



Configuring 400G Digital Coherent Optics

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

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400G Digital Coherent Optics Overview

Coherent optics uses phase and amplitude to encode data, unlike PAM4 optics (Pulse amplitude modulation) which only uses amplitude. This allows coherent optics to be more resistant to noise and support long-haul distance transmission.

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

There are two variants of 400G Digital Coherent Optics.

- **ZR variant:** The QSFP-DD ZR variant complies with OIF MSA, allowing to provide compatibility with the equivalent component compliant with the same MSA standard. The key application for the ZR standard is allowing the transmission of a 400G wavelength in point-to-point topology up to a distance of 120 km.
- **ZR Plus variant:** The QSFP-DD OpenZR+ module complies with the OpenZR+ MSA. ZR+ pluggable coherent optics support regional to long-haul transmission of wavelengths with multiple amplification sites between endpoints. ZR+ supports multiple configuration options in terms of modulation scheme, shaping, and baud rates to support different network topologies and allows longest transmission distance (> 120 km).

400G Digital Coherent Optics Parameters

400G Digital Coherent Optics is configurable and allows configuration for the following parameters on the optics. For more information on configuration values, see [Table 1: 400G Digital Coherent QSFP-DD Traffic Configuration Values](#), on page 3:

- **Transponder/Muxponder mode:** This parameter is used to configure a media line at 400G and have maximum 4 clients on a host side.
- **DAC rate:** Digital Analog Conversion (DAC) parameter is used to set oversample (pulse shape enable or disable) and media line modem to Standard (S) or Enhanced (E).
- **FEC mode:** Forward Error Correction (FEC) supports cFEC or oFEC modes on a media line and is used for controlling errors during data transmission.
- **Modulation:** This parameter is used to control an optical wave or to encode information on a carrier optical wave. Supported modulations are 16 QAM, 8 QAM, and QPSK.
- **CD min/max:** Chromatic Dispersion (CD) is a phenomenon that is an important factor in fiber optic communications. It is the result of the different colors, or wavelengths, in a light beam arriving at their destination at slightly different times. This parameter is used to set range for the device to get good optical signal and frequency.

Muxponder-FEC-Modulation	CD default High (ps/nm)	CD default Low (ps/nm)	Max provisionable CD High (ps/nm)	Min. provisionable CD Low (ps/nm)
400G-400GZR-cFEC-16QAM	2400	-2400	2400	-2400
400G-400GZR-oFEC-16QAM	13000	-13000	52000	-52000
200G-200GZR-oFEC-QPSK	50000	-50000	100000	-100000
200G-200GZR-oFEC-8QAM	26000	-26000	100000	-100000
200G-200GZR-oFEC-16QAM	21000	-21000	85000	-85000
100G-100GZR-oFEC-QPSK	80000	-80000	160000	-160000

- **Tx power:** The transmitted optical power refers to the output optical power of the light source at the transmitting end of the optical module, and the received optical power refers to the input optical power of the light source at the receiving end of the optical module.

Each optical module has its own transmitting (TX) power range. You can change the transmitting (TX) power value based on the module capability.

Optical Module	Trunk Speed ^{1,3}	Optical Transmit Power (Tx) Shaping	Interval	Supported Range of Optical Transmit Power (Tx) Values (in units of 0.1dBm) ²		
				Minimum Value	Maximum Typical Value	Maximum Worst Case Value
QDD400GZRS	400G	No	1	-150	-100	-100

Optical Module	Trunk Speed ^{1,3}	Optical Transmit Power (Tx) Shaping	Interval	Supported Range of Optical Transmit Power (Tx) Values (in units of 0.1dBm) ²		
				Minimum Value	Maximum Typical Value	Maximum Worst Case Value
QDD400GZRPS	400G	Yes	1	-150	-110	-130
QDD400GZRPS	200G	Yes	1	-150	-90	-105
QDD400GZRPS	100G	Yes	1	-150	-59	-75

- **Frequency:** In fiber-optic communications, wavelength-division multiplexing (WDM) is a technology which multiplexes several Optical Carrier signals onto single optical fiber by using different wavelengths (i.e., colors) of laser light. This technique enables bidirectional communications over a single strand of fiber, also called wavelength-division duplexing, and multiplication of capacity. This parameter is used to set any frequency on ITU C-BAND table. For more information on the values, see [ITU C-BAND table](#) section.

