CHAPTER 8

Optical Add/Drop Cards

This chapter describes optical add/drop cards used in Cisco ONS 15454 dense wavelength division multiplexing (DWDM) networks. For installation and card turn-up procedures, refer to the *Cisco ONS 15454 DWDM Procedure Guide*. For card safety and compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.

Note The cards described in this chapter are supported on the Cisco ONS 15454, Cisco ONS 15454 M6, Cisco ONS 15454 M2 platforms, unless noted otherwise.

Note Unless otherwise specified, “ONS 15454” refers to both ANSI and ETSI shelf assemblies.

Chapter topics include:

8.1 Card Overview

The card overview section contains card overview, software compatibility, interface class, and channel allocation information for optical add/drop cards.

Note Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 shelf assembly. The cards are then installed into slots displaying the same symbols. For a list of slots and symbols, see the "Card Slot Requirements" section in the *Cisco ONS 15454 Hardware Installation Guide*.

Optical add/drop cards are divided into two groups: band optical add/drop multiplexer (OADM) cards and channel OADM cards. Band OADM cards add and drop one or four bands of adjacent channels. The cards in this chapter, including the 4-Band OADM (AD-4B-xx.x) and the 1-Band OADM (AD-1B-xx.x)

are utilized only in the C band. Channel OADM cards add and drop one, two, or four adjacent channels; they include the 4-Channel OADM (AD-4C-xx.x), the 2-Channel OADM (AD-2C-xx.x), and the 1-Channel OADM (AD-1C-xx.x).

Note For information about L band add and drop capability, see Chapter 9, "Reconfigurable Optical Add/Drop Cards."

8.1.1 Card Summary

Table 8-1 lists and summarizes the functions of the optical add/drop cards.

Table 8-1 Optical Add/Drop Cards

Card	Port Description	For Additional Information
AD-1C-xx.x	The AD-1C-xx.x card has three sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "8.3 AD-1C-xx.x Card" section on page 8-11.
AD-2C-xx.x	The AD-2C-xx.x card has four sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "8.4 AD-2C-xx.x Card" section on page 8-14.
AD-4C-xx.x	The AD-4C-xx.x card has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "8.5 AD-4C-xx.x Card" section on page 8-18.
AD-1B-xx.x	The AD-1B-xx.x card has three sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "8.6 AD-1B-xx.x Card" section on page 8-22.
AD-4B-xx.x	The AD-4B-xx.x card has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "8.7 AD-4B-xx.x Card" section on page 8-25.

8.1.2 Card Compatibility

Table 8-2 lists the CTC software compatibility for each optical add/drop card.

Table 8-2 Software Release Compatibility for Optical Add/Drop Cards

Card Name	R4.5	R4.6	R4.7	R5.0	R6.0	R7.0	R7.2	R8.0	R8.5	R9.0	R9.1	R9.2
AD-1C-xx.x	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6
AD-2C-xx.x	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6
AD-4C-xx.x	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6
AD-1B-xx.x	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
AD-4B-xx.x	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM

8.1.3 Interface Classes

The AD-1C-xx.x, AD-2C-xx.x, AD-4C-xx.x, AD-1B-xx.x, and AD-4B-xx.x cards have different input and output optical channel signals depending on the interface card where the input signal originates from. The input interface cards have been grouped in classes listed in Table 8-3. The subsequent tables list the optical performances and output power of each interface class.

Table 8-3 ONS 15454 Card Interfaces Assigned to Input Power Classes

Input Power Class	Card
A	10-Gbps multirate transponder cards (TXP_MR_10G, TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) with forward error correction (FEC) enabled, 10-Gbps muxponder cards (MXP_2.5G_10G, MXP_2.5G_10E, MXP_MR_10DME_C, MXP_MR_10DME_L, MXP_2.5G_10E_C, and MXP_2.5G_10E_L) with FEC enabled, and 40-Gbps muxponder card (40G-MXP-C)
B	10-Gbps multirate transponder card (TXP_MR_10G) without FEC and the 10-Gbps muxponder card (MXP_2.5G_10G, MXP_MR_10DME_C, MXP_MR_10DME_L), and 40-Gbps muxponder card (40G-MXP-C), and ADM-10G cards with FEC disabled
C	OC-192 LR ITU cards (TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) without FEC
D	2.5-Gbps multirate transponder card (TXP_MR_2.5G), both protected and unprotected, with FEC enabled
E	OC-48 100-GHz DWDM muxponder card (MXP_MR_2.5G) and 2.5-Gbps multirate transponder card (TXP_MR_2.5G), both protected and unprotected, with FEC disabled and retime, reshape, and regenerate (3R) mode enabled
F	2.5-Gbps multirate transponder card (TXP_MR_2.5G), both protected and unprotected, in regenerate and reshape (2R) mode
G	OC-48 ELR 100 GHz card
H	2/4 port GbE transponder (GBIC WDM 100GHz)
I	TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L cards with enhanced FEC (E-FEC) and the MXP_2.5G_10E, MXP_2.5G_10E_C, MXP_2.5G_10E_L, MXP_MR_10DME_C, MXP_MR_10DME_L, and 40G-MXP-C cards with E-FEC enabled

Table 8-4 lists the optical performance parameters for 40-Gbps cards that provide signal input to the optical add/drop cards.

Table 8-4 40-Gbps Interface Optical Performance

Parameter	Class A		Class B		Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)
Maximum bit rate	40 Gbps		40 Gbps		40 Gbps	
Regeneration	3R		3R		3R	
FEC	Yes		No		Yes (E-FEC)	
Threshold	Optimum		Average		Optimum	
Maximum BER[2]	10^{-15}		10^{-12}		10^{-15}	
OSNR[1] sensitivity	23 dB	9 dB	23 dB	19 dB	20 dB	8 dB
Power sensitivity	–24 dBm	–18 dBm	–21 dBm	–20 dBm	–26 dBm	–18 dBm

Table 8-4 40-Gbps Interface Optical Performance (continued)

Parameter	Class A		Class B		Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)
Power overload	–8 dBm		–8 dBm		–8 dBm	
Transmitted Power Range[3]						
OC-192 LR ITU	—		—		—	
Dispersion compensation tolerance	+/–800 ps/nm		+/–1,000 ps/nm		+/–800 ps/nm	

1. OSNR = optical signal-to-noise ratio
2. BER = bit error rate
3. These values, decreased by patchcord and connector losses, are also the input power values for the OADM cards.

Table 8-5 lists the optical performance parameters for 40-Gbps cards that provide signal input to the optical add/drop cards.

