Optics and Hardware Configuration Guide for Cisco 8000 Series Routers

Cisco 8000 Series Routers
Updated June 16, 2026

Topics included

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1 What's changed in this book

Topics:

This cumulative guide provides a single, continuously updated version that includes all the latest IOS XR features and release updates. It simplifies your experience by letting you bookmark one link and access the complete guide, instead of navigating through multiple release-specific versions.

Whats changed in this book

This cumulative guide provides a single, continuously updated version that includes all the latest IOS XR features and release updates. It simplifies your experience by letting you bookmark one link and access the complete guide, instead of navigating through multiple release-specific versions.

Specific changes or updates tied to individual releases are clearly called out within the relevant sections. For a list of features introduced in a specific release, refer to the Release Notes or the IOS XR Feature Finder.

The table lists the release numbers for which this document has been updated since its initial publication.

Table 1: Changes to this document

Date	Summary
June 2026	First published for Release 26.2.1

2 Configuring 400G digital coherent optics

Topics:

This chapter describes Cisco 400G Digital Coherent QSFP-DD optics support, including platform compatibility, restrictions, traffic capabilities, and key configuration, monitoring, and troubleshooting procedures.

It covers Cisco 400G Digital Coherent QSFP-DD optics support, including supported modules, IOS XR release history, compatible routers and line cards, restrictions, and traffic capabilities.

It also provides configuration guidance and CLI procedures for frequency, chromatic dispersion, transmit power, muxponder/breakout modes, modulation, DAC rate, FEC, loopback, performance monitoring, alarm thresholds, and troubleshooting.

400G digital coherent QSFP-DD optical modules

Introduces 400G digital coherent QSFP-DD optical modules and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

Cisco offers a range of the new 400G Digital Coherent QSFP-DD optical modules.

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

Additional details

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.

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

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

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

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

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

- Traffic configuration – Comprises configuring DAC rate, muxponder mode, modulation, and FEC parameters. Applicable for optics controllers:
  - Configure DAC rate
  - Configure muxponder mode
  - Configure modulation
  - Configure FEC
- Optical configuration – Comprises configuring frequency, chromatic dispersion, and optical transmit power. Applicable for optics controllers:
  - Configure frequency

    - Configure chromatic dispersion
    - Configure optical transmit power
- 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:
    - Performance monitoring
    - Configure PM parameters
- Loopback configuration – Configures loopback. Applicable for coherent DSP controller:
    - Configuring loopback
- 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:
    - Configure alarm thresholds
    - FEC alarm thresholds on page 58

Feature history for 400G digital coherent optics

Provides reference details for feature history for 400G digital coherent optics used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Provides reference information for feature history for 400g digital coherent optics, including key values, supported combinations, and related constraints.

This section describes key items, values, and supported options.

Table 2: Feature History Table

Feature Name	Release Information	Description
Support for DP04QSDD-ULH-A1 optical module	Release 25.2.1	This release introduces support for the Cisco 400G QSFP-DD Ultra Long-Haul (ULH) coherent optical module on these line cards: - 88-LC0-36FH - 88-LC0-36FH-M 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.
Extended Support for QDD-400G-ZR-S and QDD-400G-ZRP-S Optical Module	Release 25.1.1	This release introduces support for the QDD-400G-ZR-S and QDD-400G-ZRP-S optical module on these line cards: - 88-LC1-12TH24FH-E - 88-LC1-36EH

Feature Name	Release Information	Description
Extended Support for DP04QSDD-ER1 Optical Module	Release 24.4.1	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: Routers: • Cisco 8201-32FH • Cisco 8201-24H8FH • Cisco 8608 Line cards: • 88-LC1-36EH
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: • 88-LC1-36EH
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: • DP04QSDD-ER1 - Cisco 400G Quad Small Form-Factor Pluggable Double Density (QSFP-DD) • DP01QSDD-ZF1 - Cisco 100G Quad Small Form-Factor Pluggable Double Density (QSFP-DD)
Support for DP04QSDD-HE0-A1 Optical Module	Release 24.2.11	This release introduces support for DP04QSDD-HE0-A1 optical module on these routers and line cards: Routers: • Cisco 8201 • Cisco 8202 • Cisco 8201-32FH • Cisco 8202-32FH-M • Cisco 8201-24H8FH Line cards: • 8800-LC-36FH • 88-LC0-36FH-M • 88-LC0-36FH • 88-LC0-34H14FH

Feature Name	Release Information	Description
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: Routers: • Cisco 8201 • Cisco 8202 Line cards: • 8800-LC-36FH • 88-LC0-36FH-M
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: Router: • Cisco 8202-32FH-M Line cards: • 88-LC0-36FH
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.
oFEC Traffic Configuration for QDD-400G-ZRP-S	Release 7.9.1	New Modulation and DAC Rate traffic configurations are supported on QDD-400G-ZRP-S optical module: • 400G-TXP-1x1-16 QAM • 4x100G-MXP-1x1-16 QAM • 3x100G-MXP-1x1-8 QAM • 2x100G-MXP-1x1-QPSK • 2x100G-MXP-1x1.25-16 QAM This increases the interoperability of the QDD-400G-ZRP-S optical module across network components supporting these formats.

Feature Name	Release Information	Description
Support for DP04QSDD-HE0 Optical Module	Release 7.9.1	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. From this release, the DP04QSDD-HE0 optical module is supported on the Cisco 8201-32FH and Cisco 8201-24H8FH routers.
Support for QDD-400G-ZRP-S Optical Module	Release 7.9.1	This release introduces support for the Cisco 400G QSFP-DD-ZRP-S Ethernet Variant on the Cisco 88-LC0-34H14FH line card.

Supported routers, line cards, and optical modules

Provides reference details for supported routers, line cards, and optical modules used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Table 3: 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

Fixed-Port Routers	Optics PID	Minimum IOS XR Software Release
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 4: 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	Release 7.3.2
	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	Release 24.4.1
	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

Line Cards	Optics PID	Minimum IOS XR Software Release
88-LC0-34H14FH	QDD-400G-ZRP-S	Release 7.9.1
	DP04QSDD-HE0-A1	Release 24.2.11

This section explains functional behavior for the referenced items.

Restrictions for 400G digital coherent optics

Details key principles for restrictions for 400G digital coherent optics that guide safe and consistent operation. Explains applicability, rationale, and expected outcomes for technical users.

Note

The Cisco 8010 Series Routers do not support this feature. For a list of supported features on the Cisco 8010 Series Routers, see Compatibility Matrix for Cisco 8010 Series Routers.

These restrictions apply to optics and routers:

Table 5: 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 these routers and line cards: - Cisco 8201 - Cisco 8202 - 8800-LC-36FH - 88-LC0-36FH-M

Traffic configuration

Introduces traffic configuration and outlines the main concept, process, task, principle, and reference areas in this section. Guides technical users to quickly locate the procedures and supporting data they need.

Traffic configuration covers traffic-mode settings and supported combinations, including muxponder modes, FEC, modulation, and DAC rate. Applicable for optics controllers.

Traffic configuration values for 400G digital coherent optics

Provides reference details for traffic configuration values for 400G digital coherent optics used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Table 6: 400G Digital Coherent QSFP-DD Traffic Capabilities and Example Settings

	Client Speed	Trunk Speed	Frequency	FEC	Modulation	DAC-Rate	Chromatic Dispersion (CD)	Transmitted (Tx) Power
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 **Note** Release 7.3.15 supports only 1x400 and 4x100 client speed.	400G, 300G, 200G, 1x100 **Note** 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	**dwdm-carrier 100MHz-grid frequency** *193100*	**fec** *OFEC* (default; can be omitted)	**modulation** *16Qam* (default; can be omitted)	**DAC-Rate** *1x1.5*	**cd-min** *-20000* **cd-max** *20000*	**transmit-power** *10* (+1 dBm)
400G Muxponder oFEC Cisco Mode (example settings)	**breakout** *4x100*	No setting required; tied to Client Speed	**dwdm-carrier 100MHz-grid frequency** *193100*	**fec** *OFEC* (default; can be omitted)	**modulation** *16Qam* (default; can be omitted)	**DAC-Rate** *1x1.25* (default; can be omitted)	**cd-min** *-20000* **cd-max** *20000*	**transmit-power** *10* (+1 dBm)

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

Table 7: 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

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

Table 8: 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.

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

Table 9: 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

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate	MSA Support
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+

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

Table 10: DP04QSDD-HE0 Transponder and Muxponder Configuration Values

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate
400G-TXP	1 Client, 400G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1.25
400G-TXP	1 clients, 400G speed		16 QAM		1x1.50
300G-TXP	1 clients, 300G speed		8 QAM		1x1.50
100G-TXP	1 Client, 100G speed	1 trunk, 400G speed	QPSK	oFEC	1x1.50
4x100G- MXP	4 clients, 100G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1.25
4x100G- MXP	4 clients, 100G speed		16 QAM		1x1.50

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate
3x100G-MXP	3 clients, 100G speed	1 trunk, 400G speed	8 QAM	oFEC	1x1.25
3x100G-MXP	3 clients, 100G speed		8 QAM		1x1.50
2x100-MXP	2 Client, 100G speed	2 Client, 100G speed	QPSK	oFEC	1x1.50

Configure muxponder mode

Provides instructions on how to configure muxponder mode in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

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. Follow this task to configure muxponder 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 and DP04QSDD-HE are:

- 4x100
- 3x100
- 2x100

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

Refer to the tables in the Traffic configuration values for 400G digital coherent optics on page 17 section for modulation values, based on the muxponder mode.

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

Ensure prerequisites for software state, hardware state, and access privileges are met.

Identify the optics **controller** *R/S/I/P* and the muxponder mode that you want to configure.

1. Configure muxponder mode on the optics controller.

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

2. Verify the running configuration on the optics controller.

   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
 !
```

3. Verify that the expected 100GE client interfaces are created.

   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
```

4. *Optional:* Switch from muxponder mode to transponder mode on the optics controller.

   This example shows how to switch to 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**
>
> In this example, the Cisco IOS XR software creates a single 400GE interface, which can be verified using the **show interfaces brief | include** *R/S/I/P* command.

5. *Optional:* Verify the running configuration on the optics controller after you switch to transponder mode.

   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
 !
```

6. *Optional:* Verify that the expected 400GE interface is created.

   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
```

Muxponder mode is configured on the optics controller and the expected client interfaces are created.

Continue with related procedures as required by your workflow.

2x200G DAC breakout modes

Introduces 2x200G DAC breakout modes and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

This topic explains 2x200G DAC breakout modes and provides the technical context you need before configuration.

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 routers. • 8011-4G24Y4H-I • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D

Feature Name	Release Information	Feature Description
Configure 2x200G DACs with 2x200 Breakout	Release 25.2.1	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200](select variants only*), Modular Systems (8800 [LC ASIC: Q200]) (select variants only*) 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). *The feature is supported on: • 88-LC0-36FH • 88-LC0-36FH-M • 8201-32FH • 8202-32FH-M This feature introduces these changes: CLI: The **breakout** keyword is enhanced to include 2x200 option in the controller optics command

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.

Configure 2x200G DAC breakout

Provides instructions on how to configure 2x200G DAC breakout in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure 2x200G DAC breakout.

Use this procedure in the appropriate operating context for your deployment.

- Associated line cards should be operational.
- Supported 2x200G modules should be inserted.

1. Configure 2x200G DAC with 2x200G breakout.

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

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.

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

Verify that the system reflects the intended configuration state.

Continue with related procedures as required by your workflow.

100G operating modes with 200G DAC

Introduces 100G operating modes with 200G DAC and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

This topic explains 100G operating modes with 200G DAC and provides the technical context you need before configuration.

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	Introduced in this release on: Fixed Systems (8010 [ASIC: A100], 8200 [ASIC: Q200)) (select variants only*) 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. 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. *This feature is supported on: • 8201-32FH • 8101-32FH The feature introduces these changes: CLI: The **speed** keyword is included along with the 100G *[host-lanes < 4 | 2 >]* option in the controller optics command.

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 operating modes with 200G and 4x100 DAC

Provides instructions on how to configure 100G operating modes with 200G and 4x100 DAC in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure 100G operating modes with 200G and 4x100 DAC.

Use this procedure in the appropriate operating context for your deployment.

Ensure prerequisites for software state, hardware state, and access privileges are met.

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

   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.

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

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

```
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
```

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

   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, remove breakout configuration before
 apply port speed configuration
!
end
```

   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.

Verify that the system reflects the intended configuration state.

Continue with related procedures as required by your workflow.

Configure modulation

Configure modulation on an optics controller and verify the running configuration and controller output so the active optical module modulation value matches the intended traffic mode.

Use this task to configure the modulation value on an optics controller.

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

For supported modulation values, see Traffic configuration values for 400G digital coherent optics on page 17.

Note

The system accepts any modulation value that you enter. However, if the modulation value is outside the supported range, the optical module is not configured with that value.

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.

Identify the optics **controller optics** *R/S/I/P* and the supported modulation value that you want to configure.

1. Enter XR configuration mode.

```
Router#config
```

2. Enter optics controller configuration mode.

```
Router(config)#controller optics 0/0/0/1
```

3. Configure the modulation value on the optics controller.

```
Router(config-Optics)#modulation 16Qam
```

4. Commit the configuration.

```
Router(config-Optics)#commit
```

5. Exit optics controller configuration mode.

```
Router(config-Optics)#exit
```

6. Exit XR configuration mode.

```
Router(config)#exit
```

7. Verify the modulation value in the 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
!
```

8. Verify the configured modulation value on the optical module.

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

```
Router#show controller optics 0/0/0/1
 Controller State: Up
 Transport Admin State: In Service
 Laser State: On
 LED State: Green
 FEC State: FEC ENABLED
 Optics Status
         Optics Type:  QSFPDD 400G ZR
         DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,

         Wavelength=1552.524nm
         Alarm Status:
         -------------
         Detected Alarms: None
         LOS/LOL/Fault Status:
         Alarm Statistics:
         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 35
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0
         Laser Bias Current = 0.0 %
         Actual TX Power = -7.87 dBm
         RX Power = -8.27 dBm
         RX Signal Power = -8.43 dBm
         Frequency Offset = 130 MHz
         Performance Monitoring: Enable
         THRESHOLD VALUES
         ----------------
         Parameter                High Alarm  Low Alarm  High Warning  Low
Warning
         -----------------------  ----------  ---------  ------------
-----------
         Rx Power Threshold(dBm)          1.9      -28.2           0.0
```

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

The optics controller is configured with the modulation value, and the controller output shows the active modulation type.

Continue with related traffic configuration tasks as required for your deployment.

Configure DAC rate

Configure the DAC sampling rate on an optics controller and verify the running configuration and controller output so the active DAC rate matches the intended FEC mode.

Use this task to configure the digital-to-analog conversion (DAC) sampling rate on an optics controller.

You can set the DAC sampling rate on optics controllers. You can modify the DAC sampling rate only on the QDD-400G-ZRP-S and DP04QSDD-HE optical modules.

For DAC rate values, see Traffic configuration values for 400G digital coherent optics on page 17.

> **Note**
>
> The QDD-400G-ZR-S optical module supports 1x1 DAC rate in cFEC mode. The QDD-400G-ZRP-S and DP04QSDD-HE optical modules support 1x1 DAC rate in cFEC mode and 1x1.25 DAC rate in oFEC mode.

Identify the optics **controller optics** *R/S/I/P*, the FEC mode, and the supported DAC rate that you want to configure.

1. Enter XR configuration mode.

```
Router#config
```

2. Enter optics controller configuration mode.

```
Router(config)#controller optics 0/0/0/1
```

3. Configure the DAC rate on the optics controller.

```
Router(config-Optics)#dac-rate 1x1
```

4. Commit the configuration.

```
Router(config-Optics)#commit
```

5. Exit optics controller configuration mode.

```
Router(config-Optics)#exit
```

6. Exit XR configuration mode.

```
Router(config)#exit
```

7. Verify the DAC rate in the running configuration.

   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
!
!
```

8. Verify the configured DAC rate on the optical module.

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

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

```
 LED State: Green
 FEC State: FEC ENABLED
 Optics Status
         Optics Type:  QSFPDD 400G ZR
         DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,

         Wavelength=1552.524nm
         Alarm Status:
         -------------
         Detected Alarms: None
         LOS/LOL/Fault Status:
         Alarm Statistics:
         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 35
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0
         Laser Bias Current = 0.0 %
         Actual TX Power = -7.87 dBm
         RX Power = -8.27 dBm
         RX Signal Power = -8.43 dBm
         Frequency Offset = 130 MHz
         DAC Rate = 1x1
         Performance Monitoring: Enable
         THRESHOLD VALUES
         ----------------
         Parameter                 High Alarm  Low Alarm  High Warning  Low
Warning
         ------------------------  ----------  ---------  ------------
-----------
         Rx Power Threshold(dBm)          1.9      -28.2           0.0
  -25.0
         Tx Power Threshold(dBm)          0.0      -15.0          -2.0
  -16.0
         LBC Threshold(mA)               0.00       0.00          0.00
   0.00
         Temp. Threshold(celsius)       80.00      -5.00         75.00
  15.00
         Voltage Threshold(volt)         3.46       3.13          3.43
   3.16
         LBC High Threshold = 98 %
         Configured Tx Power = -6.00 dBm
         Configured CD High Threshold = 80000 ps/nm
         Configured CD lower Threshold = -80000 ps/nm
         Configured OSNR lower Threshold = 9.00 dB
         Configured DGD Higher Threshold = 80.00 ps
         Baud Rate =  59.8437500000 GBd
         Modulation Type: 16QAM
         Chromatic Dispersion 0 ps/nm
         Configured CD-MIN -4000 ps/nm  CD-MAX 4000 ps/nm
         Second Order Polarization Mode Dispersion = 5.00 ps^2
         Optical Signal to Noise Ratio = 36.30 dB
         Polarization Dependent Loss = 0.40 dB
         Polarization Change Rate = 0.00 rad/s
         Differential Group Delay = 4.00 ps
         Temperature = 54.00 Celsius
         Voltage = 3.37 V
 Transceiver Vendor Details
         Form Factor            : QSFP-DD
```

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

The optics controller is configured with the DAC rate, and the controller output shows the active DAC rate.

Continue with related traffic configuration tasks as required for your deployment.

Configure FEC

Configure forward error correction (FEC) on an optics controller and verify the controller configuration and coherent DSP output so the active FEC mode matches the intended traffic mode.

Use this task to configure forward error correction on an optics controller.

You can configure FEC only on optics controllers. You can modify FEC only on the QDD-400G-ZRP-S and DP04QSDD-HE optical modules.

FEC controls errors during data transmission by adding data redundancy. This redundancy lets the receiver detect and correct a limited number of errors without requesting retransmission.

For FEC values, see Traffic configuration values for 400G digital coherent optics on page 17.

> **Note**
>
> The QDD-400G-ZR-S optical module supports cFEC. The QDD-400G-ZRP-S and DP04QSDD-HE optical modules support cFEC and oFEC.

Identify the optics **controller optics** *R/S/I/P* and the supported FEC mode that you want to configure.

1. Enter XR configuration mode.