For more information on configuration, see [Configuring 400G Digital Coherent Optics on ZR Module, on page 7](#) section.

The following table contains the possible traffic configuration values for the 400G Digital Coherent QSFP-DD optical modules, in the Transponder (TXP) and Muxponder (MXP) mode:

Table 1: 400G Digital Coherent QSFP-DD Traffic Configuration Values

Client Speed	Trunk Speed	Frequency	FEC	Modulation	DAC Rate
QDD-400G-ZR-S Transponder and Muxponder Configuration Values					
1 client, 400G speed	1 trunk, 400G	C-Band, 196.1 To 191.3 THz	cFEC	16 QAM	1x1
QDD-400G-ZRP-S Transponder and Muxponder Configuration Values					
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	cFEC	16 QAM	1x1
4X100GA UI-2					
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	cFEC	16 QAM	1x1.5
4X100GA UI-2					
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	oFEC	16 QAM	1x1.25
4X100GA UI-2					

Client Speed	Trunk Speed	Frequency	FEC	Modulation	DAC Rate
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	oFEC	16 QAM	1x2
4X100GA UI-2					
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	oFEC	16 QAM	1x1
4X100GA UI-2					
1X400GA UI-8	1 trunk, 400G speed	C-Band, 196.1 To 191.3 THz	oFEC	16 QAM	1x1.5
4X100GA UI-2					
2X100GA UI-2	1 trunk, 200G speed	C-Band, 196.1 To 191.3 THz	oFEC	QPSK	1x1.5
				QPSK	1
100G	1 trunk, 100G speed	C-Band, 196.1 To 191.3 THz	oFEC	QPSK	1x1.5

Traffic Configuration Parameters

The following table displays the different traffic configuration supported:

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate
400G-TXP	1 Client, 400G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1,1x1.25, 1x1.5 and 1x2
400G-TXP	1 Client, 400G speed	1 trunk, 400G speed	16 QAM	cFEC	1x1, and 1x1.5
4x100G- MXP	4 clients, 100G speed	1 trunk, 400G speed	16 QAM	oFEC	1x1, 1x1.25, 1x1.5, and 1x2
4x100G- MXP	4 clients, 100G speed	1 trunk, 400G speed	16 QAM	cFEC	1x1, and 1x1.5
2x100G-MXP	2 clients, 100G speed	1 trunk, 200G speed	QPSK	oFEC	1x1, and 1x1.5
			8 QAM		1x1.25
			16 QAM		1x1.25

TXP/MXP	Client	Trunk	Modulation	FEC	DAC Rate
1x100G-MXP	1 client, 100G speed	1 trunk, 100G speed	QPSK	oFEC	1x1.5

**Note**

- ZR supports only 1x400G transponder.
- ZR supports only 1x1 DAC rate.
- For configuring 4x100, and 2x100 muxponder, you need to perform interface breakout prior to ZRP configuration. For more information, see [Configuring Breakout, on page 11](#) section.

Guidelines and Limitations for 400G Digital Coherent Optics

The 400G Digital Coherent Optics has the following guidelines and limitations:

- Beginning with Cisco NX-OS Release 10.4(1)F, 400G Digital Coherent Optics (DCO) support is provided on Cisco Nexus 9300-GX2 and 9408 platform switches.
- Beginning with Cisco NX-OS Release 10.4(2)F, QDD-400G-ZR-S and QDD-400G-ZRP-S optics support is provided on the following switches and line cards:
 - Cisco Nexus 93600CD-GX, 9316D-GX switches and Cisco Nexus 9508/9504 switches with X9716D-GX line cards.
 - Cisco Nexus 9804/9808 switches with Cisco Nexus X98900CD-A and X9836DM-A line cards.
- The 1x100G transponder and 2x100G muxponder modes are not supported on Cisco Nexus 93600CD-GX, 9316D-GX switches and Cisco Nexus X98900CD-A and X9836DM-A line cards.
- QDD-400G-ZR-S optics doesn't support interface breakout.
- QDD-400G-ZRP-S optics supports interface breakout. There are multiple breakouts maps supported for ZRP optics.
- Use the breakout map **100g-2x-pam4** option for the 2x100 breakout interface.
- For better system stability and efficiency, it is recommended to avoid frequent insertion and removal of DCO. For OIR, you must wait for at least one minute between back-to-back transceiver insertion and removal.
- The optics maximum link-up time for the ZR/ZRP module can be up to 180 seconds.
- To recover any Coherent optics port or MACsec port affected because of power restrictions, you must disable an active ZR/ZRP port, or unconfigure an existing MACsec session, and flap the affected port.