Table 8-5 10-Gbps Interface Optical Performance

Parameter	Class A		Class B		Class C	Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	OSNR Limited	Power Limited	OSNR Limited (if appl.)
Maximum bit rate	10 Gbps		10 Gbps		10 Gbps	10 Gbps	
Regeneration	3R		3R		3R	3R	
FEC	Yes		No		No	Yes (E-FEC)	
Threshold	Optimum		Average		Average	Optimum	
Maximum BER[2]	10^{-15}		10^{-12}		10^{-12}	10^{-15}	
OSNR[1] sensitivity	23 dB	9 dB	23 dB	19 dB	19 dB	20 dB	8 dB
Power sensitivity	–24 dBm	–18 dBm	–21 dBm	–20 dBm	–22 dBm	–26 dBm	–18 dBm
Power overload	–8 dBm		–8 dBm		–9 dBm	–8 dBm	
Transmitted Power Range[3]							
10-Gbps multirate transponder/10-Gbps FEC transponder (TXP_MR_10G)	+2.5 to 3.5 dBm		+2.5 to 3.5 dBm		—	—	
OC-192 LR ITU	—		—		+3.0 to 6.0 dBm	—	

Table 8-5 10-Gbps Interface Optical Performance (continued)

Parameter	Class A		Class B		Class C	Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	OSNR Limited	Power Limited	OSNR Limited (if appl.)
10-Gbps multirate transponder/10-Gbps FEC transponder (TXP_MR_10E)	+3.0 to 6.0 dBm		+3.0 to 6.0 dBm		—	+3.0 to 6.0 dBm	
Dispersion compensation tolerance	+/–800 ps/nm		+/–1,000 ps/nm		+/–1,000 ps/nm	+/–800 ps/nm	

1. OSNR = optical signal-to-noise ratio
2. BER = bit error rate
3. These values, decreased by patchcord and connector losses, are also the input power values for the OADM cards.

2.5-Gbps cards that provide signal input to the optical add/drop cards have the interface performance parameters listed in Table 8-6.

Table 8-6 2.5-Gbps Interface Optical Performance

Parameter	Class D		Class E		Class F	Class G		Class H		Class J
Type	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	OSNR Limited	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	Power Limited
Maximum bit rate	2.5 Gbps		2.5 Gbps		2.5 Gbps	2.5 Gbps		1.25 Gbps		2.5 Gbps
Regeneration	3R		3R		2R	3R		3R		3R
FEC	Yes		No		No	No		No		No
Threshold	Average		Average		Average	Average		Average		Average
Maximum BER	10^{-15}		10^{-12}		10^{-12}	10^{-12}		10^{-12}		10^{-12}
OSNR sensitivity	14 dB	6 dB	14 dB	10 dB	15 dB	14 dB	11 dB	13 dB	8 dB	12 dB
Power sensitivity	–31 dBm	–25 dBm	–30 dBm	–23 dBm	–24 dBm	–27 dBm	–33 dBm	–28 dBm	–18 dBm	–26 dBm
Power overload	–9 dBm		–9 dBm		–9 dBm	–9 dBm		–7 dBm		–17dBm
Transmitted Power Range[1]										
TXP_MR_2.5G	–1.0 to 1.0 dBm		–1.0 to 1.0 dBm		–1.0 to 1.0 dBm	–2.0 to 0 dBm		—		—
TXPP_MR_2.5G	–4.5 to –2.5 dBm		–4.5 to –2.5 dBm		–4.5 to –2.5 dBm					
MXP_MR_2.5G	—		+2.0 to +4.0 dBm		—					
MXPP_MR_2.5G	—		–1.5 to +0.5 dBm		—					

Table 8-6 2.5-Gbps Interface Optical Performance (continued)

Parameter	Class D		Class E		Class F	Class G		Class H		Class J
Type	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	OSNR Limited	Power Limited	OSNR Limited (if appl.)	Power Limited	OSNR Limited (if appl.)	Power Limited
2/4 port GbE Transponder (GBIC WDM 100GHz)	—		—		—	—		+2.5 to 3.5 dBm		—
Dispersion compensation tolerance	–1200 to +5400 ps/nm		–1200 to +5400 ps/nm		–1200 to +3300 ps/nm	–1200 to +3300 ps/nm		–1000 to +3600 ps/nm		–1000 to +3200 ps/nm

1. These values, decreased by patchcord and connector losses, are also the input power values for the OADM cards.

8.1.4 DWDM Card Channel Allocation Plan

ONS 15454 DWDM channel OADM and band OADM cards are designed for use with specific channels in the C band. In most cases, the channels for these cards are either numbered (for example, 1 to 32) or delimited (odd or even). Client interfaces must comply with these channel assignments to be compatible with the ONS 15454 system.

Table 8-7 lists the channel IDs and wavelengths assigned to the C-band DWDM channels.

Note In some cases, a card uses only some or all of the channels listed in a band. Also, some cards use channels on the 100-GHz ITU-T grid while others use channels on the 50-GHz ITU-T grid. See specific card descriptions in Appendix A, "Hardware Specifications," for more details.

Table 8-7 DWDM Channel Allocation Plan (C Band)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
1	196.00	1529.55	42	193.95	1545.72
2	195.95	1529.94	43	193.90	1546.119
3	195.90	1530.334	44	193.85	1546.518
4	195.85	1530.725	45	193.80	1546.917
5	195.80	1531.116	46	193.75	1547.316
6	195.75	1531.507	47	193.70	1547.715
7	195.70	1531.898	48	193.65	1548.115
8	195.65	1532.290	49	193.60	1548.515
9	195.60	1532.681	50	193.55	1548.915
10	195.55	1533.073	51	193.50	1549.32
11	195.50	1533.47	52	193.45	1549.71
12	195.45	1533.86	53	193.40	1550.116