```
Router#configure
```

2. Enter optics controller configuration mode.

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

3. Configure FEC on the optics controller.

```
Router(config-Optics)#fec CFEC
```

4. Commit the configuration.

```
Router(config-Optics)#commit
```

5. Exit optics controller configuration mode.

```
Router(config-Optics)#exit
```

6. Exit XR configuration mode.

```
Router(config)#exit
```

7. Verify the FEC mode in the controller 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
!
```

8. Verify the FEC mode in the coherent DSP output.

   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
```

The optics controller is configured with the FEC mode, and the coherent DSP output shows the active FEC mode.

Continue with related traffic configuration tasks as required for your deployment.

Optical configuration

Introduces optical configuration and outlines the main concept, process, task, principle, and reference areas in this section. Guides technical users to quickly locate the procedures and supporting data they need.

Optical configuration covers optics-controller settings such as frequency, chromatic dispersion, transmit power, and host squelch behavior.

Configure frequency

Configure the DWDM carrier frequency on an optics controller and verify the running configuration and controller output so the active frequency matches the intended optical channel.

Use this task to configure frequency on an optics controller.

You can select any C-band frequency from 196.1 THz 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.

Identify the optics **controller optics** *R/S/I/P* and the frequency value that you want to configure.

1. Enter XR configuration mode.

```
Router#config
```

2. Enter optics controller configuration mode.

```
Router(config)#controller optics 0/2/0/16
```

3. Configure the DWDM carrier frequency.

```
Router(config-Optics)#dwdm-carrier 100MHz-grid frequency 1921500
```

4. Commit the configuration.

```
Router(config-Optics)#commit
```

5. Exit optics controller configuration mode.

```
Router(config-Optics)#exit
```

6. Exit XR configuration mode.

```
Router(config)#exit
```

7. Verify the frequency in the 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
!
```

8. Verify the configured frequency on the optics controller.

This example shows how to verify the frequency configuration:

```
Router#show controller optics 0/2/0/16
Fri May 28 01:47:23.953 UTC
 Controller State: Up
 Transport Admin State: In Service
 Laser State: Off
 LED State: Off
 FEC State: FEC ENABLED
 Optics Status
         Optics Type:  QSFPDD 400G ZRP
         DWDM carrier Info: C BAND, MSA ITU Channel=80, Frequency=192.15THz,

         Wavelength=1560.200nm
         Alarm Status:
         -------------
         Detected Alarms: None
         LOS/LOL/Fault Status:
         Alarm Statistics:
         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 0
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 0
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0
         Laser Bias Current = 0.0 mA
         Actual TX Power = -40.00 dBm
         RX Power = -40.00 dBm
         RX Signal Power = -40.00 dBm
         Frequency Offset = 0 MHz
         Laser Temperature = 0.00 Celsius
         Laser Age = 0 %
         DAC Rate = 1x1.25
         Performance Monitoring: Enable
         THRESHOLD VALUES
         ----------------
         Parameter                High Alarm  Low Alarm  High Warning  Low
Warning
         -----------------------  ----------  ---------  ------------
-----------
         Rx Power Threshold(dBm)         13.0      -24.0          10.0
  -22.0
         Tx Power Threshold(dBm)          0.0      -16.0          -2.0
  -14.0
         LBC Threshold(mA)               0.00       0.00          0.00
   0.00
         Temp. Threshold(celsius)       80.00      -5.00         75.00
   0.00
```

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

The optics controller is configured with the frequency value, and the controller output shows the active frequency.

Continue with related optical configuration tasks as required for your deployment.

Configure chromatic dispersion

Configure chromatic dispersion minimum and maximum values on an optics controller and verify the running configuration and controller output so the active CD range matches the intended deployment.

Use this task to configure chromatic dispersion on an optics controller.

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 default chromatic dispersion search ranges are:

Table 13: 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

Identify the optics **controller optics** *R/S/I/P* and the supported chromatic dispersion range that you want to configure.

1. Enter XR configuration mode.

```
Router#configure
```

2. Enter optics controller configuration mode.

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

3. Configure the maximum chromatic dispersion value.

```
Router(config-Optics)#cd-max 4000
```

4. Configure the minimum chromatic dispersion value.

```
Router(config-Optics)#cd-min -4000
```

5. Commit the configuration.

```
Router(config-Optics)#commit
```

6. Exit optics controller configuration mode and XR configuration mode.

```
Router(config-Optics)#exit
Router(config)#exit
```

7. Verify the chromatic dispersion values in the 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
 !
```

8. Verify the configured chromatic dispersion values on the optics controller.

   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
```

The optics controller is configured with the chromatic dispersion values, and the controller output shows the active CD minimum and maximum values.

Continue with related optical configuration tasks as required for your deployment.

Configure optical transmit power

Configure optical transmit power on an optics controller and verify the running configuration and controller output so the configured Tx power matches the optical module capability.

Use this task to 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 power range. You can change the optical transmit power value based on the module capability.

> **Note**
>
> The default optical transmit power value is -10 dBm. With Tx shaping enabled, the maximum power in 1x400G, 4x100G, 3x100G, 2x100G, and 1x100G modes may be less than -10 dBm.

Identify the optics **controller optics** *R/S/I/P* and the supported optical transmit power value that you want to configure.

1. Enter XR configuration mode.

```
Router#config
```

2. Enter optics controller configuration mode.

```
Router(config)#controller optics 0/2/0/16
```

3. Configure the optical transmit power.

```
Router(config-Optics)#transmit-power -125
```

4. Commit the configuration.

```
Router(config-Optics)#commit
```

5. Exit optics controller configuration mode.

```
Router(config-Optics)#exit
```

6. Exit XR configuration mode.

```
Router(config)#exit
```

7. Verify the optical transmit power in the 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
!
```

8. Verify the configured optical transmit power on the optics controller.

   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
```

The optics controller is configured with the optical transmit power, and the controller output shows the configured Tx power value.

Continue with related optical configuration tasks as required for your deployment.

Disable auto-squelching

Configure host auto-squelch disablement on an optics controller and verify controller output so the host squelch status is disabled for the selected optical module.

Use this task to disable auto-squelch functionality on the module on the host side.

Table 14: Feature history table

Feature Name	Release Information	Description
Disable Auto-Squelching	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
Disable Auto-Squelching	Release 25.1.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I

Feature Name	Release Information	Description
Disable Auto-Squelching	Release 24.4.1	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*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 88-LC1-12TH24FH-E • 88-LC1-36EH+A8:B12 • 88-LC1-52Y8H-EM
Disable Auto-Squelching	Release 7.11.1	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 generates a local fault signal on the host side if it detects a fault on the media side. By default, Auto squelch is enabled. The feature introduces these changes: CLI: The **host auto-squelch disable** keyword has been added. YANG data models: New XPaths for `Cisco-IOS-XR-controller-optics-cfg`. See GitHub and YANG Data Models Navigator.

When auto-squelch is 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, such as when Rx LOS is asserted. Auto-squelching suppresses unwanted noise from laser sources in communication systems.

When auto-squelching is disabled and no valid signal is detected on the module from the remote end, the module generates a local fault towards the NPU. Disabling auto-squelching provides expanded signal detection and helps detect extremely weak signals that are embedded within laser source noise.

By eliminating the need to continuously monitor and suppress unwanted noise, system resources can be allocated more efficiently, leading to improved performance.

The **host auto-squelch disable** command disables auto-squelch functionality when there is an invalid input signal from the remote end. This feature provides the flexibility to customize the system behavior according to your requirements.

Identify the optics controller for the host on which you want to disable auto-squelching.

1. Enter XR configuration mode.

```
router#config
```

2. Enter controller configuration mode.

```
router(config)#controller 0/0/0/0
```

3. Disable host auto-squelch.

```
router(config-Optics)#host auto-squelch disable
```

4. Commit the configuration.

```
router(config-Optics)#commit
```

5. Verify that host squelch is disabled.

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

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

Auto-squelching is disabled on the host side, and the optics controller output shows the host squelch status as disabled.

Continue with related optical configuration or signal validation tasks as required for your deployment.

Performance monitoring

Introduces performance monitoring and outlines the main concept, process, task, principle, and reference areas in this section. Guides technical users to quickly locate the procedures and supporting data they need.

Performance monitoring covers performance-monitoring enablement, thresholds, and threshold crossing alert reporting for optics and coherent DSP controllers.

Performance monitoring

Introduces performance monitoring and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds for, and report performance data for early detection of problems.

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

This table lists the details of the host PM parameters:

Feature Name	Release Information	Description
New Parameters for Performance Monitoring	Release 24.2.11	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. This feature introduces new parameters **Host-Intf-{n}-FEC-BER** and **Host-Intf-{n}-FEC-FERC** in the **show controllers coherentdsp** command.

Additional details

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 these host PM parameters:

Table 15: Performance Monitoring Parameters

PM Parameter	Mode Type	Number of Host Interfaces	Description
Host-Intf-{n}-FEC-BER	Transponder	1	*n* =0 For example, Host-Intf-0-FEC-BER
	Muxponder	4	*n* = 0, 1, 2, and 3. For example: • Host-Intf-0-FEC-BER • Host-Intf-1-FEC-BER • Host-Intf-2-FEC-BER • Host-Intf-3-FEC-BER
Host-Intf-{n}-FEC-FERC	Transponder	1	*n* =0 For example, Host-Intf-0-FEC-FERC
	Muxponder	4	*n* = 0, 1, 2, and 3 For example: • Host-Intf-0-FEC-FERC • Host-Intf-1-FEC-FERC • Host-Intf-2-FEC-FERC • Host-Intf-3-FEC-FERC

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.

Configure PM parameters

Configure performance monitoring thresholds and threshold crossing alert report status on optics controllers and coherent DSP controllers.

Use this task to enable performance monitoring and configure PM parameters on optics and coherent DSP controllers.

Performance monitoring (PM) thresholds and threshold crossing alert (TCA) report status can be configured for optics controllers and coherent DSP controllers.

Table 16: PM thresholds and TCA report status for optics controllers

PM parameters	Description
CD	Sets the CD (chromatic dispersion) threshold or TCA reporting status.
DGD	Sets the DGD (differential group delay) threshold or TCA reporting status.
LBC	Sets the LBC (laser bias current) threshold or TCA reporting status in mA.
FREQ-OFF	Sets the FREQ-OFF (low signal frequency offset) threshold or TCA reporting status in MHz.
OPR	Sets the OPR (optical power RX) threshold or TCA reporting status in uW or dBm.
OPT	Sets the OPT (optical power TX) threshold or TCA reporting status in uW or dBm.
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 17: PM thresholds and TCA report status for coherent DSP controllers

PM parameters	Description
Q	Sets the Q threshold or TCA reporting status.
Q-margin	Sets the Q margin threshold or TCA reporting status.
EC-BITS	Sets the EC-BITS (error corrected bits) threshold or TCA reporting status.
PostFEC BER	Sets the post-FEC BER threshold or TCA reporting status.
PreFEC BER	Sets the pre-FEC BER threshold or TCA reporting status.
UC-WORDS	Sets the UC-WORDS (uncorrected words) threshold or TCA reporting status.
Host-Intf-0-FEC-BER	Sets the Host-Intf-0-FEC-BER threshold or TCA reporting status, where: • AVG specifies the number of corrected bits received from the host interface prior to a PM interval. • MIN specifies the minimum number of corrected bits received from the host interface over a subinterval and prior to a PM interval. • MAX specifies the maximum number of corrected bits received from the host interface over a subinterval and prior to a PM interval.
Host-Intf-0-FEC-FERC	Sets the Host-Intf-0-FEC-FERC threshold or TCA reporting status, where: • AVG specifies the number of frames received from the host interface during a subinterval. • MIN specifies the minimum number of frames received from the host interface with uncorrected errors over a subinterval and prior to a PM interval. • MAX specifies the maximum number of frames received from the host interface with uncorrected errors over a subinterval and prior to a PM interval.

Identify the controller that you want to configure and the PM parameters that you want to set.

1. Enable performance monitoring and set the CD 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
```

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

3. Verify the configured PM thresholds on the optics controller.

   Check the Configured Threshold fields in the command output.

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

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

4. Enable performance monitoring and set PM thresholds and TCA report 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
```

5. Verify the running configuration on the coherent DSP controller.

```
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
 !
```

6. Verify the configured PM parameters on the coherent DSP controller.

   Check the highlighted threshold and TCA fields in the command output.

```
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
                                      MIN       AVG        MAX      Threshold
      TCA     Threshold     TCA
                                                                        (min)
     (enable)     (max)      (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
 !
```

7. Verify the Host-Intf-0-FEC-BER and Host-Intf-0-FEC-FERC PM parameters on the coherent DSP controller.

   You can check these parameters in transponder mode and muxponder mode.

```
/* Example in transponder mode*/
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/4 pm current 30-sec fec
Tue Dec 19 23:11:06.781 UTC

g709 FEC in the current interval [23:11:00 - 23:11:06 Tue Dec 19 2023]

FEC current bucket type : Valid
    EC-BITS   : 550344268               Threshold : 83203400000
TCA(enable)  : YES
    UC-WORDS  : 0                       Threshold : 5
```

```
TCA(enable)  : YES

                                        MIN       AVG        MAX      Threshold
      TCA     Threshold     TCA                                                 (min)
     (enable)     (max)     (enable)
PreFEC BER                        :   2.4E-04   2.5E-04   2.5E-04      0E-15
     NO       0E-15        NO
PostFEC BER                       :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Q[dB]                             :     10.80     10.80     10.80       0.00
     NO        0.00        NO
Q_Margin[dB]                      :      3.60      3.60      3.60       0.00
     NO        0.00        NO
Host-Intf-0-FEC-BER               :     0E-15   1.3E-13   2.3E-10      0E-15
     NO       0E-15        NO
Host-Intf-0-FEC-FERC              :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
```

```
/* Example in muxponder mode*/
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/30 pm current 30-sec fec
Tue Dec 19 23:16:27.132 UTC

g709 FEC in the current interval [23:16:00 - 23:16:27 Tue Dec 19 2023]

FEC current bucket type : Valid
    EC-BITS   : 3258288607              Threshold : 83203400000
TCA(enable)  : YES
    UC-WORDS  : 0                       Threshold : 5
TCA(enable)  : YES

                                        MIN       AVG        MAX      Threshold
      TCA     Threshold     TCA                                                 (min)
     (enable)     (max)     (enable)
PreFEC BER                        :   2.7E-04   2.8E-04   2.9E-04      0E-15
     NO       0E-15        NO
PostFEC BER                       :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Q[dB]                             :     10.70     10.70     10.70       0.00
     NO        0.00        NO
Q_Margin[dB]                      :      3.50      3.50      3.50       0.00
     NO        0.00        NO
Host-Intf-0-FEC-BER               :   1.0E+00     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-1-FEC-BER               :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-2-FEC-BER               :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-3-FEC-BER               :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-0-FEC-FERC              :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-1-FEC-FERC              :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-2-FEC-FERC              :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
Host-Intf-3-FEC-FERC              :     0E-15     0E-15     0E-15      0E-15
     NO       0E-15        NO
```

PM thresholds and TCA report status are configured, and the controller PM output shows the configured values.

Continue monitoring the PM output for threshold crossing alerts during normal operation.

Loopback configuration

Explains loopback configuration for coherent DSP and optics controllers, including maintenance-mode requirements, supported loopback discovery, configuration examples, running configurations, and verification outputs.

Loopback configuration is a controller configuration that places a coherent DSP or optics controller into an internal, line, media, or host loopback path for validation and troubleshooting.

You can configure internal or line loopback on coherent DSP controllers.

You can configure media loopback and host loopback on optics controllers.

Loopback can be performed only in 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.

Configure loopback

Configure loopback on coherent DSP and optics controllers, check supported loopback types, and verify the running configuration and active loopback states.

Use this task to configure loopback for controller validation and troubleshooting.

You can configure internal or line loopback on coherent DSP controllers. You can configure media loopback and host loopback on optics controllers.

Loopback can be performed only in maintenance mode.

Use the **loopback** and **host loopback** commands in optics controller configuration mode to configure the media and host loopback modes. Loopback mode for both media and host can be configured to either internal or line, depending on the supported loopback types.

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

Identify the controller *R/S/I/P* and the loopback mode that you want to configure.