**Note**

N9K-C9332D-H2R switch does not have any limitation on number of MACSec sessions.

- For some of the platforms, there is hardware power limitation due to which there is restriction on usage of the number of 400Gig-ZR/ZRP transceivers and MACsec configurations together.
- Beginning with Cisco NX-OS Release 10.4(2)F, the 2X100 muxponder supports 8QAM and 16QAM modulation.
- Beginning with Cisco NX-OS Release 10.4(3)F, the following transceivers are supported on Cisco Nexus C93400LD-H1 and N9K-C9332D-H2R switch:
 - QDD-400G-ZRP-S
 - QDD-400G-ZR-S



Note On N9K-C93400LD-H1, QDD-400G-ZRP-S and QDD-400G-ZR-S transceivers can be inserted in either odd or even numbered ports. However, on N9K-C9332D-H2R switch, the QDD-400G-ZRP-S and QDD-400G-ZR-S transceivers must be inserted in odd numbered ports only. Inserting these transceivers to even numbered ports puts the port into error state due to hardware thermal limitation.

- **For DP04QSDD-HE0**
 - From Release 10.4(3)F, DP04QSDD-HE0 is supported only in 1x400 and 1x100 mux pponder modes on GX/GX2 platform and X98900CD-A and X9836DM-A line cards, with the following dac rates.
 - dac_rate 1x1_50 with CFEC
 - dac_rates 1x1_25 and 1x1_50 with OFEC mode
 - The optics maximum link-up time can be up to 240 seconds.
 - From Cisco NX-OS Release 10.5(1)F, DP04QSDD-HE0(Bright-ZR) is supported in 4x100 and 2x100 mux pponder modes on GX/GX2 platform and X98900CD-A and X9836DM-A line cards.
- The restrictions are as summarized below:
 - **For Cisco Nexus 9364D-GX2A:**
 - When system has 9 or more MACsec sessions configured and no ZR/ZRP transceiver is present, inserting a ZR/ZRP transceiver disables the corresponding port. The maximum number of MACsec sessions allowed is 16 when no ZR/ZRP transceiver is present.
 - When system has 9 or more ZR/ZRP transceivers in active state and no MACsec session exists, bringing-up of a new MACsec session will fail. The maximum number of active ZR/ZRP transceivers is 13 when no MACsec session is present in the system. Inserting a 14th ZR/ZRP transceiver disables the corresponding port.
 - When both MACsec sessions and active ZR/ZRP transceivers coexist, the combined limit is up to 8 MACsec session and up to 8 ZR/ZRP transceivers. Configuring the 9th MACsec session or adding the 9th active ZR/ZRP will disable the corresponding port.
 - The ZR/ZRP transceivers are supported only on the odd numbered front ports of this platform. Inserting a ZR/ZRP transceiver into an even numbered front port puts the port into error state.

- **For Cisco Nexus 9332D-GX2B:**

- When system has 5 or more MACsec sessions configured and no active ZR/ZRP transceiver is present, adding a ZR/ZRP transceiver disables the corresponding port. The maximum number of MACsec sessions allowed is 8 when no active ZR/ZRP transceiver is present. Configuring a 9th MACsec session disables the corresponding port.
- When system has 5 or more active ZR/ZRP transceivers inserted and no MACsec session exists, bringing-up of a new MACsec session will fail. The maximum number of active ZR/ZRP transceivers is 8 when no MACsec session is present in the system. Inserting a 9th ZR/ZRP transceiver disables the corresponding port.
- When both MACsec sessions and active ZR/ZRP transceivers coexist, the combined limit is up to 4 MACsec session and up to 4 active ZR/ZRP transceivers. Configuring the 5th MACsec session or inserting the 5th ZR/ZRP disables the corresponding port.
- The ZR/ZRP transceivers are supported on any of the front ports of this platform.

- **For Cisco Nexus 9348D-GX2A:**

- The ZR/ZRP transceivers are supported on the following 24 front ports of this platform:
 - 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 26, 29, 32, 35, 38, 41, 44, 47



Note Inserting ZR/ZRP transceivers to other front ports that are not in the above list puts the port into error state.