Table 8-7 DWDM Channel Allocation Plan (C Band) (continued)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
13	195.40	1534.250	54	193.35	1550.517
14	195.35	1534.643	55	193.30	1550.918
15	195.30	1535.036	56	193.25	1551.319
16	195.25	1535.429	57	193.20	1551.721
17	195.20	1535.822	58	193.15	1552.122
18	195.15	1536.216	59	193.10	1552.524
19	195.10	1536.609	60	193.05	1552.926
20	195.05	1537.003	61	193.00	1553.33
21	195.00	1537.40	62	192.95	1553.73
22	194.95	1537.79	63	192.90	1554.134
23	194.90	1538.186	64	192.85	1554.537
24	194.85	1538.581	65	192.80	1554.940
25	194.80	1538.976	66	192.75	1555.343
26	194.75	1539.371	67	192.70	1555.747
27	194.70	1539.766	68	192.65	1556.151
28	194.65	1540.162	69	192.60	1556.555
29	194.60	1540.557	70	192.55	1556.959
30	194.55	1540.953	71	192.50	1557.36
31	194.50	1541.35	72	192.45	1557.77
32	194.45	1541.75	73	192.40	1558.173
33	194.40	1542.142	74	192.35	1558.578
34	194.35	1542.539	75	192.30	1558.983
35	194.30	1542.936	76	192.25	1559.389
36	194.25	1543.333	77	192.20	1559.794
37	194.20	1543.730	78	192.15	1560.200
38	194.15	1544.128	79	192.10	1560.606
39	194.10	1544.526	80	192.05	1561.013
40	194.05	1544.924	81	192.00	1561.42
41	194.00	1545.32	82	191.95	1561.83

8.2 Class 1M Laser Product Safety Lasers

This section lists the safety labels attached to the AD-1C-xx.x, AD-2C-xx.x, AD-4c-xx.x, AD-1B-xx.x, and AD-4B-xx.xx cards.

8.2.1 Class 1M Laser Product Statement

The Class 1M Laser Product statement is shown in Figure 8-1.

Figure 8-1 Class 1M Laser Product Statement

Class 1M lasers are products that produce either a highly divergent beam or a large diameter beam. Therefore, only a small part of the whole laser beam can enter the eye. However, these laser products can be harmful to the eye if the beam is viewed using magnifying optical instruments.

8.2.2 Hazard Level 1M Label

The Hazard Level 1M label is shown in Figure 8-2.

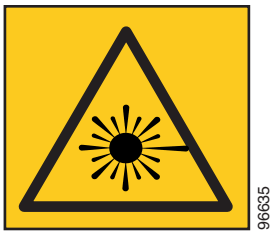
Figure 8-2 Hazard Level Label

The Hazard Level label warns users against exposure to laser radiation of Class 1 limits calculated in accordance with IEC60825-1 Ed.1.2. This label is displayed on the faceplate of the cards.

8.2.3 Laser Source Connector Label

The Laser Source Connector label is shown in Figure 8-3.

Figure 8-3 Laser Source Connector Label



This label indicates that a laser source is present at the optical connector where the label has been placed.

8.2.4 FDA Statement Label

The FDA Statement labels are shown in Figure 8-4 and Figure 8-5. These labels show compliance to FDA standards and that the hazard level classification is in accordance with IEC60825-1 Am.2 or Ed.1.2.

Figure 8-4 FDA Statement Label

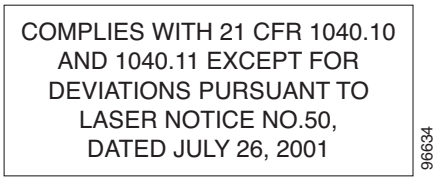
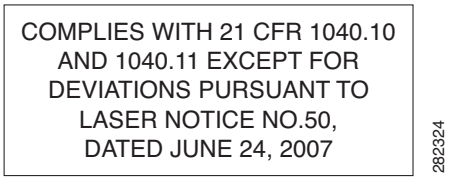


Figure 8-5 FDA Statement Label



8.2.5 Shock Hazard Label

The Shock Hazard label is shown in Figure 8-6.

Figure 8-6 Shock Hazard Label

This label alerts personnel to electrical hazard within the card. The potential of shock hazard exists when removing adjacent cards during maintenance, and touching exposed electrical circuitry on the card itself.

8.3 AD-1C-xx.x Card

Note See the "A.9.1 AD-1C-xx.x Card Specifications" section on page A-44 for hardware specifications.

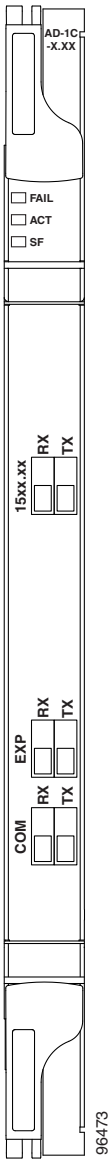
The 1-Channel OADM (AD-1C-xx.x) card passively adds or drops one of the 32 channels utilized within the 100-GHz-spacing of the DWDM card system. Thirty-two versions of this card—each designed only for use with one wavelength—are used in the ONS 15454 DWDM system. Each wavelength version of the card has a different part number. The AD-1C-xx.x can be installed in Slots 1 to 6 and 12 to 17.

The AD-1C-xx.x has the following internal features:

- Two cascaded passive optical interferential filters perform the channel add and drop functions.
- One software-controlled variable optical attenuator (VOA) regulates the optical power of the inserted channel.
- Software-controlled VOA regulates the insertion loss of the express optical path.
- VOA settings and functions, photodiode detection, and alarm thresholds, are internally controlled.
- Virtual photodiodes (firmware calculations of port optical power) at the common DWDM output and input ports are monitored within the software.

Figure 8-7 shows the AD-1C-xx.x faceplate.

Figure 8-7 AD-1C-xx.x Faceplate



For information on safety labels for the card, see the "8.2 Class 1M Laser Product Safety Lasers" section on page 8-8.

Figure 8-8 shows a block diagram of the AD-1C-xx.x card.