1. Check the supported loopback types for the optics controller.

   Use the `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
```

2. Configure internal loopback on a coherent DSP controller.

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

3. Configure media loopback and host loopback on an optics controller.

```
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
```

4. Verify the running configuration on the coherent DSP controller.

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

5. Verify the running configuration on the optics controller.

```
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
!
```

6. Verify the loopback configuration on the coherent DSP controller.

```
Router#show controller coherentdsp 0/0/0/4
Thu May 27 17:28:51.960 UTC
Port                                          : CoherentDSP 0/0/0/4
```

```
Controller State                                    : Down
Inherited Secondary State                           : Normal
Configured Secondary State                          : Maintenance
Derived State                                       : Maintenance
Loopback mode                                       : Internal
BER Thresholds                                      : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                              : Enable
Bandwidth                                           : 400.0Gb/s
Alarm Information:
LOS = 6 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0     FLEXO_GIDM = 0
FLEXO-MM = 0    FLEXO-LOM = 0   FLEXO-RDI = 0
FLEXO-LOF = 5
Detected Alarms                                     : LOS
Bit Error Rate Information
PREFEC  BER                                         : 5.0E-01
POSTFEC BER                                         : 0.0E+00
Q-Factor                                            : 0.00 dB
Q-Margin                                            : -7.20dB
OTU TTI Received
FEC mode                                            : C_FEC
```

7. Verify the loopback configuration on the optics controller.

```
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:  QSFPDD 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:
 ...
```

8. Verify the configured and applied loopback states on the optics controller.

```
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
```

Loopback is configured in maintenance mode, and the controller output shows the configured and applied loopback states.

Remove or change the loopback configuration when validation or troubleshooting is complete.

Alarm threshold configuration

Introduces alarm threshold configuration and outlines the main concept, process, task, principle, and reference areas in this section. Guides technical users to quickly locate the procedures and supporting data they need.

Alarm threshold configuration covers alarm threshold parameters, plus FEC alarm threshold definitions, restrictions, examples, and configuration steps.

Configure alarm thresholds

Configure alarm thresholds on optics controllers for monitoring alarms on optics controllers.

Use this task to configure alarm thresholds on optics controllers.

Alarm thresholds can be configured for monitoring alarms on optics controllers.

Table 18: Alarm 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.

Identify the optics controller and the alarm threshold parameters that you want to configure.

1. Configure the CD alarm thresholds 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
```

2. Verify 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
!
```

3. Verify the configured alarm threshold values on the optics controller.

```
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
!
```

Alarm thresholds are configured, and the optics controller output shows the configured threshold values.

Continue monitoring alarm status and alarm statistics during normal operation.

FEC alarm thresholds

Introduces FEC alarm thresholds and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

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 tranceiver. 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).

Table 19: Feature History Table

Feature Name	Release Information	Description
Configurable FDD and FED Alarm Threshold Values	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
Configurable FDD and FED Alarm Threshold Values	Release 25.1.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I
Configurable FDD and FED Alarm Threshold Values	Release 24.4.1	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*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 88-LC1-12TH24FH-E • 88-LC1-36EH+A8:B12 • 88-LC1-52Y8H-EM

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

Feature Name	Release Information	Description
		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. Prior to this release, the router would automatically generate FEC alarms based on default threshold values. The feature introduces these changes: CLI: Modified the controller optics command by adding these keywords: • **host fec-threshold excess-degrade raise** • **media fec-threshold excess-degrade raise** • **host fec-threshold excess-degrade clear** • **media fec-threshold excess-degrade clear** • **host fec-threshold detected-degrade raise** • **media fec-threshold detected-degrade raise** • **host fec-threshold detected-degrade clear** • **media fec-threshold detected-degrade clear** The **fec-thresholds** keyword is added to the show controller optics command. **YANG Data Model:** • New XPaths for Cisco-IOS-XR-controller-optics-oper.yang • Cisco-IOS-XR-um-cont-optics-fec-threshold-cfg.yang

Guidelines and restrictions for FEC alarm thresholds

Details key principles for guidelines and restrictions for FEC alarm thresholds that guide safe and consistent operation. Explains applicability, rationale, and expected outcomes for technical users.

- 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 1844674407370955161 5, the router only supports a range of 1 to 2046000000000000000. 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 20:

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	

FEC alarm threshold configuration examples

Provides reference details for FEC alarm threshold configuration examples used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Examples to configure FEC alarm threshold:

- Configure FED alarm thresholds
- Configure FDD alarm thresholds

Configure FDD alarm thresholds

Configure host FEC detected-degrade clear and raise alarm thresholds on an optics controller, verify the running configuration, and confirm the threshold values.

Use this task to set FDD clear and raise alarm thresholds on an optics controller.

FDD alarm thresholds use the host FEC detected-degrade threshold settings on the optics controller.

Identify the optics controller and the FDD clear and raise threshold values that you want to configure.

1. Configure the host FEC detected-degrade clear and raise 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
```

2. Verify 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
!
!
```

3. Verify the FDD alarm threshold values on the optics controller.

   Check the Host FEC detected degrade row in the command output.

```
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

 Host FEC detected degrade  :   2.2000E-14              1.1989E-14
```

FDD alarm thresholds are configured, and the optics controller output shows the host FEC detected-degrade values.

Continue monitoring FEC threshold output and alarm status during normal operation.

Configure FED alarm thresholds

Configure host FEC excess-degrade clear and raise alarm thresholds on an optics controller, verify the running configuration, and confirm the threshold values.

Use this task to set FED raise and clear alarm thresholds on an optics controller.

FED alarm thresholds use the host FEC excess-degrade threshold settings on the optics controller.

Identify the optics controller and the FED raise and clear threshold values that you want to configure.

1. Configure the host FEC excess-degrade clear and raise 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
```

2. Verify 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
!
```

3. Verify the FED alarm threshold values on the optics controller.

   Check the Host FEC excess degrade row in the command output.

```
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

 Host FEC excess degrade    :   2.3900E-14               1.3999E-14

 Host FEC detected degrade  :    9.0000E-03               9.0000E-04
```

FED alarm thresholds are configured, and the optics controller output shows the host FEC excess-degrade values.

Continue monitoring FEC threshold output and alarm status during normal operation.

Advanced optical behavior

Introduces advanced optical behavior and outlines the main concept, process, task, principle, and reference areas in this section. Guides technical users to quickly locate the procedures and supporting data they need.

Advanced optical behavior covers ULH optics features, media link-down behavior based on PreFEC degrade, and AppSel provisioning workflows.

Enhanced SOP tolerance mode for ULH optics

Introduces enhanced SOP tolerance mode for ULH optics and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

This topic explains enhanced SOP tolerance mode for ULH optics and provides the technical context you need before configuration.

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.

Feature Name	Release info	Description
Enhanced SOP support for ULH optics	Release 25.2.1	Introduced in this release on: Modular Systems (8800 [LC ASIC: Q100 , Q200 , P100]) (select variants only*) 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. This feature is applicable on: • 88-LC0-36FH • 88-LC0-36FH-M CLI: The **enh-sop-tol-mode** keyword is added to the **controller optics** command.

Benefits of SOP tolerance mode for ULH optics

Provides reference details for benefits of SOP tolerance mode for ULH optics used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Provides reference information for benefits of sop tolerance mode for ulh optics, including key values, supported combinations, and related constraints.

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

This section explains functional behavior for the referenced items.

Configure enhanced SOP tolerance mode

Provides instructions on how to configure enhanced SOP tolerance mode in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure enhanced SOP tolerance mode.

Use this procedure in the appropriate operating context for your deployment.

Ensure prerequisites for software state, hardware state, and access privileges are met.

1. Enable enhanced SOP tolerance mode.

```
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*.

2. Verify that enhanced SOP tolerance mode is enabled.

```
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
$6$g8IGE1mb2o7/BE1.$X1wz3z0fIKp6E0utoKvS6H4CFT0BOmM8PGt6M5MnndzrjnM/gJk.NwgOf5n3SZm2.qaPeRrZar7VQItNnT16o1
!
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
```

Verify that the system reflects the intended configuration state.

Continue with related procedures as required by your workflow.

Media link-down prefec degrade

Introduces media link-down prefec degrade and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

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.

Table 21: Feature History Table

Feature Name	Release Information	Description
Media Link-down PreFEC Degrade Enablement	Release 26.1.1	Introduced in this release on: Fixed Systems (8400 [ASIC: K100])(select variants only*) *This feature is now supported on the Cisco 8404-SYS-D router.

Feature Name	Release Information	Description
Media Link-down PreFEC Degrade Enablement	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
Media Link-down PreFEC Degrade Enablement	Release 25.1.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I
Media Link-down PreFEC Degrade Enablement	Release 24.3.1	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]) The Media Link-down PreFEC Degrade functionality can be used to protect the media side of the optical transceiver during transmission errors. 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. The feature introduces these changes: CLI: Modified the controller optics command by adding the **media link-down prefec-degrade** keyword. **YANG Data Model:** • New XPaths for Cisco-IOS-XR-controller-optics-oper.yang • New XPaths for Cisco-IOS-XR-um-cont-optics-fec-threshold-cfg.yang (see GitHub, YANG Data Models Navigator)

Prerequisites for using media link-down PreFEC degrade functionality

Provides prerequisite information for using media link-down PreFEC degrade functionality, including the required FEC alarm threshold configuration and the related reference topic for setup.

To use the Media Link-down PreFEC Degrade functionality, you must configure the FEC Alarm Threshold. For information about configuring FEC alarm thresholds, see FEC alarm thresholds.

About media link-down PreFEC degrade functionality

Explains how media link-down PreFEC degrade functionality works after FEC alarm thresholds are configured, including alarm behavior, link-down triggering, switchover behavior, and release support scope.

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

Provides instructions on how to configure media link-down prefec degrade in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure media link-down prefec degrade.

Use this procedure in the appropriate operating context for your deployment.

Ensure prerequisites for software state, hardware state, and access privileges are met.

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

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

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

```
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
!
```

3. Execute the **show controller optics** *R/S/I/P* command to verify link-down preFEC degrade feature 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: 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
         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
!
```

Verify that the system reflects the intended configuration state.

Continue with related procedures as required by your workflow.

Application select code provisioning

Explains application select code provisioning for QDD modules, including AppSel code behavior, CLI changes, operating-mode parameters, and benefits for optical module configuration.

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	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. This feature introduces these changes: CLI: - The **appsel simple code** keyword is introduced in the Controller optics command. - The **appsel** keyword is introduced in the Show controller optics command.

AppSel code provisioning details

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 for AppSel code provisioning

Outlines configuration guidelines for AppSel code provisioning based on the original AppSel provisioning task and concept content.

Configuration guidelines 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

Outlines restrictions for AppSel code provisioning using the original AppSel-related restriction content.

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

AppSel code provisioning enables a router to identify and configure the operating mode of an optical module.

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.

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.

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

Provides instructions on how to configure an appsel code on an optical module in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

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.

Use this procedure in the appropriate operating context for your deployment.

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

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

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

2. Enter configuration mode on the router.

```
Router# conf
```

3. Identify the controller optics interface and configure breakout to match with the AppSel code that you want to configure.

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

4. Configure the AppSel code.

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

5. Verify the configuration.

```
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       |  17    ETH 400GAUI-8 C2M (Annex |  62    OIF 400ZR, DWDM, amplifi
|  OIF            |  Yes      |  n/a            |
  2       |  13    ETH 100GAUI-2 C2M (Annex |  62    OIF 400ZR, DWDM, amplifi
|  OIF            |  Yes      |  n/a            |
  3       |  17    ETH 400GAUI-8 C2M (Annex |  70    OpenZR+ ZR400-OFEC-16QAM
|  OpenZR+        |  Yes      |  n/a            |
  4       |  13    ETH 100GAUI-2 C2M (Annex |  70    OpenZR+ ZR400-OFEC-16QAM
|  OpenZR+        |  Yes      |  n/a            |
  5       |  17    ETH 400GAUI-8 C2M (Annex |  199   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  6       |  15    ETH 200GAUI-4 C2M (Annex |  199   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  7       |  13    ETH 100GAUI-2 C2M (Annex |  199   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  8       |  17    ETH 400GAUI-8 C2M (Annex |  196   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  9       |  15    ETH 200GAUI-4 C2M (Annex |  196   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  10      |  13    ETH 100GAUI-2 C2M (Annex |  196   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
  11      |  17    ETH 400GAUI-8 C2M (Annex |  200   0xC0-0xFE  Vendor Specif
|  0xC0-0xFE      |  Yes      |  n/a            |
```

```
  12      |  15    ETH 200GAUI-4 C2M (Annex |  200   0xC0-0xFE  Vendor Specif
 |  0xC0-0xFE      |  Yes       |  n/a            |
  13      |  13    ETH 100GAUI-2 C2M (Annex |  200   0xC0-0xFE  Vendor Specif
 |  0xC0-0xFE      |  Yes       |  n/a            |
  14      |  17    ETH 400GAUI-8 C2M (Annex |  83    OTN-ITU-T FOIC4.8-DO (G.
 |  OTN-ITU-T      |  Yes       |  n/a            |
  15      |  254   0xC0-0xFE  Vendor Specif |  254   0xC0-0xFE  Vendor Specif
 |  0xC0-0xFE      |  Yes       |  n/a            |
-------------------------------------------------------------------------------
```

```
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       |  17          |  62          |  8         |  1         |  1
    |  1           |  Yes       |
  2       |  13          |  62          |  2         |  1         |  85
    |  1           |  Yes       |
  3       |  17          |  70          |  8         |  1         |  1
    |  1           |  Yes       |
  4       |  13          |  70          |  2         |  1         |  85
    |  1           |  Yes       |
  5       |  17          |  199         |  8         |  1         |  1
    |  1           |  Yes       |
  6       |  15          |  199         |  4         |  1         |  17
    |  1           |  Yes       |
  7       |  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.

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

Alarm troubleshooting

Introduces alarm troubleshooting and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

In this latest release, we bring forth advanced features to elevate your alarm management experience.

- **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.

Additional details

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

Provides reference details for CD alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the CD alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the CD alarm.

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

Provides reference details for DGD alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the DGD alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the DGD alarm.

1. Configure the threshold value within range if DGD value is not within the threshold range.
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_LOF alarm

Provides reference details for FLEXO_LOF alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the FLEXO_LOF alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the FLEXO_LOF alarm.

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.
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 alarm

Provides reference details for FLEXO_LOM alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the FLEXO_LOM alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the FLEXO_LOM alarm.

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.

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

Provides reference details for HI-LASERBIAS alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-LASERBIAS alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-LASERBIAS alarm.

1. Configure the threshold value within range if high laser bias threshold value is not within the threshold range.
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-RXPOWER alarm

Provides reference details for HI-RXPOWER alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-RXPOWER alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-RXPOWER alarm.

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

Provides reference details for HI-RXPOWER warn used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-RXPOWER warn alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-RXPOWER warn alarm.

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

Provides reference details for HI-TEMP alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-TEMP alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-TEMP alarm.

1. Verify the fan is intact and empty slots are blocked for cooling
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-TEMP warn

Provides reference details for HI-TEMP warn used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-TEMP warn alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-TEMP warn alarm.

1. Verify the fan is intact and empty slots are blocked for cooling.
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-TXPOWER alarm

Provides reference details for HI-TXPOWER alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-TXPOWER alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-TXPOWER alarm.

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

Provides reference details for HI-TXPOWER warn used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the HI-TXPOWER warn alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the HI-TXPOWER warn alarm.

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

IMPROPER-REM alarm

Provides reference details for IMPROPER-REM alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the IMPROPER-REM alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the IMPROPER-REM alarm.

1. Insert the appropriate QSFP.
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).

LOF alarm

Provides reference details for LOF alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LOF alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LOF alarm.

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.
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).

LOL alarm

Provides reference details for LOL alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LOL alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LOL alarm.

1. Verify the fiber and power levels.
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).

LOM alarm

Provides reference details for LOM alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LOM alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LOM alarm.

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.
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).

LO-RXPOWER alarm

Provides reference details for LO-RXPOWER alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LO-RXPOWER alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LO-RXPOWER alarm.

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

Provides reference details for LO-RXPOWER warn used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LO-RXPOWER warn alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LO-RXPOWER warn alarm.

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 alarm

Provides reference details for LOS alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Default Severity: Major

Logical Object: Software

This alarm occurs when there is a loss of signal

Clear the LOS alarm

Provides instructions on how to clear the LOS alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LOS alarm.

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

LOS-P alarm

Provides reference details for LOS-P alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Default Severity: Minor

Logical Object: OTN

This alarm occurs when there is a loss of signal.

Clear the LOS-P alarm

Provides instructions on how to clear the LOS-P alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LOS-P alarm.

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

LO-TXPOWER alarm

Provides reference details for LO-TXPOWER alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LO-TXPOWER alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LO-TXPOWER alarm.

1. Verify the optics detection and any failures.
2. If the alarm does not clear, 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).

LO-TXPOWER warn

Provides reference details for LO-TXPOWER warn used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the LO-TXPOWER warn alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the LO-TXPOWER warn alarm.

1. Verify the optics detection and any failures.
2. If the alarm does not clear, 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).

OOR_CD alarm

Provides reference details for OOR_CD alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

Default Severity: Minor

Logical Object: Controller

This alarm occurs when the Chromatic Dispersion is out of range

Clear the OOR_CD alarm

Provides instructions on how to clear the OOR_CD alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the OOR_CD alarm.

1. Verify the value of the OOR_CD alarm on Cisco 8000 using the **show controller optics** *R/S/I/P* command.
2. If the value is not within the OOR_CD threshold range, configure the threshold value using the **controller optics** *R/S/I/P* command in the config mode.
3. If the alarm does not clear, 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).