- **For Cisco Nexus 9408:**

- System can support up to 32 active ZR/ZRP transceivers irrespective of whether the MACsec configuration is present or not.
- The ZR/ZRP transceivers are supported on only the Cisco Nexus X9400-8D module.

Configuring 400G Digital Coherent Optics on ZR Module

You can configure the coherent optics on the ZR module for DAC rate, muxponder mode, modulation, and FEC parameters.

Before you begin

Ensure that the following points are taken care during DCO configuration:

- Without insertion of ZR optics, the coherent optics configuration will not work.
- When we configure specific zr-optics on the ZRP module, the coherent configuration will not work.
- When we configure specific zrp-optics on the ZR module, the coherent configuration will not work.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** {*type slot/port*}
3. **[no] zr-optics fec** *fec_val* **muxponder** *mxp_val* **modulation** *mod_val* **dac-rate** *dr_val*
4. (Optional) **zr-optics cd-min** *cd_min* **cd-max** *cd_max*
5. (Optional) **zr-optics transmit-power** *tx_pwr*
6. (Optional) **zr-optics dwdm-carrier** [**100MHz-grid frequency** *freq_100mhz_val* | **100GHz-grid frequency** *freq_100ghz_val* | **50GHz-grid** { **frequency** *freq* | **itu-channel** *itu-chan* | **wavelength** *wavelen* }]

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	interface ethernet { <i>type slot/port</i> }	Specifies an interface to configure, and enters interface configuration mode.
Step 3	[no] zr-optics fec <i>fec_val</i> muxponder <i>mxp_val</i> modulation <i>mod_val</i> dac-rate <i>dr_val</i> Example: <pre>switch(config-if)# zr-optics fec cFEC muxponder 1x400 modulation 16QAM dac-rate 1x1</pre>	Configures the following parameters on ZR optics. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section: <ul style="list-style-type: none"> • FEC • Muxponder • Modulation • DAC
Step 4	(Optional) zr-optics cd-min <i>cd_min</i> cd-max <i>cd_max</i> Example: <pre>switch(config-if)# zr-optics cd-min -2300 cd-max 2300</pre>	Configures chromatic dispersion on coherent optics with set minimum and maximum values. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section. Note When you configure the maximum and minimum values of CD for any data rate, ensure that the minimum difference between the configured values is equal to or greater than 1000 ps/nm.
Step 5	(Optional) zr-optics transmit-power <i>tx_pwr</i> Example: <pre>switch(config-if)# zr-optics transmit-power -190</pre>	Sets the transmit power of the optical signal. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section.

	Command or Action	Purpose
		<p>Note The Tx power parameter is best effort configuration which programs user configuration to hardware. However, the ZR/ZRP transceiver firmware will only use it as reference and calculates the actual optimal Tx power value at run time, which may or may not be same as an user configuration.</p>
Step 6	<p>(Optional) zr-optics dwdm-carrier [100MHz-grid frequency <i>freq_100mhz_val</i> 100GHz-grid frequency <i>freq_100ghz_val</i> 50GHz-grid { frequency <i>freq</i> itu-channel <i>itu-chan</i> wavelength <i>wavelen</i> }]</p> <p>Example:</p> <pre>switch(config-if)# zr-optics dwdm-carrier 100MHz-grid frequency 1913000</pre>	<p>Configures frequency based on the configured frequency (100MHz-grid or 100GHz-grid or 50GHz-grid). The 50GHz-grid provide additional ITU-channel, or wavelength parameters. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section.</p> <p>Note If the frequency is configured using 50Ghz-grid wavelength or 50Ghz-grid itu-channel option, the system calculates the frequency for a given wavelength or ITU-channel and use it to program the hardware.</p>

Configuring 400G Digital Coherent Optics on ZRP Module

You can configure the coherent optics on the ZRP module for DAC rate, muxponder mode, modulation, and FEC parameters.

Before you begin

Ensure that the following points are taken care during DCO configuration:

- Without insertion of ZRP optics, the coherent optics configuration will not work.
- When we configure specific zr-optics on the ZRP module, the coherent configuration will not work.
- When we configure specific zrp-optics on the ZR module, the coherent configuration will not work.

SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** {*type slot/port*}
3. [**no**] **zrp-optics fec** *fec_val* **muxponder** *mxp_val* **modulation** *mod_val* **dac-rate** *dr_val*
4. (Optional) **zrp-optics cd-min** *cd_min* **cd-max** *cd_max*
5. (Optional) **zrp-optics transmit-power** *tx_pwr*
6. (Optional) **zrp-optics dwdm-carrier** [**100MHz-grid frequency** *freq_100mhz_val* | **100GHz-grid frequency** *freq_100ghz_val* | **50GHz-grid** { **frequency** *freq* | **itu-channel** *itu-chan* | **wavelength** *wavelen* }]

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	interface ethernet <i>{type slot/port}</i> Example: <pre>switch(config)# interface ethernet 1/3 switch(config-if)#</pre>	Specifies an interface to configure, and enters interface configuration mode.
Step 3	[no] zrp-optics fec <i>fec_val</i> muxponder <i>mxp_val</i> modulation <i>mod_val</i> dac-rate <i>dr_val</i> Example: <pre>switch(config-if)# zrp-optics fec cFEC muxponder 1x400 modulation 16QAM dac-rate 1x1</pre>	Configures the following parameters on ZRP optics. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section: <ul style="list-style-type: none"> • FEC • Muxponder • Modulation • DAC
Step 4	(Optional) zrp-optics cd-min <i>cd_min</i> cd-max <i>cd_max</i> Example: <pre>switch(config-if)# zrp-optics cd-min -2400 cd-max 2400</pre>	Configures chromatic dispersion on coherent optics with set minimum and maximum values. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section. Note 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.
Step 5	(Optional) zrp-optics transmit-power <i>tx_pwr</i> Example: <pre>switch(config-if)# zrp-optics transmit-power -190</pre>	Sets the transmit power of the optical signal. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section. Note The Tx power parameter is best effort configuration which programs user configuration to hardware. However, the ZR/ZRP transceiver firmware will only use it as reference and calculates the actual optimal Tx power value at run time, which may or may not be same as an user configuration.
Step 6	(Optional) zrp-optics dwdm-carrier [100MHz-grid frequency <i>freq_100mhz_val</i> 100GHz-grid frequency <i>freq_100ghz_val</i> 50GHz-grid { frequency <i>freq</i> itu-channel <i>itu-chan</i> wavelength <i>wavelen</i> }] Example:	Configures frequency based on the configured frequency (100MHz-grid or 100GHz-grid or 50GHz-grid). The 50GHz-grid provide additional ITU-channel, or wavelength parameters. For more information, see 400G Digital Coherent Optics Parameters, on page 2 section.

	Command or Action	Purpose
	<code>switch(config-if)# zrp-optics dwdm-carrier 100MHz-grid frequency 1913000</code>	Note If the frequency is configured using 50Ghz-grid wavelength or 50Ghz-grid itu-channel option, the system calculates the frequency for a given wavelength or ITU-channel and use it to program the hardware.

Configuring Breakout

You can configure breakout on the interface for ZRP optics.

SUMMARY STEPS

1. **configure terminal**
2. **interface breakout module** *{slot}* **port** *{port_num}* **map** *{breakoutmap}*
3. **interface ethernet** *{type slot/port/sub-port}*
4. **[no] zrp-optics fec** *fec_val* **muxponder** *mxp_val* **modulation** *mod_val* **dac-rate** *dr_val*
5. (Optional) **show running interface ethernet** *{type slot/port}*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters global configuration mode.
Step 2	interface breakout module <i>{slot}</i> port <i>{port_num}</i> map <i>{breakoutmap}</i> Example: <code>switch(config)# interface breakout module 1</code> <code>port 3 map 100g-2x-pam4</code>	Configures interface breakout
Step 3	interface ethernet <i>{type slot/port/sub-port}</i> Example: <code>switch(config)# interface ethernet 1/3/1</code> <code>switch(config-if)#</code>	Specifies an interface to configure, and enters interface configuration mode.
Step 4	[no] zrp-optics fec <i>fec_val</i> muxponder <i>mxp_val</i> modulation <i>mod_val</i> dac-rate <i>dr_val</i> Example: <code>switch(config-if)# zrp-optics fec oFEC muxponder</code> <code>2x100 modulation QPSK dac-rate 1x1</code>	Configures the ZRP configuration on the breakout interface.