Figure 8-8 AD-1C-xx.x Block Diagram

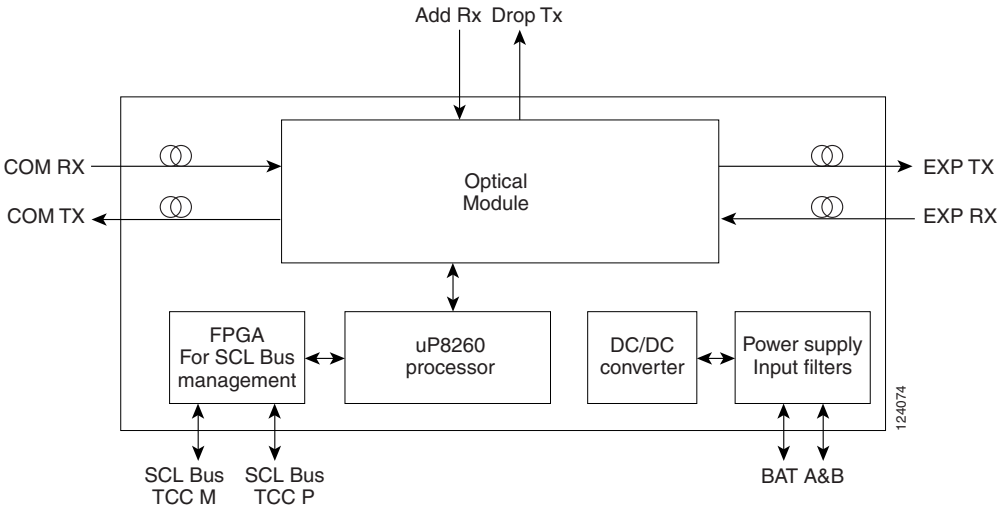
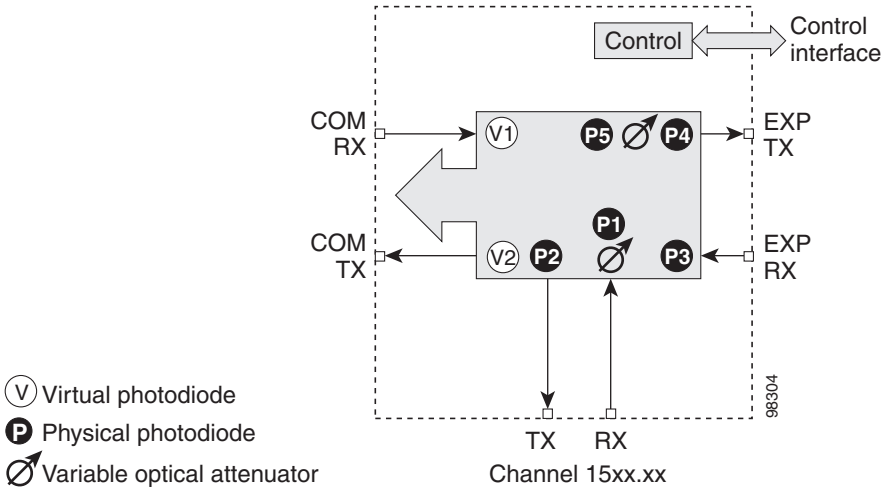


Figure 8-9 shows the AD-1C-xx.x optical module functional block diagram.

Figure 8-9 AD-1C-xx.x Optical Module Functional Block Diagram



8.3.1 Power Monitoring

Physical photodiodes P1 through P4 and virtual photodiodes V1 and V2 monitor the power for the AD-1C-xx.x card. The returned power level values are calibrated to the ports as shown in Table 8-8.

Table 8-8 AD-1C-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1	ADD	DROP RX
P2	DROP	DROP TX

Table 8-8 AD-1C-xx.x Port Calibration (continued)

Photodiode	CTC Type Name	Calibrated to Port
P3	IN EXP	EXP RX
P4	OUT EXP	EXP TX
V1	IN COM	COM RX
V2	OUT COM	COM TX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the "CTC Port Numbers and TL1 Aids" section in *Cisco ONS SONET TL1 Command Guide, Release 9.2*.

8.3.2 AD-1C-xx.x Card-Level Indicators

The AD-1C-xx.x card has three card-level LED indicators, described in Table 8-9.

Table 8-9 AD-1C-xx.x Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the AD-1C-xx.x card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure. The SF LED also illuminates when the transmitting and receiving fibers are incorrectly connected. When the fibers are properly connected, the LED turns off.

8.3.3 AD-1C-xx.x Port-Level Indicators

You can find the status of the card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. The AD-1C-xx.x has six LC-PC-II optical ports: two for add/drop channel client input and output, two for express channel input and output, and two for communication.

8.4 AD-2C-xx.x Card

Note See the "A.9.2 AD-2C-xx.x Card Specifications" section on page A-44 for hardware specifications.

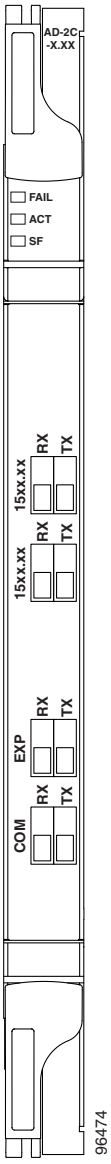
The 2-Channel OADM (AD-2C-xx.x) card passively adds or drops two adjacent 100-GHz channels within the same band. Sixteen versions of this card—each designed for use with one pair of wavelengths—are used in the ONS 15454 DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. Each version of the card has a different part number.

The AD-2C-xx.x has the following features:

- Passive cascade of interferential filters perform the channel add and drop functions.
- Two software-controlled VOAs in the add section, one for each add port, regulate the optical power of inserted channels.
- Software-controlled VOAs regulate insertion loss on express channels.
- VOA settings and functions, photodiode detection, and alarm thresholds are internally controlled.
- Virtual photodiodes (firmware calculation of port optical power) at the common DWDM output and input ports are monitored within the software.

Figure 8-10 shows the AD-2C-xx.x faceplate.

Figure 8-10 AD-2C-xx.x Faceplate



For information on safety labels for the card, see the "8.2 Class 1M Laser Product Safety Lasers" section on page 8-8.

Figure 8-11 shows a block diagram of the AD-2C-xx.x card.

