CHAPTER 10

Provision Reconfigurable Optical Add/Drop Cards

This chapter describes the Cisco ONS 15454 cards deployed in reconfigurable optical add/drop (ROADM) networks. 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:

Note This chapter contains information about cards that perform mesh topology functions. Multiplexer and demultiplexer cards that do not perform these functions are described in Chapter 6, "Provision Multiplexer and Demultiplexer Cards."

10.1 Card Overview

The ROADM cards include six add drop cards utilized in the C-band (32WSS, 32DMX, 32DMX-C, 40-MUX-C, 40-WXC-C, 80-WXC-C, and MMU), two add drop cards utilized for the L-band (32WSS-L, and 32DMX-L), and two single module ROADM (SMR) cards utilized in the C-band (40-SMR1-C and 40-SMR2-C).

This section provides card summary, compatibility, channel allocation, and safety information.

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 that have the same symbols. For a list of slots and symbols, see the "Card Slot Requirements" section in the *Cisco CPT and Cisco ONS 15454 Hardware Installation Guide*.

10.1.1 Card Summary

Table 10-1 lists and summarizes information about each ROADM card.

Table 10-1 ROADM Card Summary

Card	Port Description	For Additional Information
32WSS	The 32WSS card has seven sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.3 32WSS Card" section on page 10-16
32WSS-L	The 32WSS-L card has seven sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.4 32WSS-L Card" section on page 10-22

Table 10-1 ROADM Card Summary (Continued)

Card	Port Description	For Additional Information
32DMX	The 32DMX has five sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.5 32DMX Card" section on page 10-29
32DMX-L	The 32DMX-L has five sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.6 32DMX-L Card" section on page 10-34
40-DMX-C	The 40-DMX-C has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.7 40-DMX-C Card" section on page 10-39
40-DMX-CE	The 40-DMX-CE has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.8 40-DMX-CE Card" section on page 10-44
40-MUX-C	The 40-MUX-C has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.9 40-MUX-C Card" section on page 10-49.
40-WSS-C	The 40-WSS-C card has eight sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.10 40-WSS-C Card" section on page 10-54
40-WSS-CE	The 40-WSS-CE card has eight sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.11 40-WSS-CE Card" section on page 10-60
40-WXC-C	The 40-WXC-C card has five sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.12 40-WXC-C Card" section on page 10-67
80-WXC-C	The 80-WXC-C card has 14 ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.13 80-WXC-C Card" section on page 10-73.
40-SMR1-C	The 40-SMR1-C card has six sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.14 Single Module ROADM (SMR-C) Cards" section on page 10-80
40-SMR2-C	The 40-SMR2-C card has six sets of ports located on the faceplate. It operates in Slots 1 to 5 and 12 to 16.	See the "10.14 Single Module ROADM (SMR-C) Cards" section on page 10-80
MMU	The MMU card has six sets of ports located on the faceplate. It operates in Slots 1 to 6 and 12 to 17.	See the "10.15 MMU Card" section on page 10-90

10.1.2 Card Compatibility

Table 10-2 lists the Cisco Transport Controller (CTC) software compatibility for the ROADM cards.

Table 10-2 Software Release Compatibility for ROADM 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	R9.2.1	R9.3
32WSS	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
32WSS-L	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
40-WSS-C	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
40-WSS-CE	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
32DMX	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM,	15454-DWDM,	15454-DWDM,
32DMX-L	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
40-DMX-C	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
40-DMX-CE	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
40-MUX-C	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
40-WXC-C	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6

Table 10-2 Software Release Compatibility for ROADM 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	R9.2.1	R9.3
80-WXC-C	No	No	No	No	No	No	No	No	No	No	No	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
40-SMR1-C	No	No	No	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
40-SMR2-C	No	No	No	No	No	No	No	No	No	No	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
MMU	No	No	No	No	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM

10.1.3 Interface Classes

The input interface cards have been grouped in classes listed in Table 10-3. The subsequent tables list the optical performance and output power of each interface class.