OSNR alarm

Provides reference details for OSNR alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the OSNR alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the OSNR alarm.

1. Verify the value of the OSNR alarm on Cisco 8000 using the **show controller optics** *R/S/I/P* command.
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).
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

Provides reference details for UNC-WORD alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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

Provides instructions on how to clear the UNC-WORD alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the UNC-WORD alarm.

1. Ensure that the fiber connector for the card is completely plugged in.
2. Ensure that the ports on the far end and near end nodes have the same port rates and FEC settings.
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.
4. If the optical power level is good, verify that the optical receive levels are within the acceptable range.
5. If receive levels are good, clean the fibers at both ends.
6. If the condition does not clear, verify that a single-mode fiber is used.
7. Verify if the fiber is of single-mode type.
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-OOL alarm

Provides reference details for WVL-OOL alarm used during configuration and validation. Covers key values, constraints, and supporting technical data for quick lookup.

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-OOL alarm

Provides instructions on how to clear the WVL-OOL alarm in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to clear the WVL-OOL alarm.

1. Verify the wavelength configuration.
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).

3 Configuring 800G optics

Topics:

This chapter describes Cisco 800G QSFP-DD optics support, including breakout configuration, platform and port-pairing guidelines, and DP08QSDD-ZRB-19B 800G-ZR+ support for high-capacity DWDM/DCI connectivity.

The content describes Cisco 800G QSFP-DD optical module support for high-capacity Ethernet connectivity in data center and enterprise networks. Cisco 800G QSFP-DD modules provide high-density 800 Gigabit Ethernet connectivity

Configure 2x400G and 8x100G breakout modes

Explains the capabilities of Cisco QSFP-DD800 modules for high-density 800G Ethernet connectivity, detailing configuration requirements for 2x400G and 8x100G breakout modes to support scalable data center and enterprise network deployments.

The Cisco QSFP-DD800 modules offer advanced high-density 800 Gigabit Ethernet connectivity for modern data centers and enterprise networks, featuring:

- Increased density and flexibility to support web customer deployments.
- Utilization of QSFP-DD800 optics technology for efficient, high-density ethernet connections.
- Enhanced scalability for seamless data center interconnection and network growth.

Table 23: Feature History Table

Feature Name	Release Information	Feature Description
Configure 2x400G and 8x100G breakout modes	Release 25.3.1	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100],(select variants only*); ; Modular Systems (8800 [LC ASIC: Q100, Q200, P100])(select variants only*) You can now configure 2x400G and 8x100G breakout modes on the 8212-32FH-M routers and 88-LC1-36EH line cards using the QSFP-DD800 optical modules. This feature introduces these changes: CLI: - **mode 800** keyword in **hw-module port-range** command - **breakout 8X100** keyword in **controller optics** command. *This feature is supported on: - 8212-32FH-M - 88-LC1-36EH

Guidelines for using Cisco QSFP-DD800 optical modules

Provides operational guidelines for Cisco QSFP-DD800 optical modules, specifying active port pairing requirements and clarifying system alarm behaviors when modules are installed in 800G-configured ports.

Use these guidelines to operate Cisco QSFP-DD800 optical modules:

- When operating 800G optical modules in supported port pairs, only the first port in each pair (e.g., Port 0, 1, 4, 8, 9, 12, 13, 16) is active, while the second port in the pair (e.g., Port 2, 3, 6, 10, 11, 14, 15, 18) remains inactive.

  For example, in the first port pair (ports 0 and 2), port 0 is enabled, whereas port 2 is disabled.

- The major alarm `hw_optics: OPTICS Module is not supported on this port`does not appear when a Cisco 800G optical module is installed in a port configured with `mode 800`.

Supported port pairings on Cisco 8212-48FH-M Router

Lists the specific port pairings on the Cisco 8212-48FH-M router that support 800G optics, ensuring correct hardware installation and configuration for high-speed connectivity.

800G optics are supported on these port pairings of the Cisco 8212-48FH-M Router:

Port 1	Port 2
0	2
1	3
4	6
8	10
9	11
12	14
13	15
16	18
17	19
20	22
21	23
24	26
25	27
28	30
29	31
32	33
34	35
36	37
38	39
40	41
42	43
44	45
46	47

Configure 800G optics

Teaches you how to configure the 800G mode on designated port pairings, enabling the primary port for 800G module insertion while automatically disabling the associated secondary port.

To support 800G modules, configure the mode as 800 on the designated port pairings. This setup activates the primary port for 800G module insertion while disabling the secondary port in each pair.

1. Enter the global configuration mode.

```
Router# configure terminal
```

2. Configure **mode 800** using the **hw-module port-range mode 800** command for the desired port pairing. Insert the module into the *first* port number of the pair.

```
Router(config)# hw-module port-range  0 0 instance 0 location 0/RP0/CPU0 mode
 800
```

3. Commit the configuration.

```
Router(config)# commit
```

Configure 8x100G breakout mode

Configures the Cisco QDD-8X100G-FR optical module to operate as eight separate 100 Gigabit Ethernet interfaces, providing flexible high-density connectivity options for network administrators.

You can configure the Cisco QDD-8X100G-FR optical module for 8x100G breakout mode to operate as eight separate 100 Gigabit Ethernet interfaces. The Cisco QDD-2X400G-FR4 optical module operates by default in 2x400G mode and does not require a breakout configuration.

1. Enter global configuration mode.

```
Router# configure terminal
```

2. Access the controller optics configuration for the port where the QDD-8X100G-FR optical module is inserted.

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

3. Apply the breakout 8x100.

```
Router(config-Optics)# breakout 8x100
Router# commit
```

4. Verify the installed 800 GbE modules and their configurations using the **show inventory | include 8x100.**

```
Router#show inventory | i 8x100
NAME: "EightHundredGigE0/0/0/13", DESCR: "Cisco QSFPDD 8x100G FR Pluggable
Optics Module"
NAME: "EightHundredGigE0/0/0/38", DESCR: "Cisco QSFPDD 8x100G FR Pluggable
Optics Module"
```

Support for DP08QSDD-ZRB-19B optics on 88-LC1-36EH line card

Describes support for the DP08QSDD-ZRB-19B 800G-ZR+ coherent optics module, which enables high-capacity long-haul and data center interconnect links directly from the router port without external transponders.

A DP08QSDD-ZRB-19B optic is a QSFP-DD800 coherent pluggable module that

- delivers 800-Gbps ZR/ZR+ transmission over amplified C-band DWDM networks
- enables high-capacity long-haul and data center interconnect (DCI) optical links directly from the router port, and
- eliminates the need for external transponders for long-distance DWDM connections.

Starting with Cisco IOS XR Release 25.4.1, the DP08QSDD-ZRB-19B optical module is supported in 88-LC1-36EH line cards.

Table 24: Feature History Table

Feature Name	Release Information	Feature Description
Support for DP08QSDD-ZRB-19B optics on 88-LC1-36EH line card	Release 25.4.1	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100], 8010 [ASIC: A100]); Centralized Systems (8600 [ASIC: Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) We have introduced support for the DP08QSDD-ZRB-19B 800G-ZR+ C-band coherent QSFP-DD module on the Cisco 88-LC1-36EH line card. This module enables 800G ZR/ZR+ coherent transmission over amplified C-band DWDM systems, providing high-capacity routed optical networking directly from the router port.

4 Configuring controllers

Topics:

This chapter describes Cisco IOS XR Optics Controller configuration, including optical module control, diagnostics, alarms, PRBS testing, and loopback procedures for monitoring and troubleshooting transceivers.

It covers Cisco IOS XR Optics Controller configuration, remotely disabling and re-enabling optical modules, and viewing transceiver status, module state, datapath state, diagnostic parameters, and alarms.

It also provides procedures for PRBS link testing and host/media-side loopback configuration to help monitor, validate, and troubleshoot optical transceivers and coherent optics.

Controller configuration

Introduces controller configuration concepts for optics controller breakout and optical module power-state management.

Controller configuration includes optics controller settings and optical module power-state controls that are applied from the CLI for the 36-port QSFP56-DD 400 GbE and 48-port QSFP28 100 GbE Line Cards.

The optics controller supports breakout configuration from controller optics configuration mode.

The optical module disable feature lets you disable and re-enable an optical module through the CLI. This operation simulates online insertion and removal (OIR) by disabling power to the transceiver port.

Typical optical module troubleshooting can include OIR by removing and reinstalling the module, which requires onsite personnel to physically reseat the module. Remote disable and enable operations can reduce the need for physical reseating and significantly reduce operational expenses.

When an optical module is disabled, the controller state changes from Up to Down, the optics type can be reported as unknown optics, and transmit and receive power values can display as N/A. Use the **transceiver disable** command in controller optics configuration mode to disable the module, and use the **no transceiver disable** command to re-enable it.

Note

When two MACsec enabled Cisco 8000 Series Routers with Coherent Line Cards are connected, there is no compatibility between Coherent Line Cards of IOS XR Release.

- breakout - Configure breakout mode (‘breakout 4x10’ only.)
- clear - Clear the uncommitted configuration.
- commit - Commit the configuration changes to running.
- do - Run an exec command.
- end - Exit from configure mode.
- exit - Exit from this submode.

The other options are:

- ext-description - Set ext-description for this controller.
- no - Negate a command or set its defaults.
- pwd - Commands used to reach current submode.
- root - Exit to the global configuration mode.
- show - Show contents of configuration.

Configure the optics controller

Provides detailed steps to configure breakout mode on the optics controller and verify the running configuration.

Follow this task to configure the optics controller for breakout 4x10 operation.

Ensure that you have configuration privileges and that the target optics controller is available on the router.

1. Enter XR configuration mode.

```
RP/0/RP0/CPU0:uut#configure
Fri Oct 11 16:22:31.222 UTC
```

2. Enter controller optics configuration mode for the target optics controller.

```
RP/0/RP0/CPU0:uut(config)#controller optics 0/1/0/28
```

3. Configure breakout 4x10 mode on the optics controller.

```
RP/0/RP0/CPU0:uut(config-Optics)#breakout 4x10
```

   This command configures the optics controller for breakout 4x10 operation.

4. Commit the configuration.

```
RP/0/RP0/CPU0:uut(config-Optics)#commit
Fri Oct 11 16:23:26.868 UTC
```

5. Exit controller optics configuration mode.

```
RP/0/RP0/CPU0:uut(config-Optics)#end
RP/0/RP0/CPU0:uut#
```

6. Verify the running configuration for the optics controller.

```
RP/0/RP0/CPU0:uut#show running-config controller optics 0/1/0/28
Fri Oct 11 16:23:41.273 UTC
controller Optics0/1/0/28
breakout 4x10
!
```

   The running configuration displays the breakout 4x10 setting under the selected optics controller.

The optics controller is configured for breakout 4x10 operation.

Continue with related controller configuration or validation tasks as required.

Disable optical modules

Provides steps to verify that an optical module is powered on, disable the module, and verify that the module is powered down.

Use this task to remotely disable an optical module from controller optics configuration mode.

This feature provides the ability to disable and re-enable an optical module through the CLI, which simulates online insertion and removal (OIR) by disabling power to the transceiver port.

Typical troubleshooting procedures for optical modules can include performing OIR by removing and reinstalling the module, which requires onsite personnel to physically reseat the optical module. The ability to remotely disable and enable an optical module can significantly reduce operational expenses.

1. Verify that the optical module is powered on and in the UP state.

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

Controller State: Up

Transport Admin State: In Service
```

```
Laser State: Off

LED State: Not Applicable

FEC State: FEC ENABLED

 Optics Status

         Optics Type:  QSFP28 100G FR
         Wavelength = 1311.00 nm

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


         LOS/LOL/Fault Status:

         Laser Bias Current = 26.2 mA
         Actual TX Power = 0.73 dBm
         RX Power = -0.68 dBm

         Performance Monitoring: Disable

         THRESHOLD VALUES
         ----------------

         Parameter                 High Alarm  Low Alarm  High Warning  Low
Warning
         ------------------------  ----------  ---------  ------------
-----------
         Rx Power Threshold(dBm)          7.4      -10.4           4.5
   -6.3
         Tx Power Threshold(dBm)          7.0       -6.3           4.0
   -2.4
         LBC Threshold(mA)             100.00       8.00         83.00
  10.00
         Temp. Threshold(celsius)       75.00      -5.00         70.00
   0.00
         Voltage Threshold(volt)         3.63       2.97          3.46
   3.13

         Polarization parameters not supported by optics

         Temperature = 27.92 Celsius
         Voltage = 3.24 V

Transceiver Vendor Details

         Form Factor            : QSFP28
         Optics type            : QSFP28 100G FR
         Name                   : CISCO-CISCO
         OUI Number             : 00.00.0c
         Part Number            : 10-3248-01
         Rev Number             : 01
         Serial Number          : FBN2331A114
         PID                    : QSFP-100G-FR-S
         VID                    : ES0
         Date Code(yy/mm/dd)    : 19/09/19
```

The output shows the controller state as Up and the optics type as QSFP28 100G FR.

2. Disable the optical module.

```
Router(config)# controller optics 0/0/0/0
Router(config-Optics)# transceiver disable
Router(config-Optics)# commit
Router(config-Optics)# end
```

The **transceiver disable** command disables power to the transceiver port.

3. Verify that the optical module is disabled and powered down.

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

Controller State: Down

Transport Admin State: In Service

Laser State: Off

 Optics Status

         Optics Type:  Unknown optics
         Wavelength = 0.00 nm

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


         LOS/LOL/Fault Status:

         TX Power = N/A
                        RX Power = N/A

         Performance Monitoring: Disable

         THRESHOLD VALUES
         ----------------

         Parameter                 High Alarm  Low Alarm  High Warning  Low
Warning
         ------------------------  ----------  ---------  ------------
-----------
         Rx Power Threshold(dBm)          7.4      -10.4           4.5
   -6.3
         Tx Power Threshold(dBm)          7.0       -6.3           4.0
   -2.4
         LBC Threshold(mA)             100.00       8.00         83.00
  10.00
         Temp. Threshold(celsius)       75.00      -5.00         70.00
   0.00
         Voltage Threshold(volt)         3.63       2.97          3.46
   3.13

         Polarization parameters not supported by optics

         Temperature = 0.00 Celsius
         Voltage = 0.00 V

Transceiver Vendor Details
```

The output shows the controller state as Down, the optics type as unknown optics, and the transmit and receive power values as N/A.

The optical module is disabled and powered down.

> **Note**
>
> To re-enable the module, use the **no transceiver disable** command in controller optics configuration mode.

Diagnostic parameters for optical transceivers

Introduces diagnostic parameters for optical transceivers and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

To monitor and report optical transceiver performance and enhance troubleshooting, the observable-info keyword is added to the show controllers optics command to display the diagnostics parameters. These parameters help in monitoring the health of the network when the optical transceiver heats up, when the link is down, when alarms are raised, or when there's traffic loss in the network. This improvement in the show controllers optics command now displays the following diagnostic parameters:

- Effective Signal to Noise Ratio (eSNR)
- Pulse Amplitude Modulation with Four Levels (PAM4) Level Transition Parameter (LTP)
- Pre-Forward Error Correction (FEC) and Post-FEC Bit Error Rate (BER)
- Frame Error Count (FERC)
- Laser age
- Thermoelectric Cooler (TEC) current
- Laser frequency
- Laser temperature

Table 25: Feature History Table

Feature Name	Release Information	Description
Diagnostic Parameters for Optical Transceivers	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: - 8011-32Y8L2H2FH - 8011-12G12X4Y-A/D
Diagnostic Parameters for Optical Transceivers	Release 25.1.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on Cisco 8011-4G24Y4H-I routers.

Feature Name	Release Information	Description
Diagnostic Parameters for Optical Transceivers	Release 24.4.1	Introduced in this release on: Fixed Systems (8200 [ASIC: P100], 8700 [ASIC: P100, K100])(select variants only*); Modular Systems (8800 [LC ASIC: P100])(select variants only*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 8712-MOD-M • 88-LC1-12TH24FH-E • 88-LC1-36EH+A8:B12 • 88-LC1-52Y8H-EM

Feature Name	Release Information	Description
Diagnostic Parameters for Optical Transceivers	Release 7.11.1	You can analyze the diagnostic parameters for optical transceivers installed on a network device and detect potential issues with the optical transceivers, such as excessive power levels, abnormal temperature readings, or degradation of the optical signal. Such analysis is possible because the **show controllers optics** command now displays the diagnostic parameters: • Effective Signal to Noise Ratio (eSNR) • Pulse Amplitude Modulation with Four Levels (PAM4) Level Transition Parameter (LTP) • Pre-Forward Error Correction (FEC) and Post-FEC Bit Error Rate (BER) • Frame Error Count (FERC) • Laser age • Thermoelectric Cooler (TEC) current • Laser frequency • Laser temperature For additional information on VDM (Versatile Diagnostics Monitoring), see the Common Management Interface Specification. The feature introduces these changes: CLI: The **observable-info** keyword is added to the show controller optics command. **YANG Data Model:** New XPath for `Cisco-IOS-XR-controller-optics-oper.yang` (see GitHub, YANG Data Models Navigator)

> **Note**
>
> Not all optical transceivers support the **observable-info** keyword. Also, the parameters that are displayed depend on what the optical transceiver supports, that is, not all optical transceivers display the same parameters. For additional information on VDM (Versatile Diagnostics Monitoring), see the Common Management Interface Specification.