	Command or Action	Purpose
Step 5	(Optional) show running interface ethernet <i>{type slot/port}</i> Example: switch(config-if)# show running interface ethernet1/3/1	Displays the configuration information set on the breakout interface.

Verifying 400G Digital Coherent Optics

To verify the 400G Digital Coherent Optics configuration information, perform one of the following tasks:

Command	Purpose
show running interface ethernet <i>{type slot/port}</i>	Displays the running configuration information of the interfaces configured to validate the coherent ZR/ZRP optics.
show interface ethernet <i>{type slot/port}</i> transceiver details	Displays the coherent ZR/ZRP optics configuration information of the interfaces.

Configuration Examples for 400G Coherent Optics

The following example show the running configuration with ZR/ZRP optics:

```
switch(config-if)# show running interface ethernet1/3

!Command: show running-config interface Ethernet1/3
!Running configuration last done at: Mon Aug 28 12:16:40 2023
!Time: Mon Aug 17 12:17:40 2023

version 10.3(2) Bios:version 01.10

interface Ethernet1/3
  zr-optics fec cFEC muxponder 1x400 modulation 16QAM dac-rate 1x1
  zr-optics cd-min -2400 cd-max 2400
  zr-optics transmit-power -190
  zr-optics dwdm-carrier 100MHz-grid frequency 1931000
  no shutdown
```

The following example shows how to verify the coherent configuration:

```
switch# show interface ethernet1/3 transceiver details
Ethernet1/3
  transceiver is present
  type is QSFP-DD-400G-ZR-S
  name is CISCO-ACACIA
  part number is DP04QSDD-E20-190
  revision is A
  serial number is ACA254700F0
  nominal bitrate is 425000 MBit/sec per channel
  cisco id is 0x18
  cisco extended id number is 21
  cisco part number is 10-3495-01
  cisco product id is QDD-400G-ZR-S
```

```

cisco version id is V01
firmware version is 61.10
Link length SMF is 12 km
Nominal transmitter wavelength is 1547.70 nm
Wavelength tolerance is 166.550 nm
host lane count is 8
media lane count is 1
max module temperature is 80 deg C
min module temperature is 0 deg C
min operational voltage is 3.12 V
vendor OUI is 0x7cb25c
date code is 211125
clei code is INUIANYEAA
power class is 8 (>14 W maximum)
max power is 20.00 W
near-end lanes used none
far-end lane code for 8 lanes Undefined
media interface is unknown value 0x10
Advertising code is Optical Interfaces: SMF
Host electrical interface code is 400GAUI-8 C2M (Annex 120E)

```

FEC State: FEC cFEC

Optics Status

Optics Type: QSFP-DD-400G-ZR-S

DWDM carrier Info: Frequency: 193.10 THz

Alarm Status

DAC Rate: 1x1

THRESHOLD VALUES

Configured Tx Power: -400 dBm

Modulation Type: 16QAM

Muxponder Type: 1x400

Configured CD-MIN: -2400 ps/nm CD-MAX: 2400 ps/nm

Lane Number:1 Network Lane

	Current Measurement	Alarms		Warnings	
		High	Low	High	Low
Temperature	36.00 C	80.00 C	-5.00 C	75.00 C	15.00 C
Voltage	3.36 V	3.46 V	3.13 V	3.43 V	3.16 V
Current	N/A	N/A	N/A	N/A	N/A
Tx Power	N/A	0.00 dBm	-18.23 dBm	-2.00 dBm	-16.02 dBm
Rx Power	N/A	1.99 dBm	-23.01 dBm	0.00 dBm	-20.00 dBm
Transmit Fault Count = 0					

Note: ++ high-alarm; + high-warning; -- low-alarm; - low-warning

The following sample shows how to configure the breakout configuration on the breakout interface:

```

switch(config)# interface ethernet 1/3/1
switch(config-if)# zrp-optics fec ofec muxponder 2x100 modulation QPSK dac-rate 1x1

switch (config-if)# show running interface ethernet1/3/1

```

```

interface Ethernet1/3/1
zrp-optics fec oFEC muxponder 2x100 modulation QPSK dac-rate 1x1
zrp-optics cd-min -50000 cd-max 50000
zrp-optics transmit-power -190
zrp-optics dwdm-carrier 100MHz-grid frequency 1913000
no shutdown

```