Table 10-3 Cisco 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), 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 forward error correction (FEC) enabled, 40-Gbps transponder cards (40E-TXP-C, and 40ME-TXP-C), and 40-Gbps muxponder cards (40G-MXP-C, 40G-MXP-C, 40E-MXP-C, and 40ME-MXP-C)
B	10-Gbps multirate transponder card (TXP_MR_10G) and muxponder card (MXP_2.5G_10G) without FEC
C	OC-192 LR ITU cards without FEC, 10-Gbps multirate transponder (TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) and muxponder (MXP_2.5G_10E, MXP_2.5G_10E_L, and MXP_MR_10DME_L) cards with FEC disabled
D	2.5-Gbps multirate transponder card (TXP_MR_2.5G), both protected and unprotected, with FEC enabled
E	OC-48 100-GHz dense wavelength division multiplexing (DWDM) muxponder card (MXP_MR_2.5G) and 2.5-Gbps multirate transponder card (TXP_MR_2.5G), protected or unprotected; FEC disabled; and retime, reshape, and regenerate (3R) mode enabled
F	2.5-Gbps multirate transponder card (TXP_MR_2.5G), protected or unprotected, in regenerate and reshape (2R) mode
G	OC-48 ELR 100 GHz card
H	2/4 port GbE transponder (GBIC WDM 100GHz)
I	10-Gbps multirate transponder cards (TXP_MR_10E, TXP_MR_10E_C, and TXP_MR_10E_L) and 10-Gbps muxponder cards (MXP_2.5G_10E, MXP_2.5G_10E_L, and MXP_MR_10DME_L) with enhanced FEC (E-FEC) enabled, 40-Gbps transponder cards (40E-TXP-C, and 40ME-TXP-C), and 40-Gbps muxponder cards (40G-MXP-C, 40G-MXP-C, 40E-MXP-C, and 40ME-MXP-C)
K	OC-192/STM-64 LR ITU cards without FEC, 100GHz 10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with FEC disabled
L	40Gbps Duobinary CRS-1 DWDM ITU-T line card
M	2.5 Gbps DWDM ITU-T SPF
N	10Gbps enhanced full tunable transponder (TXP_MR_10E_C) and muxponder (MXP_2.5G_10E_C, MXP_MR_10DME_C) with E-FEC enabled
O	10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), 10Gbps Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with FEC enabled

Table 10-3 Cisco ONS 15454 Card Interfaces Assigned to Input Power Classes (Continued)

Input Power Class	Card
P	10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), 10Gbps Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with E-FEC enabled
T	40Gbps DPSK CRS-1 DWDM ITU-T line card
V	OC-192/STM-64 LR ITU cards without FEC, full tunable 10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with FEC disabled, full tunable
W	10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with FEC enabled, full tunable
X	10Gbps Ethernet Xponder (GE_XP, GE_XPE, 10GE_XP, 10GE_XPE), Sonet/SDH add/drop (ADM_10G), OTU2 Xponder (OTU2_XP), with E-FEC enabled, full tunable
Y	10Gbps enhanced full tunable transponder (TXP_MR_10EX_C) and muxponder (MXP_2.5G_10EX_C, MXP_MR_10DMEX_C), with FEC enabled and maximum likelihood sequence estimator (MLSE) correction
Z	10Gbps enhanced full tunable transponder (TXP_MR_10EX_C) and muxponder (MXP_2.5G_10EX_C, MXP_MR_10DMEX_C), with E-FEC enabled and MLSE correction

Table 10-4 lists the optical performance parameters for 40-Gbps cards.

Table 10-4 40-Gbps Interface Optical Performance

Parameter	Class A		Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)
Maximum bit rate	10 Gbps		10 Gbps	
Regeneration	3R		3R	
FEC	Yes		Yes (E-FEC)	
Threshold	Optimum		Optimum	
Maximum BER[2]	10^{-15}		10^{-15}	
OSNR[1] sensitivity	23 dB	9 dB	20 dB	8 dB
Power sensitivity	–24 dBm	–18 dBm	–26 dBm	–18 dBm
Power overload	–8 dBm		–8 dBm	
Transmitted Power Range[3]				
40-Gbps multirate transponder/40-Gbps FEC transponder (40E-TXP-C, and 40ME-TXP-C)	+2.5 to 3.5 dBm		—	

Table 10-4 40-Gbps Interface Optical Performance (Continued)

Parameter	Class A		Class I	
Type	Power Limited	OSNR[1] Limited (if appl.)	Power Limited	OSNR Limited (if appl.)
OC-192 LR ITU	—		—	
Dispersion compensation tolerance	+/–800 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 10-5, Table 10-6, and Table 10-7 lists the optical performance parameters for 10-Gbps cards.