The **show controllers optics observable-info** command displays the monitoring parameters of the optical transceiver present in the 0/0/0/9 location ID. The 0/0/0/9 location ID represents rack/slot/instance/port. Network administrators can use the displayed values of this command for monitoring and troubleshooting.

```
Router#show controllers optics 0/0/0/9 observable-info
Observable Information

[eSNR Media Input]
 Unit: dB
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                Low High  Low High
 Lane0    21.30               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane1    22.05               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane2    22.62               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane3    22.05               0.00                0.00                0.00
            0.00                n   n     n   n

[PAM4 Level Transition Parameter Media Input]
 Unit: dB
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                Low High  Low High
 Lane0    47.79               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane1    54.70               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane2    64.34               0.00                0.00                0.00
            0.00                n   n     n   n
 Lane3    59.64               0.00                0.00                0.00
            0.00                n   n     n   n

[Pre-FEC BER Minimum Media Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00           n   n     n   n

[Pre-FEC BER Minimum Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm
```

```
                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Maximum Media Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Maximum Host Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Average Media Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Average Host Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Current Media Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[Pre-FEC BER Current Host Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                    Low High  Low High
 Module   0.000E+00           0.000E+00           0.000E+00           0.000E+00
           0.000E+00             n   n     n   n

[FERC Minimum Media Input]
 Unit: n/a
 Id       Value                LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm
```

```
                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Minimum Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Maximum Media Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Maximum Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Average Media Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Average Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Current Media Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                  Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n   n     n   n

[FERC Current Host Input]
 Unit: n/a
 Id       Value               LowThreshWarn       HighThresWarn
```

```
LowThreshAlarm      HighThreshAlarm     TCAWarn   TCAAlarm

                                 Low High  Low High
 Module   0.000E+00          0.000E+00          0.000E+00          0.000E+00
           0.000E+00            n    n     n    n
```

View coherent optical transceiver module parameters

Provides instructions on how to view coherent optical transceiver module parameters in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

The display of the show controller optics command is now improved to include information about the module state and datapath state of the optical transceivers. You can view these details using the **information all** and **information counters** keywords of the show controller optics command.

Table 26: Feature History Table

Feature Name	Release Information	Description
View Coherent Optical Transceiver Module Parameters	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
View Coherent Optical Transceiver Module Parameters	Release 25.4.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I
View Coherent Optical Transceiver Module Parameters	Release 24.4.1	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*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 88-LC1-12TH24FH-E • 88-LC1-36EH • 88-LC1-52Y8H-EM

Feature Name	Release Information	Description
View Coherent Optical Transceiver Module Parameters	Release 24.1.1	You can now monitor the overall functioning and status of the coherent optical transceiver. This is possible because you can now view the module state and data path state of the optical transceivers, which provide insight into the current state of the optical transceiver. This feature modifies the output of the **show controller optics** command.

Module State Machine (MSM) defines host-module interactions and behavioral characteristics of the optical module, such as the initialization of the management interface and the module power mode. The Module State field provides the current status of the optical transceiver. The optical transceiver can be in any one of the states:

- Low power
- Power up
- Ready
- Power down
- Fault

Data Path State Machine (DPSM) defines the host-module interactions and behavioral characteristics needed for the initialization of one particular data path, which represents the signal flow and signal processing of any one instance of one type of application.

The Datapath State field provides the current state of the data path on each host lane. It represents the initialization status of the resources associated with a data path in response to host configuration settings or commands.

By default, the data paths begin initializing when the module state is ready. The data path state is dependent on the module state. The host uses the activated data path to carry traffic.

Note

For additional information on the module state and datapath state, see the Common Management Interface Specification.

1. Verify coherent optical transceiver module parameters.

   The **show controllers optics** *r/s/i/p* **information counters** command displays the parameters of the optical transceiver present in the 0/0/0/8 location ID. The 0/0/0/8 location ID represents rack/slot/instance/port. Network administrators can use the displayed values of this command for monitoring and troubleshooting. This example displays the details when the optical transceiver operates in the transponder mode.

```
Router#show controllers optics 0/0/0/8 information counters
Fri Feb 16 11:06:31.415 UTC

Module State : Ready

Datapath State [Client-0]: TX Turn On
```

```
Acquisition Counter:    INVALID

HOST SIDE ALARM COUNTERS
====================================
Host-Intf-0-FDD-Alarm-Counter[0]
Host-Intf-0-FED-Alarm-Counter[0]


HOST SIDE FEC-BER FEC-FERC CURRENT VALUES
====================================
Host-Intf-0-FEC-BER[0.00E+00]                Host-Intf-0-FEC-FERC[0.00E+00]



 Supported Loopback Types :
============================
 [1.] Media Internal
 [2.] Media Line
 [3.] Host Line
 [4.] Host Internal
 [5.] Host Per Lane
 [6.] Media Per Lane
 [7.] Simultaneous Media Host

 Unsupported Loopback Types :
============================

 Media Configured Loopback : Media Loopback None
 Media Applied Loopback    : Media Loopback None


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



FW Upgrade Capability Mode:
==========================
 Supports Both Warm & Cold boot
 Supports Cold boot only
```

2. This example displays the details when the optical transceiver operates in the muxponder mode.

```
Router#show controllers optics 0/0/0/29 information all
Fri Feb 16 11:06:31.415 UTC

Module State : Ready

Datapath State [Client-0]: Activated

Datapath State [Client-1]: Activated

Datapath State [Client-2]: Activated

Datapath State [Client-3]: Activated

Acquisition Counter:    INVALID

HOST SIDE ALARM COUNTERS
====================================
Host-Intf-0-FDD-Alarm-Counter[0]
```

```
Host-Intf-0-FED-Alarm-Counter[0]
Host-Intf-1-FDD-Alarm-Counter[0]
Host-Intf-0-FED-Alarm-Counter[0]
Host-Intf-2-FDD-Alarm-Counter[0]
Host-Intf-0-FED-Alarm-Counter[0]
Host-Intf-3-FDD-Alarm-Counter[0]
Host-Intf-0-FED-Alarm-Counter[0]


HOST SIDE FEC-BER FEC-FERC CURRENT VALUES
=========================================
Host-Intf-0-FEC-BER[0.00E+00]                 Host-Intf-0-FEC-FERC[0.00E+00]
Host-Intf-1-FEC-BER[0.00E+00]                 Host-Intf-1-FEC-FERC[0.00E+00]
Host-Intf-2-FEC-BER[0.00E+00]                 Host-Intf-2-FEC-FERC[0.00E+00]
Host-Intf-3-FEC-BER[0.00E+00]                 Host-Intf-3-FEC-FERC[0.00E+00]


Supported Loopback Types :
==========================
 [1.] Media Internal
 [2.] Media Line
 [3.] Host Line
 [4.] Host Internal
 [5.] Host Per Lane
 [6.] Media Per Lane
 [7.] Simultaneous Media Host
```

This example displays the details when the optical transceiver operates in the muxponder mode.

Verify that the system reflects the intended configuration state.

Continue with related procedures as required by your workflow.

Display of alarms for coherent optical transceivers

Introduces display of alarms for coherent optical transceivers and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

Alarms are raised when the optical transceiver malfunctions.

- TX loss of alignment - indicates loss of signal alignment on the transmitter.
- TX out of alignment - indicates that the signal on the transmitter (TX) is out of alignment.
- TX CMU loss of lock - indicates that the transmitter (TX) has lost connection (locked) with the external clock (clock monitor unit).
- TX reference clock loss of lock - indicates that the transmitter (TX) has lost connection (locked) with the reference clock.
- TX deskew loss of lock - for traffic flow in the TX direction, this alarm indicates that the end receiver cannot align the physical lanes using alignment marker.
- TX FIFO error - indicates signal FIFO error on the transmitter.
- RX demodulator loss of lock - indicates that the media demodultor cannot achieve lock.
- RX CDC loss of lock - indicates that the receiver (RX) has lost connection (locked) with the external clock.
- RX loss of alignment - indicates that the signal alignment on the receiver (RX) is lost.

Continue with these items:

- RX out of alignment – indicates that the signal on the receiver (RX) is out of alignment.
- RX deskew loss of lock – for traffic flow in the RX direction, this alarm indicates that the end receiver cannot align the physical lanes using alignment marker.
- RX FIFO error – indicates signal FIFO error on the receiver.
- RX FEC excessive degrade – indicates that the signal has reached or exceeded FED threshold.
- RX FEC detected degrade – indicates that the signal has reached or exceeded FDD threshold.
- Remote degrade – indicates remote signal degradation.
- Local degrade – indicates local signal degradation.
- Remote Phy fault – indicates remote signal fault (RPF).

Table 27: Feature History Table

Feature Name	Release Information	Description
View Coherent Optical Transceiver Module Parameters	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
View Additional Alarms for Coherent Optical Transceiver	Release 25.1.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I
View Additional Alarms for Coherent Optical Transceiver	Release 24.4.1	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*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 88-LC1-12TH24FH-E • 88-LC1-36EH • 88-LC1-52Y8H-EM

Feature Name	Release Information	Description
View Additional Alarms for Coherent Optical Transceiver	Release 24.1.1	You can now monitor the optical transceivers for proper functioning and identify the cause of any malfunction. This is made possible because the output of the show alarms command is now enhanced to display the additional media lane alarms for coherent optical transceivers.

The media lane alarms are now reported in the **show alarms** command:

Restrictions for displaying optical transceiver alarms

Details key principles for restrictions that guide safe and consistent operation. Explains applicability, rationale, and expected outcomes for technical users.

The optical transceivers may not display the alarms if:

- The optical transceiver is disabled and the optical transceiver is in the **secondary admin-state maintenance** mode.
- Higher priority alarms such as improper removal and loss of signal (LOS) are reported. In such instances, these alarms can be viewed using the **show alarms brief suppressed** command.

Verify alarms for coherent optical transceivers

Provides instructions on how to verify alarms for coherent optical transceivers in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to verify alarms for coherent optical transceivers.

The **show alarms** command displays the alarms for the coherent optical transceivers.

```
Router#show alarms brief system active

------------------------------------------------------------------------------------
Active Alarms
------------------------------------------------------------------------------------
Location        Severity     Group            Set Time
Description



------------------------------------------------------------------------------------
0/RP0/CPU0      Major        Software         03/30/2023 12:30:39 UTC
Communications Failure With Cisco Licensing Cloud



0/RP0/CPU0      Minor        Software         04/02/2023 13:55:38 UTC
Optics0/0/0/31 - hw_optics:  RX POWER LANE-0 HIGH WARNING



0/RP0/CPU0      Major        Software         04/02/2023 13:55:38 UTC
Optics0/0/0/31 - hw_optics: Optics media rx signal power high warning
```

```
0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx fifo error


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx loss of alignment


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx out of alignment


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx CMU loss of lock


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx reference clock loss of lock


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media tx deskew loss of lock


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media rx loss of alignment


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media rx out of alignment


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media rx fifo error


0/RP0/CPU0      Major        Software         04/02/2023 14:00:01 UTC
Optics0/0/0/29 - hw_optics: Optics media rx demodulation loss of lock
```

The **show alarms** command displays the alarms for the coherent optical transceivers.

Pseudo random binary sequences

Introduces pseudo random binary sequences and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

The Pseudo Random Binary Sequence (PRBS) feature provides a robust mechanism for performing data integrity checks on router interfaces by generating and analyzing pseudo-random bit patterns. It operates simultaneously on both the

transmit (Tx) and receive (Rx) directions without generating actual client traffic, ensuring that the optical links and interfaces maintain a good state and are error-free.

Feature Name	Release Information	Feature Description
PRBS support for high-speed optical interfaces	Release 25.4.1	Introduced in this release on: Modular Systems (8800 [ASIC: Q200]) The Pseudo Random Binary Sequence (PRBS) feature provides data integrity checks on router interfaces by generating and analyzing pseudo-random bit patterns, PRBS15 and PRBS31 between the Cisco 88-LC0-36FH router line card and QDD-400G-FR4 optics. CLI: This feature introduces these commands: • **controller Optics R/S/I/P prbs-mode** *<source/sink/source-sink>* **pattern** *<pn15/pn31>* **direction** *<line/system>* • **show controllers optics** *R/S/I/P* **prbs-details**

The feature supports PRBS15 and PRBS31 patterns, which correspond to pseudo-random sequences of lengths 2^15-1 and 2^31-1 bits respectively.

PRBS is typically employed during system installations, or when replacing line cards or nodes, especially in Ethernet-based lossless fabric environments such as simple two-tier leaf and spine network designs.

PRBS operational modes

Introduces PRBS operational modes and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

PRBS testing uses three primary operational modes to check data integrity on links without generating live client traffic

You can configure PRBS in one of the modes on the optics controller.

- Source mode – The device continuously generates the PRBS signal on the line according to the configured pattern.
- Sink mode – The device locks onto the incoming PRBS signal, analyzes it, and reports any errors detected.
- Source-Sink mode – The device acts as both transmitter and receiver, generating the PRBS pattern and simultaneously verifying the incoming signal for errors.

Limitations for PRBS on optics controllers

Introduces limitations for PRBS on optics controllers and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

- The PRBS support is limited to modules that comply with the QSFP-DD Common Management Interface Specification (CMIS).
- User-defined pattern is not supported.
- Configuration is supported only on the main controller and is not supported on breakout controllers.

Configure PRBS on the optics controller

Provides instructions on how to configure PRBS on the optics controller in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure PRBS on the optics controller.

Before enabling PRBS, ensure that the interfaces are unshut.

Ensure that the optics controller is set in the maintenance mode using the sec-admin-state maintenance configuration.

1. Check the capabilities of the optical module.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/2/0/28 prbs-capability-info
Wed Sep  3 16:26:42.376 UTC

Supported:
    Mode: Source | Sink | Source-Sink
    Pattern: PN9Q | PN13 | PN13Q | PN15 | PN15Q
    Direction: Line | System
    Error-Inject: None

Unsupported Combinations:
    None
RP/0/RP0/CPU0:ios#
```

2. Configure PRBS on the optics controller:

```
controller Optics0/0/0/18
  prbs mode source-sink pattern pn15q direction line
  sec-admin-state maintenance
!
```

3. Verify that PRBS is configured on the optics controller. Verify that PRBS mode, pattern, and direction are configured using the **show controllers optics R/S/I/P prbs-info** command:

```
RP/0/0/CPU0:#show controllers Optics 0/0/0/18 prbs-info
 PRBS ----------------------------------------------
Port:    Optics0/0/0/31


----------------------PRBS details-----------------
PRBS Test   : Enable
PRBS Mode   : Source-Sink
PRBS Pattern   : PN31Q
PRBS Status   : Locked
PRBS Direction   : Line
PRBS Configured Time  : 18 Aug 01:40:23 (1755506423 seconds)
PRBS First Lock Established Time: 18 Aug 01:40:26 (1755506426 seconds)
Counter last updated timestamp  : 18 Aug 01:47:16 (1755506836 seconds)

Lane       SNR(dBm)           MaxSNR(dBm)           ErrorCount
TotalBits               BER                  MaxBER
 1          22.78                23.11                11071
43558738601216         0.000e+00            0.000e+00
 2          22.04                22.32                132435
43546486903424         0.000e+00            0.000e+00
 3          22.62                22.78                53296
43589169331456         0.000e+00            0.000e+00
 4          22.18                22.32                307982
```

```
43580449870336         0.000e+00            0.000e+00

Lane      LockStatus           LostCount            FoundCount
LockTime(secs)     LockLostTimestamp
 1          Locked                 0                    1
417
 2          Locked                 0                    1
417
 3          Locked                 0                    1
417
 4          Locked                 0                    1
417
```

Configure PRBS on the coherent DSP controller

Provides instructions on how to configure PRBS on the coherent DSP controller in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

Follow this task to configure PRBS on the coherent DSP controller.

Use this procedure in the appropriate operating context for your deployment.

Before enabling PRBS, ensure that the interfaces are unshut.

1. Configure PRBS on the coherent DSP controller:

```
controller CoherentDsp0/0/0/14
  prbs mode source-sink pattern pn15q direction line
  sec-admin-state maintenance
```

2. Verify that PRBS is configured on the coherent DSP controller. Verify the current performance monitoring parameters of the coherent DSP controller in 30 second intervals using the **show controllers optics R/S/I/P pm current 30-sec prbs** command:

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/14 pm current 30-sec
prbs
Thu Oct 24 14:07:45.189 UTC

PRBS in the current interval [14:07:30 - 14:07:45 Thu Oct 24 2024]

PRBS current bucket type : Valid

EBC          : 0           Threshold : 0         TCA(enable)  : NO
 FOUND-COUNT  : 0            Threshold : 0         TCA(enable)  : NO
 LOST-COUNT   : 0            Threshold : 0         TCA(enable)  : NO

FOUND-AT-TS  : NULL
LOST-AT-TS   : NULL

CONFIG-PTRN  : PRBS_PATTERN_PN31
STATUS       : LOCKED

Last clearing of "show controllers OTU" counters never
RP/0/RP0/CPU0:ios#
```

Loopback on optical transceivers

Introduces loopback on optical transceivers and explains the core idea and technical context. Highlights the main characteristics and usage guidance needed before configuration.

You can now enable loopback functionality on the optical transceivers.