Figure 8-11 AD-2C-xx.x Block Diagram

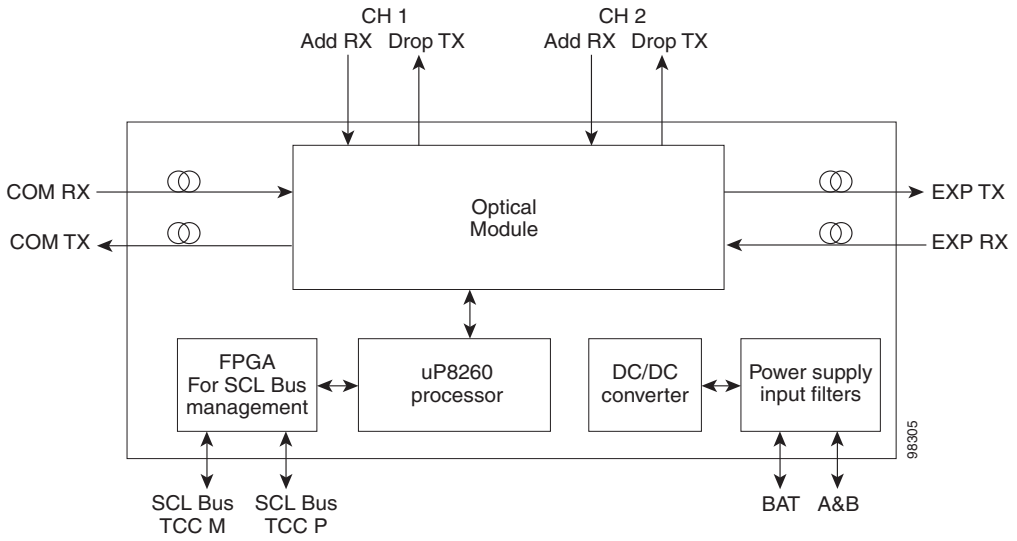
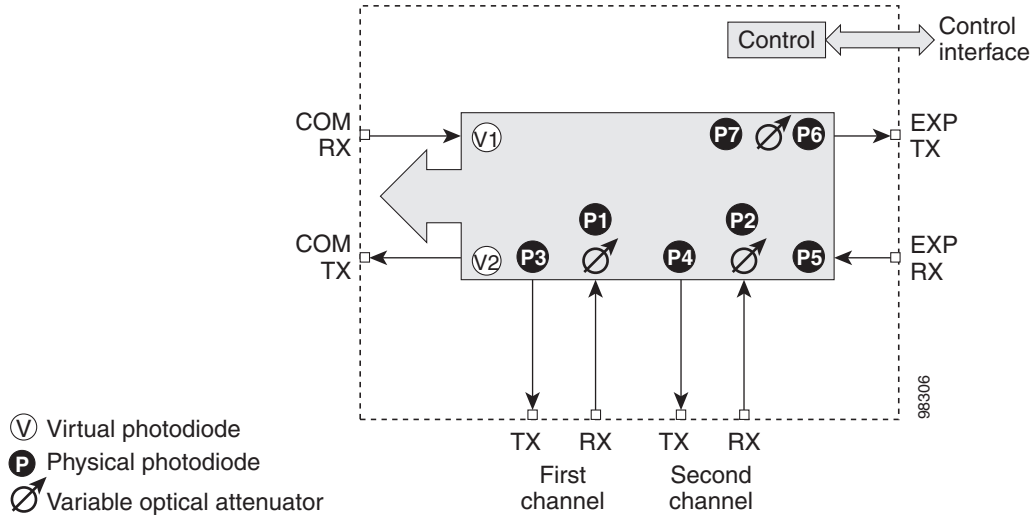


Figure 8-12 shows the AD-2C-xx.x optical module functional block diagram.

Figure 8-12 AD-2C-xx.x Optical Module Functional Block Diagram



8.4.1 Wavelength Pairs

The AD-2C-xx.x cards are provisioned for the wavelength pairs listed in Table 8-10. In this table, channel IDs are given rather than wavelengths. To compare channel IDs with the actual wavelengths they represent, see wavelengths in Table 8-7 on page 8-7.

Table 8-10 AD-2C-xx.x Channel Pairs

Band ID	Add/Drop Channel ID
Band 30.3 (A)	30.3, 31.2
	31.9, 32.6
Band 34.2 (B)	34.2, 35.0
	35.8, 36.6
Band 38.1 (C)	38.1, 38.9
	39.7, 40.5
Band 42.1 (D)	42.1, 42.9
	43.7, 44.5
Band 46.1 (E)	46.1, 46.9
	47.7, 48.5
Band 50.1 (F)	50.1, 50.9
	51.7, 52.5
Band 54.1 (G)	54.1, 54.9
	55.7, 56.5
Band 58.1 (H)	58.1, 58.9
	59.7, 60.6

8.4.2 Power Monitoring

Physical photodiodes P1 through P10 and virtual photodiodes V1 and V2 monitor the power for the AD-2C-xx.x card. The returned power level values are calibrated to the ports as shown in Table 8-11.

Table 8-11 AD-2C-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P2	ADD	COM TX
P3–P4	DROP	DROP TX
P5	IN EXP	EXP RX
P6	OUT EXP	EXP TX
V1	IN COM	COM RX
V2	OUT COM	COM TX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the "CTC Port Numbers and TL1 Aids" section in *Cisco ONS SONET TL1 Command Guide, Release 9.2*.

8.4.3 AD-2C-xx.x Card-Level Indicators

The AD-2C-xx.x card has three card-level LED indicators, described in Table 8-12.

Table 8-12 AD-2C-xx.x Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the AD-2C-xx.x card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

8.4.4 AD-2C-xx.x Port-Level Indicators

You can find the status of the card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. The AD-2C-xx.x card has eight LC-PC-II optical ports: four for add/drop channel client input and output, two for express channel input and output, and two for communication.

8.5 AD-4C-xx.x Card

Note See the "A.9.3 AD-4C-xx.x Card Specifications" section on page A-45 for hardware specifications.

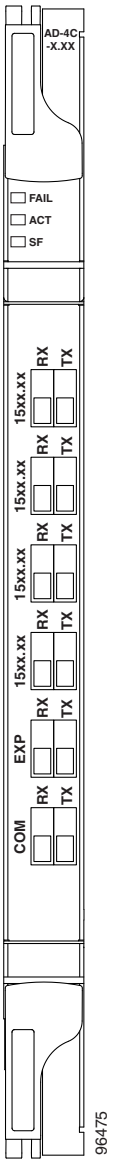
The 4-Channel OADM (AD-4C-xx.x) card passively adds or drops all four 100-GHz-spaced channels within the same band. Eight versions of this card—each designed for use with one band of wavelengths—are used in the ONS 15454 DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. There are eight versions of this card with eight part numbers.

The AD-4C-xx.x has the following features:

- Passive cascade of interferential filters perform the channel add and drop functions.
- Four software-controlled VOAs in the add section, one for each add port, regulate the optical power of inserted channels.
- Two software-controlled VOAs regulate insertion loss on express and drop path, respectively.
- Internal control of the VOA settings and functions, photodiode detection, and alarm thresholds.
- Software-monitored virtual photodiodes (firmware calculation of port optical power) at the common DWDM output and input ports.

Figure 8-13 shows the AD-4C-xx.x faceplate.

Figure 8-13 AD-4C-xx.x Faceplate



For information on safety labels for the card, see the "8.2 Class 1M Laser Product Safety Lasers" section on page 8-8.

Figure 8-14 shows a block diagram of the AD-4C-xx.x card.

