
Router# show controllers optics 0/0/0/0 appsel detailed
```

**Step 2** Enter configuration mode on the router.

**Example:**

```
Router# conf
```

**Step 3** (Optional) Identify the controller optics interface and configure breakout to match with the AppSel code that you want to configure.

**Example:**

```
Router(config)# controller optics 0/0/0/0 breakout 4x100
```

**Step 4** Configure the AppSel code.

**Example:**

```
Router(config)# controller optics 0/0/0/0
appsel simple code 4
!
!
```

**Step 5** Verify the configuration.

**Example:**

```
Router# #show controllers optics 0/0/0/0 appsel advertised
```

```
Sun Feb  2 20:00:04.884 UTC
```

```
-----
App-ID | Host-ID | Media-ID | Standard |
Host   | Power  |          |          |
```

Supported	Consumption(W)						
1 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	62	OIF 400ZR, DWDM, amplifi	OIF		
2 Yes	13 n/a	ETH 100GAUI-2 C2M (Annex	62	OIF 400ZR, DWDM, amplifi	OIF		
3 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	70	OpenZR+ ZR400-OFEC-16QAM	OpenZR+		
4 Yes	13 n/a	ETH 100GAUI-2 C2M (Annex	70	OpenZR+ ZR400-OFEC-16QAM	OpenZR+		
5 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	199	0xC0-0xFE Vendor Specif	0xC0-0xFE		
6 Yes	15 n/a	ETH 200GAUI-4 C2M (Annex	199	0xC0-0xFE Vendor Specif	0xC0-0xFE		
7 Yes	13 n/a	ETH 100GAUI-2 C2M (Annex	199	0xC0-0xFE Vendor Specif	0xC0-0xFE		
8 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	196	0xC0-0xFE Vendor Specif	0xC0-0xFE		
9 Yes	15 n/a	ETH 200GAUI-4 C2M (Annex	196	0xC0-0xFE Vendor Specif	0xC0-0xFE		
10 Yes	13 n/a	ETH 100GAUI-2 C2M (Annex	196	0xC0-0xFE Vendor Specif	0xC0-0xFE		
11 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	200	0xC0-0xFE Vendor Specif	0xC0-0xFE		
12 Yes	15 n/a	ETH 200GAUI-4 C2M (Annex	200	0xC0-0xFE Vendor Specif	0xC0-0xFE		
13 Yes	13 n/a	ETH 100GAUI-2 C2M (Annex	200	0xC0-0xFE Vendor Specif	0xC0-0xFE		
14 Yes	17 n/a	ETH 400GAUI-8 C2M (Annex	83	OTN-ITU-T FOIC4.8-DO (G.	OTN-ITU-T		
15 Yes	254 n/a	0xC0-0xFE Vendor Specif	254	0xC0-0xFE Vendor Specif	0xC0-0xFE		

Router# show controllers optics 0/0/0/0 appsel detailed

Sun Feb 2 20:00:29.702 UTC

App-ID	Host-ID	Media-ID	Host Lane	Media Lane	Host Lane	Media Lane
Host			Count	Count	Assign	Assign
Supported						
1 Yes	17	62	8	1	1	1
2 Yes	13	62	2	1	85	1
3 Yes	17	70	8	1	1	1
4 Yes	13	70	2	1	85	1
5 Yes	17	199	8	1	1	1
6 Yes	15	199	4	1	17	1
7 Yes	13	199	2	1	85	1

Yes														
8		17		196		8		1		1		1		
Yes														
9		15		196		4		1		17		1		
Yes														
10		13		196		2		1		85		1		
Yes														
11		17		200		8		1		1		1		
Yes														
12		15		200		4		1		17		1		
Yes														
13		13		200		2		1		85		1		
Yes														
14		17		83		8		1		1		1		
Yes														
15		254		254		8		1		255		1		
Yes														