- Loopback Internal or Media Side Output Loopback
- Loopback Line or Media Side Input Loopback
- Host Loopback Internal or Host Side Input Loopback
- Host Loopback Line or Host Side Output Loopback

Table 28: Feature History Table

Feature Name	Release Information	Description
Loopback on Optical Transceivers	Release 25.4.1	Introduced in this release on: Fixed Systems (8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8011-32Y8L2H2FH • 8011-12G12X4Y-A/D
Loopback on Optical Transceivers	Release 25.1.1	Introduced in this release on: Fixed Systems (8700 [ASIC: K100], 8010 [ASIC: A100])(select variants only*) *This feature is supported on: • 8712-MOD-M • 8011-4G24Y4H-I
Loopback on Optical Transceivers	Release 24.4.1	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*) *This feature is now supported on: • 8212-48FH-M • 8711-32FH-M • 88-LC1-12TH24FH-E • 88-LC1-36EH • 88-LC1-52Y8H-EM

Feature Name	Release Information	Description
Loopback on Optical Transceivers	Release 7.11.1	You can now easily detect link failures between the optical transceiver and an external device such as a router by creating a loopback within the transceiver itself. Enabling loopback detects the fault in the physical or network connections, such as, traffic loss or a faulty optical transceiver. The loopback configuration allows incoming traffic within the transceiver to be redirected back to its source. By analyzing the loopback signals received at the source, it becomes possible to detect physical connectivity failures or network issues, such as packet loss or a malfunctioning transceiver. The feature introduces these changes: CLI: Modified the controller optics command by adding the keywords: · **host loopback internal** · **host loopback line** · **loopback internal** · **loopback line** The **information loopback** keyword is added to the show controller optics command. **YANG Data Model:** New XPaths for `Cisco-IOS-XR-controller-optics-cfg.yang` (see GitHub, YANG Data Models Navigator)

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. It is possible to enable loopback on both the host side and media side of the optical transceiver.

Note

Loopback can be performed only when the controller state is active (UP) and in the maintenance mode.

There are four types of loopback:

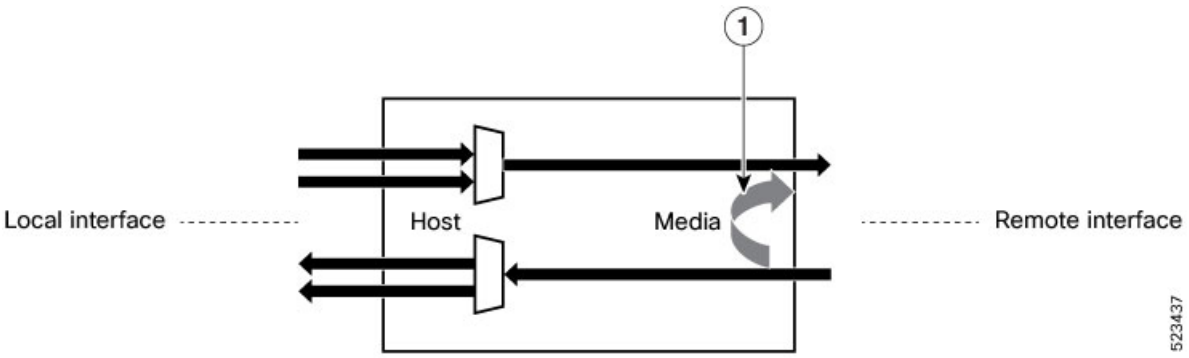
> **Note**
>
> Configuring the internal loopback brings up the host interface and configuring the line loopback brings up the remote interface.

Configure media side input loopback

Provides instructions on how to configure media side input loopback in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

In loopback line or media side input loopback, the signals received at the media side are looped back to the media side, indicating that the received data on the media is transmitted back to the media, that is, towards the remote interface. This is indicated by the arrow labeled as 1 in the illustration.

Figure 1: Media Side Input Loopback on the Optical Transceiver



1. Configure media side input loopback.

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#loopback line
Loopback is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

2. Display the running configuration for media side input loopback.

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 loopback line
!
```

3. Verify media side input loopback.

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
```

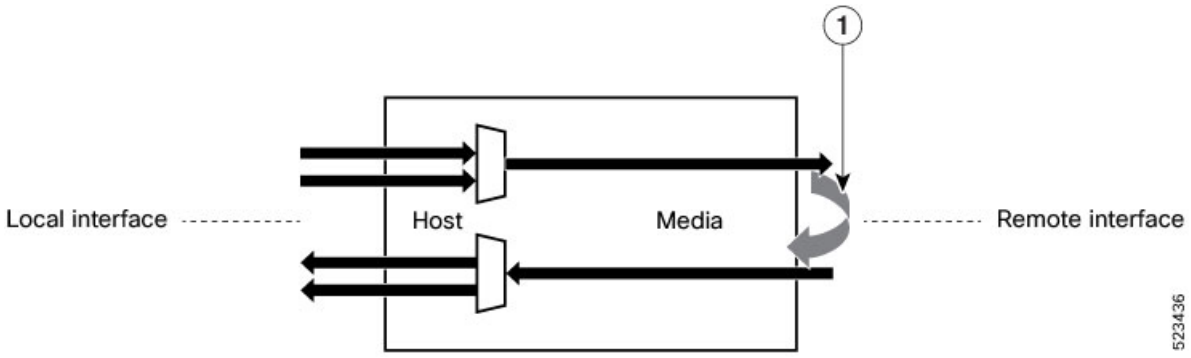
```
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: None
Loopback Media: Line

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Configure media side output loopback

Provides instructions on how to configure media side output loopback in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

In loopback internal or media side output loopback, the loopback signal originating from the NPU is looped back to the same NPU on the media or line side, towards the remote interface. This is indicated by the arrow labeled as 1 in the illustration.

Figure 2: Media Side Output Loopback on the Optical Transceiver



1. Configure media side output loopback.

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#loopback internal
Loopback is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

2. Display the running configuration for media side output loopback.

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 loopback internal
!
```

3. Verify media side output loopback.

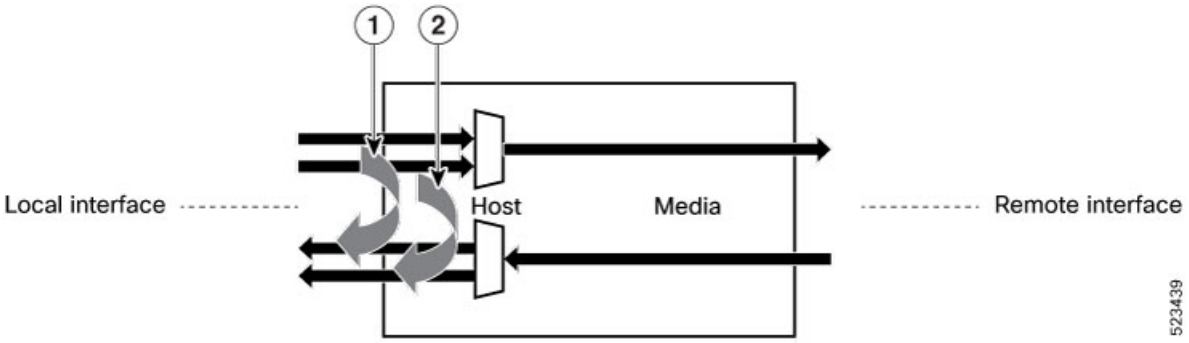
```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: None
Loopback Media: Internal

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Configure host side input loopback

Provides instructions on how to configure host side input loopback in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

In host loopback internal or host side input loopback, the loopback signal coming from the NPU is looped back to the NPU on the host, that is, towards the local interface. This is indicated by the arrows labeled as 1 and 2 in the illustration.

Figure 3: Host Side Input Loopback on the Optical Transceiver



1. Configure host side input loopback.

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#host loopback line
Loopback host is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

2. Display the running configuration for host side input loopback.

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
```

```
 secondary-admin-state maintenance
 host loopback line
!
```

3. Verify host side input loopback.

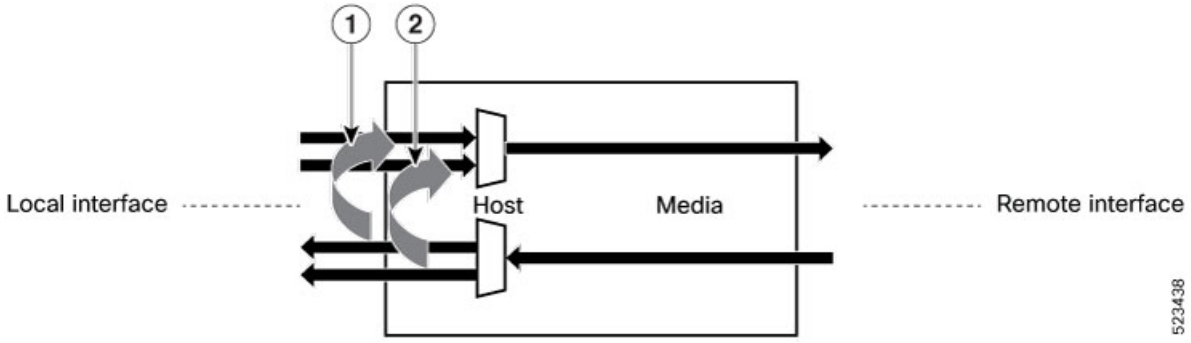
```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: Line
Loopback Media: None

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

Configure host side output loopback

Provides instructions on how to configure host side output loopback in a controlled workflow. Covers prerequisites, execution steps, and result checks needed for successful completion.

In host loopback line or host side output loopback, the signals received at the host side are looped back to the host side, indicating that the received data on the host is transmitted back to the host, that is, towards the local interface. This is indicated by the arrows labeled as 1 and 2 in the illustration.

Figure 4: Host Side Output Loopback on the Optical Transceiver



1. Configure host side output loopback.

```
Router#config
Router(config)#controller optics 0/0/0/9
Router(config-Optics)#secondary-admin-state maintenance
Router(config-Optics)#host loopback internal
Loopback host is a traffic-affecting operation
Router(config-Optics)#commit
Router(config-Optics)#end
```

2. Display the running configuration for host side output loopback.

```
Router#show run controller optics 0/0/0/9
controller Optics0/0/0/9
 secondary-admin-state maintenance
 host loopback internal
!
```

3. Verify host side output loopback.

```
Router#show controller optics 0/0/0/9
Controller State: Up
Transport Admin State: Maintenance
Laser State: On
LED State: Green
FEC State: FEC ENABLED
Optics Status:

Optics Type: QSFPDD 400G FR4
Wavelength: 1301.00 nm
Loopback Host: Internal
Loopback Media: None