Table 10-5 10-Gbps Interface Optical Performance (Class A, B, C, I, and K)

Parameter	Class A		Class B		Class C		Class I		Class K	
Type	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Maximum bit rate	10 Gbps		10 Gbps		10 Gbps		10 Gbps		10 Gbps	
Regeneration	3R		3R		3R		3R		3R	
FEC	Yes		No		No		Yes (E-FEC)		No	
Threshold	Optimum		Average		Average		Optimum		Average	
Maximum BER[2]	10^{-15}		10^{-12}		10^{-12}		10^{-15}		10^{-12}	
OSNR[1] sensitivity	23 dB	8.5 dB	23 dB	19 dB	19 dB	19 dB	20 dB		23 dB[3]	16 dB[3]
							6 dB		23 dB[4]	17 dB[4]
									23 dB[5]	17 dB[5]
Power sensitivity	–24 dBm	–18 dBm	–21 dBm	–20 dBm	–22 dBm	–22 dBm	–26 dBm	–18 dBm	–24 dBm[3]	–17 dBm[3]
									–23 dBm[4]	–18 dBm[4]
									–23 dBm[5]	–17 dBm[5]
Power overload	–8 dBm		–8 dBm		–9 dBm		–8 dBm		–7 dBm	

Table 10-5 10-Gbps Interface Optical Performance (Class A, B, C, I, and K) (Continued)

Parameter	Class A		Class B		Class C		Class I		Class K	
Type	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Transmitted Power Range[6]										
10-Gbps multirate transponder/ 10-Gbps FEC transponder	+2.5 to 3.5 dBm (for TXP_MR_10G) +3.0 to 6.0 dBm (for TXP_MR_10E)		+2.5 to 3.5 dBm		+3.0 to 6.0 dBm		+3.0 to 6.0 dBm		—	
OC-192 LR ITU	—		—		+3.0 to 6.0 dBm		—		–1.0 to +3.0 dBm	
10-Gbps Ethernet Xponder, Sonet/SDH Add/Drop, OTU2 Xponder	—		—		—		—		–1.0 to +3.0 dBm	
Dispersion compensation tolerance	+/–800 ps/nm		+/–1,000 ps/nm		+/–1,000 ps/nm		+/–800 ps/nm		–400 to +800 ps/nm	

1. OSNR = optical signal-to-noise ratio
2. BER = bit error rate
3. This value is for Xen Pak XFP used with Catalyst card.
4. This value is for XFP used with Catalyst, Xponder, and ADM-10G cards.
5. This value is for X2 XFP used with Catalyst card.
6. These values, decreased by patchcord and connector losses, are also the input power values for the optical add drop multiplexer (OADM) cards.

Table 10-6 10-Gbps Interface Optical Performance (Class N, O, P, and V)

Parameter	Class N		Class O		Class P		Class V	
Type	Power Limited	OSNR Limited	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Maximum bit rate	10 Gbps		10 Gbps		10 Gbps		10 Gbps	
Regeneration	3R		3R		3R		3R	
FEC	Yes (E-FEC)		Yes		Yes (E-FEC)		No	
Threshold	Optimum		Optimum		Optimum		Average	
Maximum BER[2]	10^{-15}		10^{-15}		10^{-15}		10^{-12}	
OSNR[1] sensitivity	19 dB	5 dB	11 dB	11 dB	23 dB	8 dB	23 dB	16 dB
Power sensitivity	–27 dBm	–20 dBm	–18 dBm	–18 dBm	–27 dBm	–18 dBm	–24 dBm	–18 dBm

Table 10-6 10-Gbps Interface Optical Performance (Class N, O, P, and V) (Continued)

Parameter	Class N		Class O		Class P		Class V	
Type	Power Limited	OSNR Limited	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Power overload	–8 dBm		–7 dBm		–7 dBm		–7 dBm	
Transmitted Power Range[3]								
10-Gbps multirate transponder/10-Gbps FEC transponder	+3.0 to 6.0 dBm		—		—		—	
OC-192 LR ITU	—		—		—		0 to +3.0 dBm	
10-Gbps Ethernet Xponder, Sonet/SDH Add/Drop, OTU2 Xponder	—		–1.0 to +3.0 dBm		–1.0 to +3.0 dBm		0 to +3.0 dBm	
Dispersion compensation tolerance	+/–800 ps/nm		–500 to +1100 ps/nm		–500 to +1100 ps/nm		–500 to +1600 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 optical add drop multiplexer (OADM) cards.