Figure 8-14 AD-4C-xx.x Block Diagram

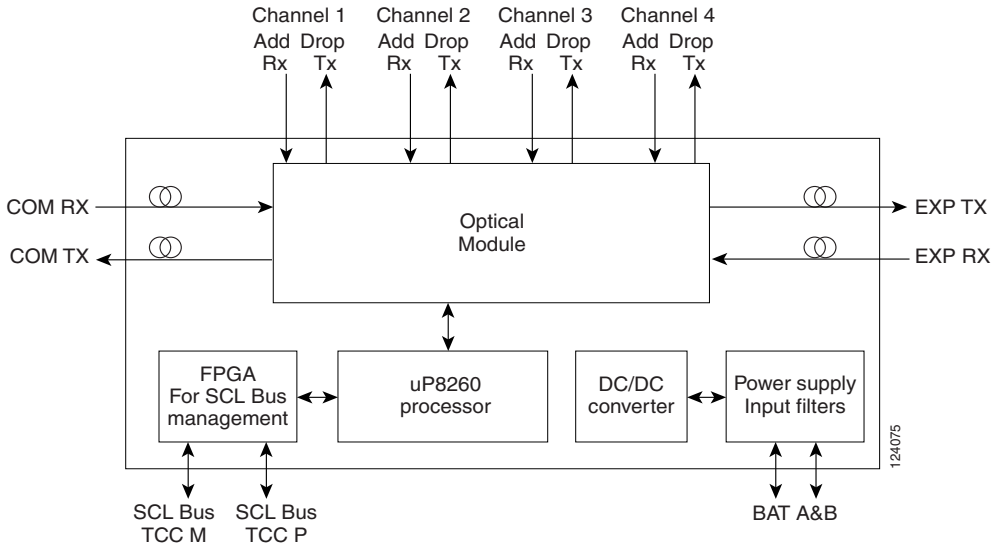
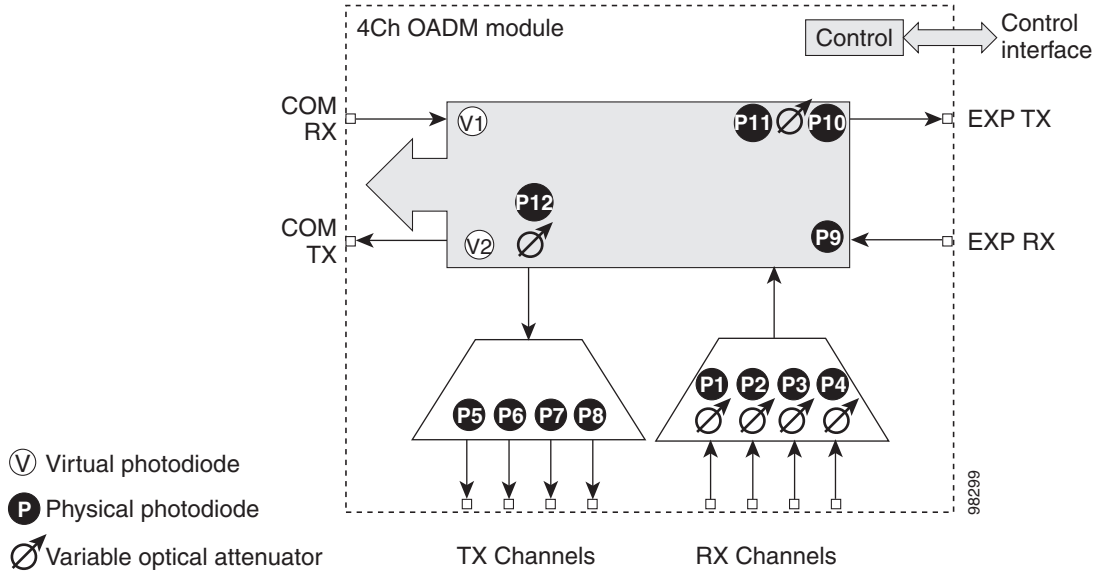


Figure 8-15 shows the AD-4C-xx.x optical module functional block diagram.

Figure 8-15 AD-4C-xx.x Optical Module Functional Block Diagram



8.5.1 Wavelength Sets

The AD-4C-xx.x cards are provisioned for the sets of four 100-GHz-spaced wavelengths shown Table 8-13 on page 8-21.

Table 8-13 AD-4C-xx.x Channel Sets

Band ID	Add/Drop Wavelengths
Band 30.3 (A)	1530.3, 1531.2, 1531.9, 1532.6
Band 34.2 (B)	1534.2, 1535.0, 1535.8, 1536.6
Band 38.1 (C)	1538.1, 1538.9, 1539.7, 1540.5
Band 42.1 (D)	1542.1, 1542.9, 1543.7, 1544.5
Band 46.1 (E)	1546.1, 1546.9, 1547.7, 1548.5
Band 50.1 (F)	1550.1, 1550.9, 1551.7, 1552.5
Band 54.1 (G)	1554.1, 1554.9, 1555.7, 1556.5
Band 58.1 (H)	1558.1, 1558.9, 1559.7, 1560.6

8.5.2 Power Monitoring

Physical photodiodes P1 through P10 and virtual photodiodes V1 and V2 monitor the power for the AD-4C-xx.x card. The returned power level values are calibrated to the ports as shown in Table 8-14.

Table 8-14 AD-4C-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P4	ADD	COM TX
P5–P8	DROP	DROP TX
P9	IN EXP	EXP RX
P10	OUT EXP	EXP TX
V1	IN COM	COM RX
V2	OUT COM	COM TX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the “CTC Port Numbers and TL1 Aids” section in *Cisco ONS SONET TL1 Command Guide, Release 9.2*.

8.5.3 AD-4C-xx.x Card-Level Indicators

The AD-4C-xx.x card has three card-level LED indicators, described in Table 8-15.

Table 8-15 AD-4C-xx.x Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card’s processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.

Table 8-15 AD-4C-xx.x Card-Level Indicators (continued)

Card-Level Indicators	Description
Green ACT LED	The green ACT LED indicates that the AD-4C-xx.x card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure or condition. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

8.5.4 AD-4C-xx.x Port-Level Indicators

You can find the status of the card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. The AD-4C-xx.x card has 12 LC-PC-II optical ports: eight for add/drop channel client input and output, two for express channel input and output, and two for communication.

8.6 AD-1B-xx.x Card

(Cisco ONS 15454 only)

Note See the "A.9.4 AD-1B-xx.x Card Specifications" section on page A-47 for hardware specifications.

The 1-Band OADM (AD-1B-xx.x) card passively adds or drops a single band of four adjacent 100-GHz-spaced channels. Eight versions of this card with eight different part numbers—each version designed for use with one band of wavelengths—are used in the ONS 15454 DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. This card can be used when there is asymmetric adding and dropping on each side (east or west) of the node; a band can be added or dropped on one side but not on the other.