Alarm Status:
----------------
Detected Alarms: None
LOS/LOL/Fault Status:
Performance Monitoring: Disable
```

5 Configuring QDD optical line system

Topics:

This chapter describes the Cisco QDD optical line system (OLS), including pluggable amplifier operation, DWDM deployment use cases, OTS controller configuration, safety controls, and OLS alarm troubleshooting.

It covers the Cisco QDD optical line system, a QSFP-DD pluggable optical amplifier for point-to-point DWDM links, including supported platforms, wavelength/frequency ranges, COM/Line subport behavior, and 8/16-channel deployment use cases.

It also provides configuration and verification procedures for OTS controllers, including amplifier gain or power mode, low power thresholds, OSRI, safety control mode, Force APR, and troubleshooting common OLS alarms.

QDD optical line systems

This topic explains how the QDD optical line system integrates amplification into a QSFP-DD pluggable module to interconnect routers or switches over a single-span point-to-point link, removing the need for an external optical line system chassis.

A QDD optical line system is a pluggable optical amplifier that

- integrates amplification directly into a QSFP-DD module, eliminating the need for external OLS chassis
- enables two routers or switches to interconnect and transport a limited number of coherent optical channels over a single span point-to-point link, and
- increases fiber bandwidth and transmission reach through compact, energy-efficient amplification.

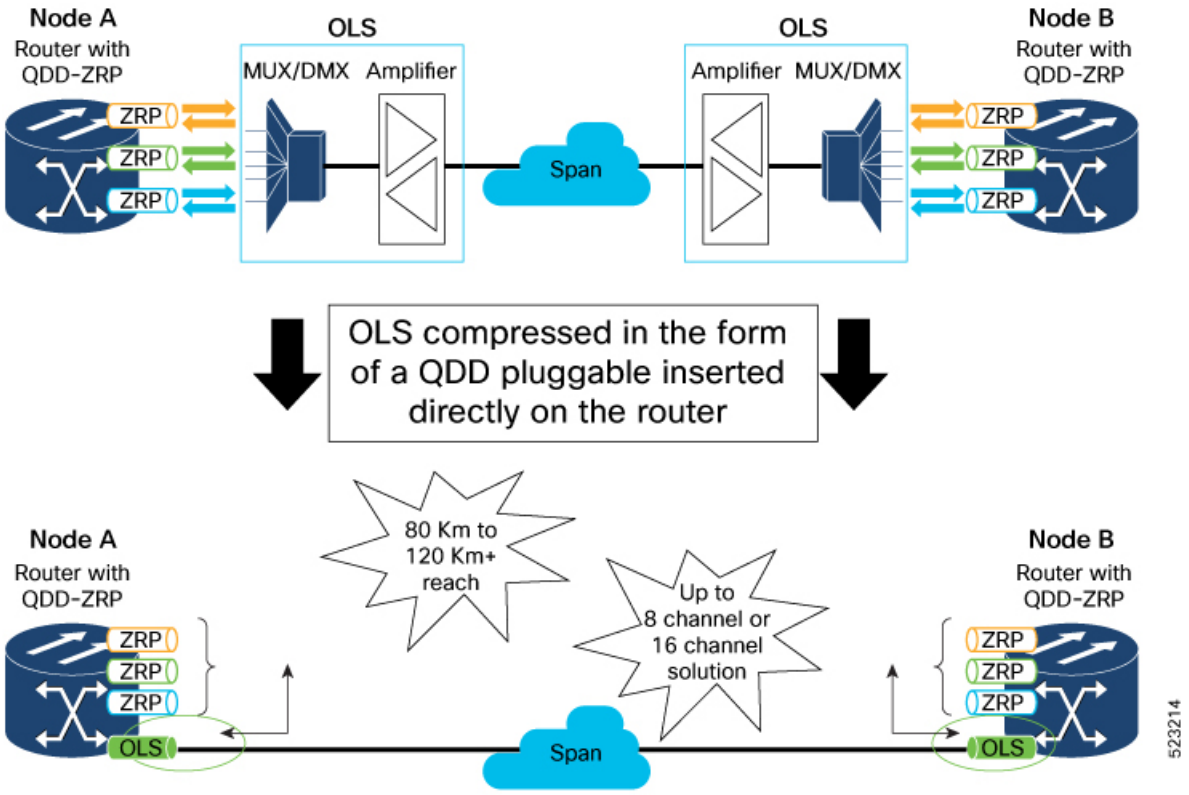
Table 29: Feature History Table

Feature Name	Release Information	Description
QDD Optical Line System	Release 25.3.1	The QDD Optical Line System (OLS) is a new pluggable optical amplifier that interconnects two routers or switches for transmitting traffic on a limited number of coherent optical channels over a single span point-to-point link. With the QDD OLS pluggable, it's now possible to obtain the functionality of amplification into a QSFP-DD module that can be plugged into a port of the line card. The benefits of this pluggable are: • Provides compact solution for amplification. • Provides extended reach. • Increases fiber bandwidth. • Lowers power dissipation.

Simplifying network infrastructure with QDD-based optical line systems

Traditional optical line systems (OLS) require separate chassis-based solutions—such as Cisco NCS 1000 or 2000 Series—with multiplexers/demultiplexers (MUX/DMX) and amplifiers. The QDD optical line system simplifies this model by combining amplification functionality into a QSFP-DD pluggable module, installed directly in compatible router or switch ports, with passive cables providing MUX/DMX capability.

Figure 5: QDD optical line system



Multi-channel optical line system

This topic explains the 8-channel and 16-channel optical line system configurations that the QDD OLS pluggable supports, including the cables, modules, port assignments, and node interconnections used to extend fiber bandwidth and span reach.

The QDD OLS pluggable enables transport of 8 or 16 coherent optical channels from DWDM optical modules installed in Cisco 8000 series routers. It interconnects optical modules with QDD OLS amplifiers to extend fiber bandwidth and span reach.

Supported cables for multi-channel optical line system

Table 30: Supported cables for multi-channel optical line system

Cable Name	Description	Purpose
ONS-BRK-CS-8LC	Dual fanout 1x8 cable-assembly with embedded passive splitter/coupler	Connects 8 modules to a QDD OLS pluggable
ONS-BRK-CS-16LC	Dual fanout 1x16 cable-assembly with embedded passive splitter/coupler	Connects 16 modules to a QDD OLS pluggable
ONS-CAB-CS-LC-5	Dual adapter patch-cord, CS-connector to LC-connector	Connects two QDD OLS pluggables on different nodes

8-channel optical line system

This section explains the 8-channel optical line system (OLS) that is achieved by using the QDD OLS pluggable and QDD-400G-ZR-S or QDD-400G-ZRP-S module.

Capabilities of the 8-channel optical line system

- Achieves up to 28 dB / 112 kilometer span reach in the 8-channel OLS configuration
- Increases fiber bandwidth utilization by up to 8 times compared to single-wavelength operation

Components for the 8-channel optical line system

This section explains the 8-channel optical line system (OLS) that is achieved by using the following:

- Four Cisco 8000 series router (represented as Node A, Node B, Node C, and Node D)
- Sixteen QDD-400G-ZR-S or QDD-400G-ZRP-S modules
- Two QDD OLS (ONS-QDD-OLS) pluggables
- Two ONS-BRK-CS-8LC breakout cables
- Two ONS-CAB-CS-LC-5 fiber optic cable

Node port assignments of the 8-channel optical line system

Table 31: Port assignments of the 8-channel optical line system

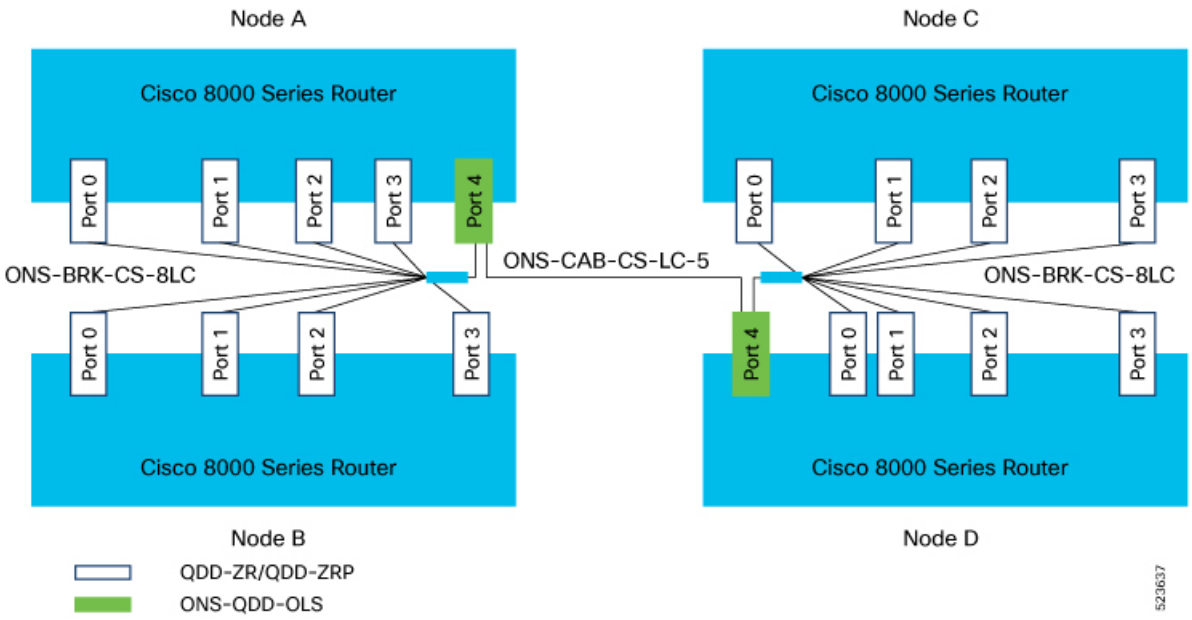
Node	Ports for QDD-400G-ZR-S/ZRP-S modules	Port for QDD OLS pluggable
A	0, 1, 2, 3	4
B	0, 1, 2, 3	-
C	0, 1, 2, 3	-
D	0, 1, 2, 3	4

Interconnections of the 8-channel optical line system

- Use an ONS-BRK-CS-8LC breakout cable to connect eight QDD-400G-ZR-S/ZRP-S modules (four from Node A and four from Node B) to the QDD OLS pluggable on Node A.
- Use a second ONS-BRK-CS-8LC breakout cable to connect eight QDD-400G-ZR-S/ZRP-S modules (four from Node C and four from Node D) to the QDD OLS pluggable on Node D.
- Use an ONS-CAB-CS-LC-5 fiber optic cable to connect the QDD OLS pluggables in Node A and Node D.

This image illustrates the 8-channel optical line system, component placement, and cabling.

Figure 6: 8-Channel Optical Line System



Supported wavelength or frequency configuration

Adhere to these wavelength and frequency ranges when you configure channels that use the ONS-BRK-CS-8LC or ONS-BRK-CS-16LC passive mux cables on the QDD OLS pluggable to keep each channel within the supported operating bands.

For each channel that uses an ONS-BRK-CS-8LC or ONS-BRK-CS-16LC passive or mux cable, configure the channel's wavelength or frequency according to the specified operating ranges listed in this table:

Table 32: QDD OLS operating signal wavelength range

Channel Spacing	Total Bandwidth	Wavelength		Frequency	
		Start	End	Start	End
8 channels - 200 GHz spaced 16 channels - 100 GHz spaced	19.2 nm 2.4 THz	1539.1 nm	1558.4 nm	192.375 THz	194.775 THz

Port mapping for QDD OLS pluggable

This topic explains how the COM and Line optical ports on the QDD OLS pluggable map to the optical transmission section (OTS) subport controllers, and identifies the booster and preamplifier associations used for configuration and troubleshooting.

The QDD OLS pluggable module includes two main physical ports—COM and Line—each represented by a separate optical transmission section (OTS) controller, known as subport 0 and subport 1. This mapping clarifies which optical ports and signal amplification functions are assigned to each controller. Use this mapping when configuring or troubleshooting the QDD OLS pluggable to ensure correct controller and port assignment for optical signal management.

Port and controller associations

This table shows how OTS controllers map to the QDD OLS optical ports:

Table 33: Mapping of OTS controller to the optical ports

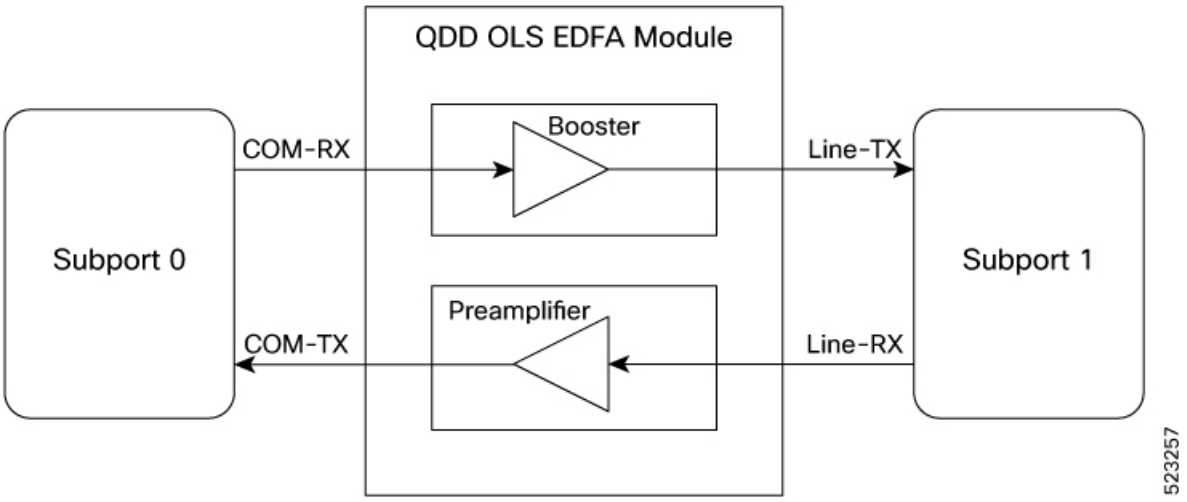
Controller	Optical Ports
ots R/S/I/P/0	COM-RX (booster input)
	COM-TX (preamplifier output)
ots R/S/I/P/1	LINE-RX (preamplifier input)
	LINE-TX (booster output)

Each physical port has both RX and TX interfaces:

- The COM port corresponds to subport 0.
- The Line port corresponds to subport 1.
- The booster amplifier gain is associated with the Line port (subport 1).
- The preamplifier gain is associated with the COM port (subport 0).

This figure hows how the COM side and Line side relate to OTS controllers and optical ports, helping you identify signal flow and controller associations within the module.

Port and controller mapping in QDD OLS pluggable



QDD OLS configurations

This topic explains the configurations available on the QDD OLS pluggable, including operational mode, low-threshold power, optical safety remote interlock (OSRI), safety control, and force automatic power reduction (APR), and links to the procedure for each.

You can configure the mode of operation, adjust the low-threshold power, set the optical safety remote interlock (OSRI), enable safety control, and configure force APR setting for the OLS pluggable.

Table 34: Summary of QDD OLS configurations

Configuration Item	Description	Configuration Procedure
Mode of operation, amplifier gain, and amplifier output power	Select operating mode, including amplifier gain/output power	Configure operational mode, amplifier gain, and amplifier output power
Low-threshold power	Adjust the minimum permissible optical power level	Configure low-threshold power
Optical safety remote interlock (OSRI)	Set and manage remote safety interlock functions	Configure optical safety remote interlock (OSRI)
Safety control	Enable or configure safety mechanisms for optical output	Configure safety control mode
Force APR setting	Configure forced automatic power recovery routines	Configure force APR

Configure the operational mode, amplifier gain, and amplifier output power

Use this procedure to set the operational mode of the QDD OLS pluggable amplifier to gain control or power control, and configure the corresponding amplifier gain or output power for your optical link.

- Check that you have the necessary privileges to use the router CLI.
- Determine the controller identifier for the OLS pluggable (for example, `0/0/2/1/0`).

Set up the operational mode of the OLS pluggable and configure either amplifier gain (gain control mode) or amplifier output power (power control mode) as required for your optical link system.

Use this task to configure an OLS (Optical Line System) pluggable's amplifier settings. Depending on deployment needs, you can enable gain control (to set a specific gain value) or power control (to set an output power value).

Follow these steps to configure the operational mode and amplifier settings for the OLS pluggable:

1. Configure the amplifier operational mode to **manual** and set the desired amplifier gain.

```
Router#config
Router(config)#controller ots 0/0/2/1/0
Router(config-Ots)#ampli-control-mode manual
Router(config-Ots)#egress-ampli-gain 150
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

2. Configure the amplifier operational mode to **powermode** and set the desired amplifier output power.

```
Router#config
Router(config)#controller ots 0/0/2/1/0
Router(config-Ots)#ampli-control-mode powermode
Router(config-Ots)#egress-ampli-power 50
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

3. Use the **show controllers ots** command to verify the configuration.

This example shows the controller output after setting the amplifier operational mode to **manual** and configuring the amplifier gain.

```
Router#show controllers ots 0/0/2/1/0

 Controller State: Up

 Transport Admin State: In Service

 LED State: Yellow

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

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

         Parameter Statistics:
         ---------------------
         Total Tx Power = -50.00 dBm
         Rx Signal Power = -50.00 dBm
         Tx Signal Power = -50.00 dBm
         Egress Ampli Gain = 0.0 dB
         Egress Ampli OSRI = OFF


         Configured Parameters:
         -------------
         Egress Ampli Gain = 20.0 dB
         Egress Ampli Power = 8.0 dBm
         Egress Ampli OSRI = OFF
         Ampli Control mode = Manual
         Rx Low Threshold = -20.0 dBm
         Tx Low Threshold = -5.0 dBm


         Temperature = 14.29 Celsius
         Voltage = 3.37 V

 Optical Module Details

         Optics type            : QDD DUAL EDFA
         Name                   : CISCO-ACCELINK
         OUI Number             : 00.00.00
         Part Number            : EDFA-211917-QDD
```

```
         Rev Number             : 19
         Serial Number          : ACW2631Z00X
         PID                    : ONS-QDD-OLS=
         Firmware Version       : 1.09
         Date Code(yy/mm/dd)    : 22/06/02
         Fiber Connector Type   : CS
```

This example shows the controller output after setting the amplifier operational mode to **powermode** and configuring the amplifier output power.

```
Router#show controllers ots 0/0/2/1/0
Thu Jun  1 08:56:37.236 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green

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

                Alarm Statistics:
                -----------------
                RX-LOS-P = 4
                 RX-LOC = 0
                 TX-POWER-FAIL-LOW = 1
                 INGRESS-AUTO-LASER-SHUT = 0
                 INGRESS-AUTO-POW-RED = 0
                 INGRESS-AMPLI-GAIN-LOW = 0
                 INGRESS-AMPLI-GAIN-HIGH = 0
                 EGRESS-AUTO-LASER-SHUT = 0
                 EGRESS-AUTO-POW-RED = 0
                 EGRESS-AMPLI-GAIN-LOW = 4
                 EGRESS-AMPLI-GAIN-HIGH = 1
                 HIGH-TX-BR-PWR = 0
                 HIGH-RX-BR-PWR = 0
                 SPAN-TOO-SHORT-TX = 0
                 SPAN-TOO-SHORT-RX = 0

                Parameter Statistics:
                ---------------------
                Total Tx Power = 5.00 dBm
                 Rx Signal Power = -22.29 dBm
                 Tx Signal Power = 4.99 dBm
                 Egress Ampli Gain = 3.2 dB
                Egress Ampli OSRI = OFF

                 Configured Parameters:
                -------------
                Egress Ampli Gain = 15.0 dB
                 Egress Ampli Power = 5.0 dBm
                Egress Ampli OSRI = OFF
                 Ampli Control mode = Power
                 Rx Low Threshold = -30.0 dBm
                 Tx Low Threshold = -5.0 dBm

                Temperature = 29.33 Celsius
                 Voltage = 3.34 V

Optical Module Details
```

```
                Optics type                     : QDD DUAL EDFA
                Name                            : CISCO-II-VI
                OUI Number                      : 00.90.65
                Part Number                     : 60P310001
                Rev Number                      : 01
                Serial Number                   : IFB26520001
                PID                             : ONS-QDD-OLS
                VID                             : VES1
                Firmware Version                : 0.10
                Date Code(yy/mm/dd)             : 23/02/22
                Fiber Connector Type            : CS
```

The OLS pluggable operates in the selected mode with amplifier parameters applied as configured. Running configuration and controller status commands show the updated operational mode and amplifier values.

Configure the low-threshold power

Use this procedure to set the receive (RX) and transmit (TX) low-threshold power values on the QDD OLS pluggable so the controller raises low-signal alarms when optical power falls below the configured limits.

- Check that you have the necessary privileges to use the router CLI.
- Determine the controller identifier for the OLS pluggable (for example, `0/0/2/1/0`).

Set the low-threshold power values (RX or TX) for the optical signal received or transmitted by an OLS pluggable.

Use this task when you need to adjust the OLS pluggable's sensitivity for detecting low optical signal levels. Configuring these thresholds helps ensure reliable operation by triggering warnings or alarms if signal power falls below the set value.

Follow these steps to configure the low-threshold power:

1. Configure the optical receive (RX) low power threshold on the OLS pluggable.

```
Router#config
Router(config)#controller ots 0/0/2/1/0
Router(config-Ots)#rx-low-threshold -200
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

> **Note**
>
> Use the `tx-low-threshold` command to set the transmit (TX) low power threshold.

2. Use the **show controllers ots** command to verify the configuration.

   This example shows the controller output after setting the low-threshold power on the OLS pluggable.

```
Router#show controllers ots 0/0/2/1/0
Thu Mar 23 21:33:49.862 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green
```

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

                Alarm Statistics:
                -----------------
                RX-LOS-P = 4
                 RX-LOC = 0
                 TX-POWER-FAIL-LOW = 1
                 INGRESS-AUTO-LASER-SHUT = 0
                 INGRESS-AUTO-POW-RED = 0
                 INGRESS-AMPLI-GAIN-LOW = 0
                 INGRESS-AMPLI-GAIN-HIGH = 0
                 EGRESS-AUTO-LASER-SHUT = 0
                 EGRESS-AUTO-POW-RED = 0
                 EGRESS-AMPLI-GAIN-LOW = 4
                 EGRESS-AMPLI-GAIN-HIGH = 1
                 HIGH-TX-BR-PWR = 0
                 HIGH-RX-BR-PWR = 0
                 SPAN-TOO-SHORT-TX = 0
                 SPAN-TOO-SHORT-RX = 0

                Parameter Statistics:
                ---------------------
                Total Tx Power = 16.72 dBm
                 Rx Signal Power = -22.29 dBm
                 Tx Signal Power = 16.53 dBm
                 Egress Ampli Gain = 14.7 dB
                Egress Ampli OSRI = OFF

                Configured Parameters:
                -------------
                Egress Ampli Gain = 15.0 dB
                 Egress Ampli Power = 4.0 dBm
                Egress Ampli OSRI = OFF
                 Ampli Control mode = Manual
                 Rx Low Threshold = -30.0 dBm
                 Tx Low Threshold = -5.0 dBm


                Temperature = 27.92 Celsius
                 Voltage = 3.33 V

Optical Module Details

                Optics type                 : QDD DUAL EDFA
                Name                        : CISCO-II-VI
                OUI Number                  : 00.90.65
                Part Number                 : 60P310001
                Rev Number                  : 01
                Serial Number               : IFB26520001
                PID                         : ONS-QDD-OLS
                VID                         : VES1
                Firmware Version            : 0.10
                Date Code(yy/mm/dd) : 23/02/22
                Fiber Connector Type    : CS
```

This example shows the controller output after setting the amplifier operational mode to **powermode** and configuring the amplifier output power.

```
Router#show controllers ots 0/0/2/1/0
Thu Jun  1 08:56:37.236 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green

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

                Alarm Statistics:
                -----------------
                RX-LOS-P = 4
                 RX-LOC = 0
                 TX-POWER-FAIL-LOW = 1
                 INGRESS-AUTO-LASER-SHUT = 0
                 INGRESS-AUTO-POW-RED = 0
                 INGRESS-AMPLI-GAIN-LOW = 0
                 INGRESS-AMPLI-GAIN-HIGH = 0
                 EGRESS-AUTO-LASER-SHUT = 0
                 EGRESS-AUTO-POW-RED = 0
                 EGRESS-AMPLI-GAIN-LOW = 4
                 EGRESS-AMPLI-GAIN-HIGH = 1
                 HIGH-TX-BR-PWR = 0
                 HIGH-RX-BR-PWR = 0
                 SPAN-TOO-SHORT-TX = 0
                 SPAN-TOO-SHORT-RX = 0

                Parameter Statistics:
                ---------------------
                Total Tx Power = 5.00 dBm
                 Rx Signal Power = -22.29 dBm
                 Tx Signal Power = 4.99 dBm
                 Egress Ampli Gain = 3.2 dB
                Egress Ampli OSRI = OFF

                 Configured Parameters:
                -------------
                Egress Ampli Gain = 15.0 dB
                 Egress Ampli Power = 5.0 dBm
                Egress Ampli OSRI = OFF
                 Ampli Control mode = Power
                 Rx Low Threshold = -30.0 dBm
                 Tx Low Threshold = -5.0 dBm

                Temperature = 29.33 Celsius
                 Voltage = 3.34 V

Optical Module Details

                Optics type                  : QDD DUAL EDFA
                Name                         : CISCO-II-VI
                OUI Number                   : 00.90.65
                Part Number                  : 60P310001
                Rev Number                   : 01
                Serial Number                : IFB26520001
```

```
                PID                             : ONS-QDD-OLS
                VID                             : VES1
                Firmware Version                : 0.10
                Date Code(yy/mm/dd)             : 23/02/22
                Fiber Connector Type            : CS
```

The specified RX and/or TX low-threshold power settings are applied to the OLS pluggable controller. The router will monitor for low signal conditions based on the configured thresholds.

Configure the optical safety remote interlock (OSRI)

Use this procedure to enable the optical safety remote interlock (OSRI) on the QDD OLS pluggable to safely limit amplifier output power during maintenance, debugging, or when the pluggable is not in use.

- Check that you have the necessary privileges to use the router CLI.
- Determine the controller identifier for the OLS pluggable (for example, `0/0/2/1/0`).
- Plan a maintenance window, if necessary, to avoid service disruption.

Ensure safety and proper maintenance by configuring the Optical Safety Remote Interlock (OSRI) on an OLS pluggable. OSRI enables safe shutdown of the amplifier during maintenance, debugging, or when the OLS pluggable is not in use.

The OSRI configuration limits the output power of the amplifier based on the input power when enabled. This safety mechanism protects both equipment and personnel during specific scenarios. With OSRI enabled, the output power can be a maximum of -15 dBm, based on the input power.

Follow these steps to configure the optical safety remote interlock (OSRI):

1. Enable the egress amplifier OSRI.