```
Router# show controllers optics 0/0/0/0 appsel active
```

```
Sun Feb 2 20:00:47.776 UTC
Instance      : 1
App-ID       : 3
Host-ID      : 17   ETH 400GAUI-8 C2M (Annex
Media-ID     : 70   OpenZR+ ZR400-OFEC-16QAM
Host Lane Count : 8
Media Lane Count : 1
Host Lane Assign : 0x1
Media Lane Assign : 0x1
```

The optical module operates in the selected application mode, ensuring compatibility and optimal performance.

### What to do next

- Monitor the interface status and confirm the active AppSel code.
- Ensure alarms are cleared, and the interface is operational.

# Alarms Troubleshooting

Table 23: Feature History Table

Feature Name	Release	Description
Enhanced Alarm Prioritization, Monitoring, and Management	Release 25.1.1	<p>Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*)</p> <p>*This feature is supported on:</p> <ul style="list-style-type: none"> <li>• 8712-MOD-M</li> <li>• 8011-4G24Y4H-I</li> </ul>
Enhanced Alarm Prioritization, Monitoring, and Management	Release 24.4.1	<p>Introduced in this release on: Fixed Systems (8200 [ASIC: P100], 8700 [ASIC: P100])(select variants only*); Modular Systems (8800 [LC ASIC: P100])(select variants only*)</p> <p>*This feature is now supported on:</p> <ul style="list-style-type: none"> <li>• 8212-48FH-M</li> <li>• 8711-32FH-M</li> <li>• 88-LC1-12TH24FH-E</li> <li>• 88-LC1-36EH+A8:B12</li> <li>• 88-LC1-52Y8H-EM</li> </ul>
Enhanced Alarm Prioritization, Monitoring, and Management	Release 24.1.1	<p>To improve alarm prioritization, precise monitoring, and streamlined management, ensuring a more efficient and responsive approach to network events, we have introduced the suppression of LOL (Loss of Line) alarms when the LOS-P (Loss of Signal-Payload) alarm is generated, the clearing of alarm static counters, and the suppression of warnings when the respective alarm is triggered.</p>

In this latest release, we bring forth advanced features to elevate your alarm management experience. The key highlights include:

- **LOL Alarm Suppression:** Prioritize the detection and handling of critical LOS-P (Loss of Signal-Payload) alarms by suppressing LOL (Loss of Line) alarms when LOS-P alarms are generated.

- **Clearing Static Counters:** Gain the ability to clear alarm static counters using the command `clear counters controller coherentDSP location`, facilitating focused monitoring within a specific time frame.
- **Warning Suppression:** Enhance your monitoring environment by suppressing warnings when the corresponding alarm is triggered, effectively preventing redundant or repetitive alerts.

These enhancements collectively contribute to improved alarm prioritization, precise monitoring, and streamlined management, ensuring a more efficient and responsive approach to network events.

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

---

- Step 1** 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.

**Step 2** 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

---

- Step 1** 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.

**Step 2** 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

---

**Step 1** Identify and correct the underlying cause of mis-alignment. The Flexo LOF (Loss of Frame) alarm is cleared

**Step 2** 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

Loss of lock (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

---

**Step 1** Identify and correct the underlying cause of mis-alignment. The Flexo LOM alarm is cleared when good

**Step 2** 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

---

**Step 1** Verify the value of the minimum acceptable OSNR value of Cisco 8000 using the show controller optics R/S/I/P command.

- Step 2** 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 to 4000 (in units of 01db).
- Step 3** If the value is within the range of the minimum acceptable OSNR, contact TAC .
- 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).

## UNC-WORD Alarm

Default Severity: Not Reported (NR), Not-Alarmed, 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

- Step 1** Ensure that the fiber connector for the card is completely plugged in.
- Step 2** Ensure that the ports on the far end and near end nodes have the same port rates and FEC settings.
- Step 3** 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.
- Step 4** 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.
- Step 7** Verify if the fiber is of single-mode type.
- Step 8** Clean the fiber connectors at both ends for a signal degrade.
- 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** 1 Verify the wavelength configuration.
- Step 2** 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).

---

Clear the WVL-00L Alarm