The AD-1B xx.x can be installed in Slots 1 to 6 and 12 to17 and has the following features:

- Passive cascaded interferential filters perform the channel add and drop functions.
- Two software-controlled VOAs regulate the optical power flowing in the express and drop OADM paths (drop section).
- Output power of the dropped band is set by changing the attenuation of the VOA drop.
- The VOA express is used to regulate the insertion loss of the express path.
- VOA settings and functions, photodiode detection, and alarm thresholds are internally controlled.
- Virtual photodiode (firmware calculation of port optical power) at the common DWDM output are monitored within the software.

Figure 8-16 shows the AD-1B-xx.x faceplate.

Figure 8-16 AD-1B-xx.x Faceplate

For information on safety labels for the card, see the "8.2 Class 1M Laser Product Safety Lasers" section on page 8-8.

Figure 8-17 shows a block diagram of the AD-1B-xx.x card.

Figure 8-17 AD-1B-xx.x Block Diagram

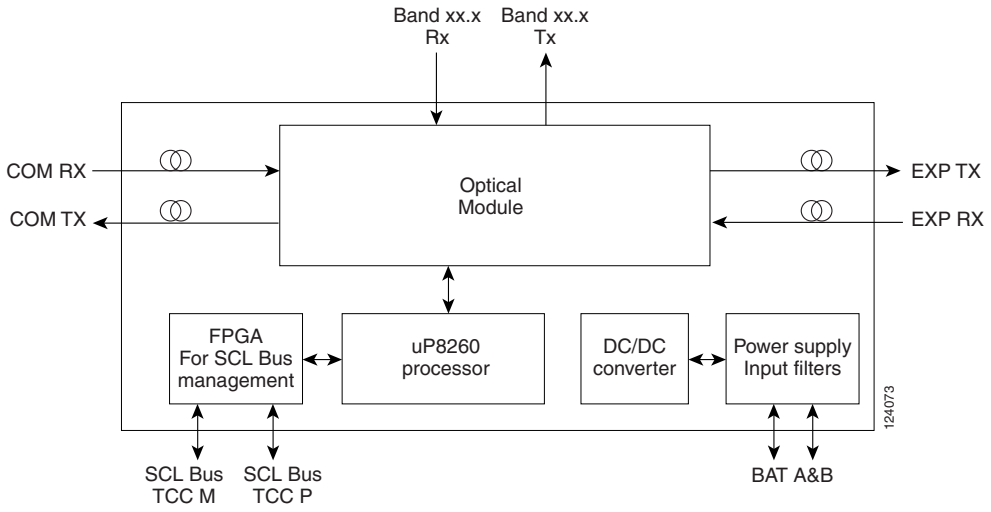
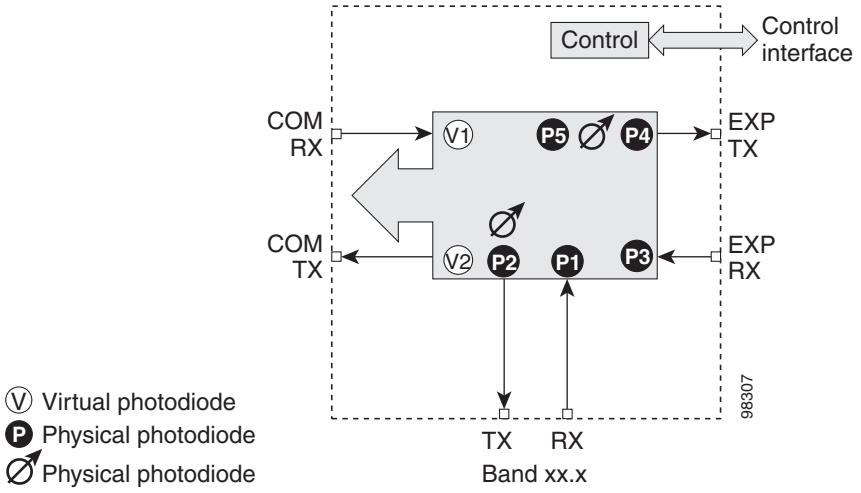


Figure 8-18 shows the AD-1B-xx.x optical module functional block diagram.

Figure 8-18 AD-1B-xx.x Optical Module Functional Block Diagram



8.6.1 Power Monitoring

Physical photodiodes P1 through P4 and virtual photodiodes V1 and V2 monitor the power for the AD-1B-xx.x card. The returned power level values are calibrated to the ports as shown in Table 8-16.

Table 8-16 AD-1B-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1	ADD	BAND RX
P2	DROP	BAND TX

Table 8-16 AD-1B-xx.x Port Calibration (continued)

Photodiode	CTC Type Name	Calibrated to Port
P3	IN EXP	EXP RX
P4	OUT EXP	EXP TX
V1	IN COM	COM RX
V2	OUT COM	COM TX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the "CTC Port Numbers and TL1 Aids" section in *Cisco ONS SONET TL1 Command Guide, Release 9.2*.

8.6.2 AD-1B-xx.x Card-Level Indicators

The AD-1B-xx.x card has three card-level LED indicators, described in Table 8-17.

Table 8-17 AD-1B-xx.x Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the AD-1B-xx.x card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

8.6.3 AD-1B-xx.x Port-Level Indicators

You can find the status of the card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. The AD-1B-xx.x has six LC-PC-II optical ports: two for add/drop channel client input and output, two for express channel input and output, and two for communication.

8.7 AD-4B-xx.x Card

(Cisco ONS 15454 only)

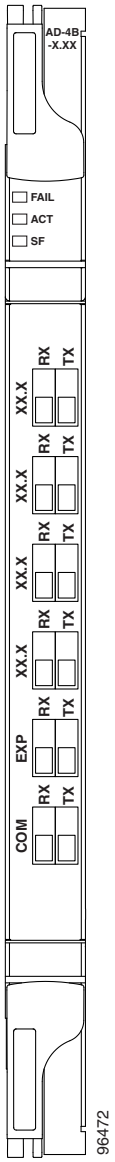
The 4-Band OADM (AD-4B-xx.x) card passively adds or drops four bands of four adjacent 100-GHz-spaced channels. Two versions of this card with different part numbers—each version designed for use with one set of bands—are used in the ONS 15454 DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. This card can be used when there is asymmetric adding and dropping on each side (east or west) of the node; a band can be added or dropped on one side but not on the other.

The AD1B-xx.x can be installed in Slots 1 to 6 and 12 to 17 and has the following features:

- Five software-controlled VOAs regulate the optical power flowing in the OADM paths.
- Output power of each dropped band is set by changing the attenuation of each VOA drop.
- The VOA express is used to regulate the insertion loss of the express path.
- VOA settings and functions, photodiode detection, and alarm thresholds are internally controlled.
- Virtual photodiode (firmware calculation of port optical power) at the common DWDM output port are monitored within the software.