```
Router#config
Router(config)#controller ots 0/0/2/1/0
Router(config-Ots)#egress-ampli-osri on
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

2. Use the **show controllers ots** command to verify the configuration.

```
Router#show controllers ots 0/0/2/1/0

Thu Jun  1 09:04:10.335 UTC

Controller State: Up

Transport Admin State: In Service

LED State: Green

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

                Alarm Statistics:
                -----------------
                RX-LOS-P = 4
                 RX-LOC = 0
                 TX-POWER-FAIL-LOW = 1
                 INGRESS-AUTO-LASER-SHUT = 0
                 INGRESS-AUTO-POW-RED = 0
```

```
                 INGRESS-AMPLI-GAIN-LOW = 0
                 INGRESS-AMPLI-GAIN-HIGH = 0
                 EGRESS-AUTO-LASER-SHUT = 0
                 EGRESS-AUTO-POW-RED = 0
                 EGRESS-AMPLI-GAIN-LOW = 4
                 EGRESS-AMPLI-GAIN-HIGH = 1
                 HIGH-TX-BR-PWR = 0
                 HIGH-RX-BR-PWR = 0
                 SPAN-TOO-SHORT-TX = 0
                 SPAN-TOO-SHORT-RX = 0

                Parameter Statistics:
                --------------------
                Total Tx Power = -50.00 dBm
                 Rx Signal Power = -22.36 dBm
                 Tx Signal Power = -50.00 dBm
                 Egress Ampli Gain = 0.0 dB
                Egress Ampli OSRI = ON

                Configured Parameters:
                -------------
                Egress Ampli Gain = 15.0 dB
                 Egress Ampli Power = 5.0 dBm
                Egress Ampli OSRI = ON
                 Ampli Control mode = Power
                 Rx Low Threshold = -30.0 dBm
                 Tx Low Threshold = -5.0 dBm

                Temperature = 27.90 Celsius
                 Voltage = 3.34 V

Optical Module Details

                Optics type                     : QDD DUAL EDFA
                Name                            : CISCO-II-VI
                OUI Number                      : 00.90.65
                Part Number                     : 60P310001
                Rev Number                      : 01
                Serial Number                   : IFB26520001
                PID                             : ONS-QDD-OLS
                VID                             : VES1
                Firmware Version                : 0.10
                Date Code(yy/mm/dd)             : 23/02/22
                Fiber Connector Type            : CS
```

The optical safety remote interlock (OSRI) is enabled on the OLS pluggable. The amplifier output power is now limited for safe handling during maintenance and debugging.

Configure safety control mode

Use this procedure to enable safety control mode on subport 1 of the QDD OLS pluggable so the system normalizes the line transmit power and raises the automatic laser shutdown (ALS) and APR alarms when a loss of signal occurs on the line receive side.

- Check that you have the necessary privileges to use the router CLI.
- Determine the controller identifier for the OLS pluggable (for example, `0/0/2/1/0`).
- Identify the correct OTS (Optical Transport Section) controller and the relevant subport (must be subport 1).

Enable safety control mode on subport 1 of an OLS (Optical Line System) pluggable to automatically manage signal output power and trigger safety alarms under specified conditions.

Safety control mode ensures laser safety. If you set the safety control mode to **auto**, and a loss of signal (LOS) is detected on the line RX, the system automatically normalizes the line TX signal output power to 8 dBm and activates the ALS (Automatic Laser Shutdown) and APR (Automatic Power Reduction) alarms.

Follow these steps to configure the safety control mode for the OLS pluggable:

1. Enable safety control mode on the OLS pluggable (on subport 1):

```
Router#config
Router(config)#controller ots 0/0/2/1/1
Router(config-Ots)#egress-ampli-safety-control-mode auto
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

2. Use the **show controllers ots** command to verify the configuration.

   This example shows the controller output after enabling the safety control mode.

```
Router#show controllers ots 0/0/2/1/1

Controller State: Down

Transport Admin State: In Service

LED State: Yellow

               Alarm Status:
               -------------
               Detected Alarms:
                               RX-LOS-P
                               EGRESS-AUTO-LASER-SHUT
                               EGRESS-AUTO-POW-RED
                               EGRESS-AMPLI-GAIN-HIGH

               Alarm Statistics:
               -----------------
               RX-LOS-P = 12
                RX-LOC = 0
                TX-POWER-FAIL-LOW = 1
                INGRESS-AUTO-LASER-SHUT = 0
                INGRESS-AUTO-POW-RED = 0
                INGRESS-AMPLI-GAIN-LOW = 0
                INGRESS-AMPLI-GAIN-HIGH = 0
                EGRESS-AUTO-LASER-SHUT = 13
                EGRESS-AUTO-POW-RED = 13
                EGRESS-AMPLI-GAIN-LOW = 2
                EGRESS-AMPLI-GAIN-HIGH = 12
                HIGH-TX-BR-PWR = 0
                HIGH-RX-BR-PWR = 0
                SPAN-TOO-SHORT-TX = 0
                SPAN-TOO-SHORT-RX = 0

               Parameter Statistics:
               ---------------------
               Total Tx Power = 8.08 dBm
                Rx Signal Power = -50.00 dBm
                Tx Signal Power = 5.61 dBm
                Egress Ampli Gain = 28.9 dB
```

```
                Egress Ampli Safety Control mode = auto
                 Egress Ampli OSRI = OFF



                Configured Parameters:
                ------------
                Egress Ampli Gain = 23.0 dB
                 Egress Ampli Power = 3.0 dBm
                Egress Ampli Safety Control mode = auto
                 Egress Ampli OSRI = OFF
                 Ampli Control mode = Manual
                 Rx Low Threshold = -30.0 dBm
                 Tx Low Threshold = -5.0 dBm


                Temperature = 23.00 Celsius
                 Voltage = 3.36 V

Optical Module Details

                Optics type                     : QDD DUAL EDFA
                Name                            : CISCO-ACCELINK
                OUI Number                      : 00.00.00
                Part Number                     : EDFA-211917-QDD
                Rev Number                      : 24
                Serial Number                   : ACW2651Z001
                PID                             : ONS-QDD-OLS
                VID                             : VES1
                Firmware Version                : 2.04
                Date Code(yy/mm/dd)             : 22/12/27
                Fiber Connector Type            : CS
```

Safety control mode is enabled on subport 1 of the selected OLS pluggable. If LOS is detected on the line RX, the system will automatically normalize the TX output power to 8 dBm and trigger the ALS (automatic laser shutdown) and APR (automatic power reduction) safety alarms.

Configure force APR

Use this procedure to enable force automatic power reduction (APR) on the QDD OLS pluggable so the amplifier remains in the eye-safe APR state instead of returning to gain mode or power mode after a restart.

- Check that you have the necessary privileges to use the router CLI.
- Determine the controller identifier for the OLS pluggable (for example, `0/0/2/1/0`).

Automatic Power Reduction (APR) is an eye-safe output power level of the OLS pluggable when you restart the pluggable (amplifier).

If the OLS pluggable is in the APR state, then the default value for APR power is 8 dBm and APR timer is 9 seconds. When `Force APR` is configured or enabled, the OLS pluggable continues to remain in the APR state. If force APR is not configured or disabled, then the OLS pluggable remains in the Gain mode or Power mode, based on the `ampli-control-mode`user configuration.

Follow these steps to configure force APR:

1. Configure force APR on the OLS pluggable.

```
Router#config
Router(config)#controller ots 0/0/2/1/1
```

```
Router(config-Ots)#egress-ampli-force-apr on
Router(config-Ots)#commit
Router(config-Ots)#exit
Router(config)#exit
```

2. Use the **show controllers ots** command to verify the configuration.

```
Router#show controllers ots 0/0/2/1/1

Mon Jan  1 12:37:17.536 UTC

 Controller State: Up

 Transport Admin State: In Service

 LED State: Green

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

         Alarm Statistics:
         -----------------
         RX-LOS-P = 1
         RX-LOC = 0
         TX-POWER-FAIL-LOW = 0
         INGRESS-AUTO-LASER-SHUT = 0
         INGRESS-AUTO-POW-RED = 0
         INGRESS-AMPLI-GAIN-LOW = 0
         INGRESS-AMPLI-GAIN-HIGH = 0
         EGRESS-AUTO-LASER-SHUT = 0
         EGRESS-AUTO-POW-RED = 0
         EGRESS-AMPLI-GAIN-LOW = 5
         EGRESS-AMPLI-GAIN-HIGH = 0
         HIGH-TX-BR-PWR = 0
         HIGH-RX-BR-PWR = 0
         SPAN-TOO-SHORT-TX = 0
         SPAN-TOO-SHORT-RX = 0

         Parameter Statistics:
         ---------------------
         Total Tx Power = 17.49 dBm
         Rx Signal Power = -19.91 dBm
         Tx Signal Power = 17.47 dBm
         Egress Ampli Gain = 17.0 dB
         Egress Ampli OSRI = OFF
         Amplifier Control Mode = Manual
         Egress Ampli Force APR = ON


         Configured Parameters:
         -------------
         Egress Ampli Gain = 20.0 dB
         Egress Ampli Power = 8.0 dBm
         Egress Ampli OSRI = OFF
         Egress Ampli Force APR = OFF
         Ampli Control mode = Manual
         Egress Ampli Force APR = ON
         Rx Low Threshold = -30.0 dBm
         Tx Low Threshold = -5.0 dBm
```

```
        Temperature = 33.40 Celsius
        Voltage = 3.25 V

Optical Module Details

        Optics type             : QDD DUAL EDFA
        Name                    : CISCO-II-VI
        OUI Number              : 00.90.65
        Part Number             : 60P310001
        Rev Number              : 01
        Serial Number           : IIF26410004
        PID                     : ONS-QDD-OLS
        VID                     : VES1
        Firmware Version        : 1.00
        Date Code(yy/mm/dd)     : 22/10/10
        Fiber Connector Type    : CS
```

Types of OLS alarms and their troubleshooting procedures

This topic explains the main optical line system (OLS) alarm types that the QDD OLS pluggable reports and links to the troubleshooting procedure for each alarm.

This table summarizes the main OLS (Optical Line System) alarm types and provides brief descriptions of each, along with the associated troubleshooting procedure:

Table 35: Summary of OLS alarms and troubleshooting procedures

Alarm Type	Description	Troubleshooting Procedure
RX LOS (Loss of Signal)	Indicates that the receiver is not detecting any input optical signal.	Rx LOS troubleshooting
RX Power Fail Low	Receiver optical power is below the expected operational threshold.	RX Power Fail Low troubleshooting
TX Power Fail Low	Transmitter optical output power is lower than the required specification.	TX Power Fail Low troubleshooting
Egress Amplifier Gain Low	Amplifier output gain is below the configured minimum.	Egress Amplifier Gain Low troubleshooting
Egress Amplifier Gain High	Amplifier output gain exceeds the allowable maximum, potentially causing distortion.	Egress Amplifier Gain High troubleshooting
Egress Auto Laser Shut	System automatically shuts the laser to prevent damage or ensure safety due to detected fault.	Egress Auto Laser Shut troubleshooting
Egress Auto Power Red	System detects reduced power and triggers automatic power reduction or shutdown for protection.	Egress Auto Power Red troubleshooting

Clear the RX-LOS-P alarm

Use this procedure to clear the RX-LOS-P alarm, which the QDD OLS pluggable raises when the receiver loses the input optical signal.

Resolve the RX-LOS-P loss of signal alarm reported on the controller.

The RX-LOS-P alarm is raised when there is loss of signal.

Default Severity: Critical

Logical Object: Controller

Follow these steps to clear the RX-LOS-P alarm:

1. Verify the transmission (TX) at the peer end.
2. Check the fiber connections.

The RX-LOS-P alarm is cleared if the signal is restored to normal.

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the RX-POWER-FAIL-LOW alarm

Use this procedure to clear the RX-POWER-FAIL-LOW alarm, which the QDD OLS pluggable raises when the received optical power falls below the configured low-threshold value.

Resolve the RX-POWER-FAIL-LOW alarm reported on the controller.

The RX-POWER-FAIL-LOW alarm is raised when the RX power is below the configured low threshold values.

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

Logical Object: Controller

Follow these steps to clear the RX-POWER-FAIL-LOW alarm:

1. Verify the transmission (TX) at the peer end.
2. Check the fiber connections.
3. Increase the peer end gain or transmit-power value to obtain the RX power above the threshold.

The RX-POWER-FAIL-LOW alarm is cleared if the RX power is increased above the threshold value.

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the TX-POWER-FAIL-LOW alarm

Use this procedure to clear the TX-POWER-FAIL-LOW alarm, which the QDD OLS pluggable raises when the transmitted optical power falls below the configured low-threshold value.

Resolve the TX-POWER-FAIL-LOW alarm reported on the controller.

The TX-POWER-FAIL-LOW alarm is raised when the TX power is below the configured low threshold values.

Default Severity: Critical

Logical Object: Controller

Follow these steps to clear the TX-POWER-FAIL-LOW alarm:

Increase the gain or power configuration value to obtain the TX power above the threshold.

The TX-POWER-FAIL-LOW alarm is cleared if the TX power is increased above the threshold value.

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the EGRESS-AMPLI-GAIN-LOW alarm

Use this procedure to clear the EGRESS-AMPLI-GAIN-LOW alarm, which the QDD OLS pluggable raises when the measured amplifier gain falls below the configured gain value.

Resolve the EGRESS-AMPLI-GAIN-LOW alarm reported on the controller.

The EGRESS-AMPLI-GAIN-LOW alarm is raised when the actual gain of the OLS pluggable is lower than the configured gain value.

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

Logical Object: Controller

Follow these steps to clear the EGRESS-AMPLI-GAIN-LOW alarm:

Configure the gain value within the optimum range.

The EGRESS-AMPLI-GAIN-LOW alarm is cleared when the gain value is set within the optimum range.

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the EGRESS-AMPLI-GAIN-HIGH alarm

Use this procedure to clear the EGRESS-AMPLI-GAIN-HIGH alarm, which the QDD OLS pluggable raises when the measured amplifier gain exceeds the configured gain value.

Resolve the EGRESS-AMPLI-GAIN-HIGH alarm reported on the controller.

The EGRESS-AMPLI-GAIN-HIGH alarm is raised when the actual gain of the OLS pluggable is higher than the configured gain value.

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

Logical Object: Controller

Follow these steps to clear the EGRESS-AMPLI-GAIN-HIGH alarm:

Verify the RX and TX values and adjust the gain within the optimum working range.

The EGRESS-AMPLI-GAIN-HIGH alarm is cleared when the gain value is set within the optimum range.

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the EGRESS-AUTO-LASER-SHUT alarm

Use this procedure to clear the EGRESS-AUTO-LASER-SHUT alarm, which the QDD OLS pluggable raises when a loss of signal (LOS) occurs on the optical transmission section (OTS) line side, subport 1.

Resolve the EGRESS-AUTO-LASER-SHUT alarm reported on the controller.

The EGRESS-AUTO-LASER-SHUT alarm is raised when there is loss of signal (LOS) on the OTS line side (subport 1).

Default Severity: Not-Alarmed

Logical Object: Controller

Follow these steps to clear the EGRESS-AUTO-LASER-SHUT alarm:

1. Verify the fiber connections on the line side of the OLS pluggable.
2. Verify the gain or power on the line side of the peer end.

The EGRESS-AUTO-LASER-SHUT alarm is cleared when there is no loss of signal on the OTS line side (subport 1).

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.

Clear the EGRESS-AUTO-POW-RED alarm

Use this procedure to clear the EGRESS-AUTO-POW-RED alarm, which the QDD OLS pluggable raises when a loss of signal (LOS) occurs on the optical transmission section (OTS) line side, subport 1.

Resolve the EGRESS-AUTO-POW-RED alarm reported on the controller.

The EGRESS-AUTO-POW-RED alarm is raised when there is loss of signal (LOS) on the OTS line side (subport 1).

Default Severity: Not-Alarmed

Logical Object: Controller

Follow these steps to clear the EGRESS-AUTO-POW-RED alarm:

1. Verify the fiber connections on the line side of the OLS pluggable.
2. Verify the gain or power on the line side of the peer end.

The EGRESS-AUTO-POW-RED alarm is cleared when there is lno oss of signal (LOS) on the OTS line side (subport 1).

If the alarm does not clear, go to the Cisco Technical Support Website for additional troubleshooting assistance or contact Cisco TAC at 1 800 553-2447.