Figure 8-19 shows the AD-4B-xx.x faceplate.

Figure 8-19 AD-4B-xx.x Faceplate



For information on safety labels for the card, see the "8.2 Class 1M Laser Product Safety Lasers" section on page 8-8.

Figure 8-20 shows a block diagram of the AD-4B-xx.x card.

Figure 8-20 AD-4B-xx.x Block Diagram

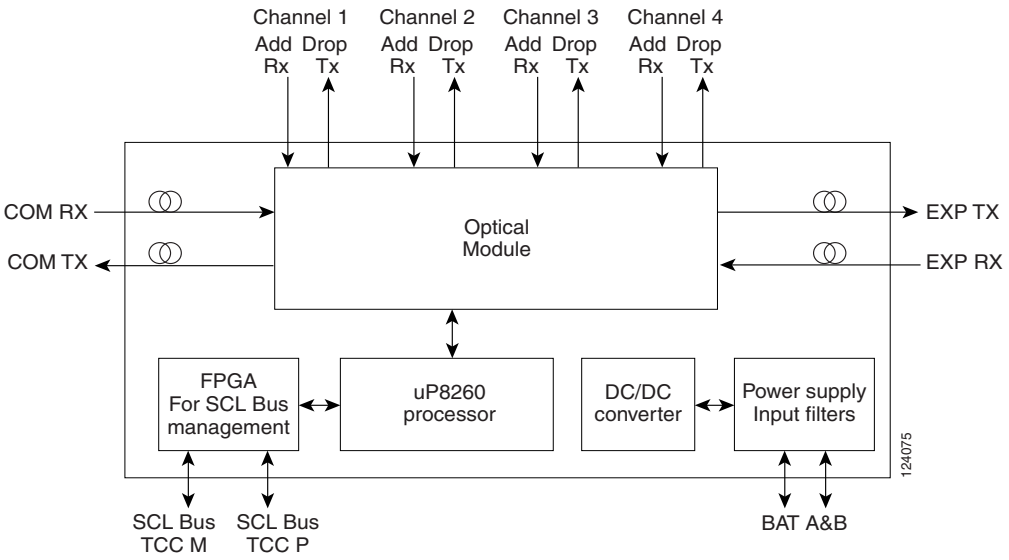
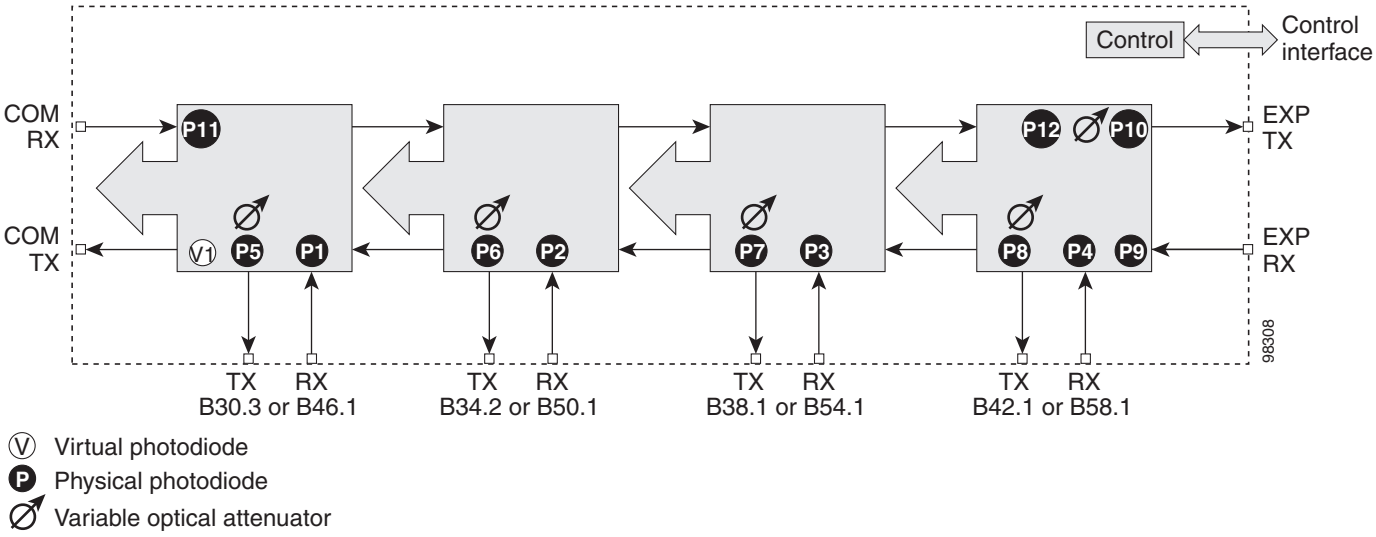


Figure 8-21 shows the AD-4B-xx.x optical module functional block diagram.

Figure 8-21 AD-4B-xx.x Optical Module Functional Block Diagram



8.7.1 Power Monitoring

Physical photodiodes P1 through P11 and virtual photodiode V1 monitor the power for the AD-4B-xx.x card. The returned power level values are calibrated to the ports as shown in Table 8-18.

Table 8-18 AD-4B-xx.x Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P4	ADD	COM TX
P5–P8	DROP	DROP TX
P9	IN EXP	EXP RX
P10	OUT EXP	EXP TX
P11	IN COM	COM RX
V1	OUT COM	COM TX

For information on the associated TL1 AIDs for the optical power monitoring points, refer the "CTC Port Numbers and TL1 Aids" section in *Cisco ONS SONET TL1 Command Guide, Release 9.2*.

8.7.2 AD-4B-xx.x Card-Level Indicators

The AD-4B-xx.x card has three card-level LED indicators, described in Table 8-19.

Table 8-19 AD-4B-xx.x Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that there is an internal hardware failure. Replace the card if the red FAIL LED persists.
Green ACT LED	The green ACT LED indicates that the AD-4B-xx.x card is carrying traffic or is traffic-ready.
Amber SF LED	The amber SF LED indicates a signal failure. The amber SF LED also illuminates when the transmit and receive fibers are incorrectly connected. When the fibers are properly connected, the light turns off.

8.7.3 AD-4B-xx.x Port-Level Indicators

You can find the status of the card port using the LCD screen on the ONS 15454 fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. The AD-4B-xx.x has 12 LC-PC-II optical ports: eight for add/drop band client input and output, two for express channel input and output, and two for communication.