Table 10-7 10-Gbps Interface Optical Performance (Class W, X, Y, and Z)

Parameter	Class W		Class X		Class Y		Class Z	
Type	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited
Maximum bit rate	10 Gbps		10 Gbps		10 Gbps		10 Gbps	
Regeneration	3R		3R		3R		3R	
FEC	Yes		Yes (E-FEC)		Yes		Yes (E-FEC)	
Threshold	Optimum		Optimum		Optimum		Optimum	
Maximum BER[2]	10^{-15}		10^{-15}		10^{-15}		10^{-15}	
OSNR[1] sensitivity	8.5 dB	8.5 dB	19 dB	5 dB	23 dB	8 dB	19 dB	5.5 dB
Power sensitivity	–18 dBm	–18 dBm	–27 dBm	–20 dBm	–24 dBm	–20 dBm	–27 dBm	–20 dBm
Power overload	–7 dBm		–7 dBm		–8 dBm		–8 dBm	
Transmitted Power Range[3]								
10-Gbps multirate transponder/10-Gbps FEC transponder	—		—		+3.0 to 6.0 dBm		+3.0 to 6.0 dBm	
OC-192 LR ITU	—		—		—		—	

Table 10-7 10-Gbps Interface Optical Performance (Class W, X, Y, and Z) (Continued)

Parameter	Class W		Class X		Class Y		Class Z	
Type	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR[1] Limited	Power Limited	OSNR Limited
10-Gbps Ethernet Xponder, Sonet/SDH Add/Drop, OTU2 Xponder	0 to +3.0 dBm		0 to +3.0 dBm		—		—	
Dispersion compensation tolerance	–500 to +1100 ps/nm		–500 to +1300 ps/nm		–800 to +1600 ps/nm		–2200 to +3700 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 optical add drop multiplexer (OADM) cards.

Table 10-8 and Table 10-9 lists the optical interface performance parameters for 2.5-Gbps cards.

Table 10-8 2.5-Gbps Interface Optical Performance (Class D, E, and F)

Parameter	Class D		Class E		Class F	
Type	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Maximum bit rate	2.5 Gbps		2.5 Gbps		2.5 Gbps	
Regeneration	3R		3R		2R	
FEC	Yes		No		No	
Threshold	Average		Average		Average	
Maximum BER	10^{-15}		10^{-12}		10^{-12}	
OSNR sensitivity	14 dB	5 dB	14 dB	10 dB	15 dB	15 dB
Power sensitivity	–31 dBm	–25 dBm	–30 dBm	–23 dBm	–24 dBm	–24 dBm
Power overload	–9 dBm		–9 dBm		–9 dBm	
Transmitted Power Range[1]						
TXP_MR_2.5G and TXPP_MR_2.5G	–1.0 to 1.0 dBm		–1.0 to 1.0 dBm		–1.0 to 1.0 dBm	
MXP_MR_2.5G and MXPP_MR_2.5G	—		+2.0 to +4.0 dBm		—	
OC-48 ELR 100 GHz	—		—		—	
2/4 port GbE Transponder (GBIC WDM 100GHz)	—		—		—	
2.5 Gbps DWDM ITU-T SPF	—		—		—	
Dispersion compensation tolerance	–1200 to +5400 ps/nm		–1200 to +5400 ps/nm		–1200 to +3300 ps/nm	

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

Table 10-9 2.5-Gbps Interface Optical Performance (Class G, H, and M)

Parameter	Class G		Class H		Class M	
Type	Power Limited	OSNR Limited	Power Limited	OSNR Limited	Power Limited	OSNR Limited
Maximum bit rate	2.5 Gbps		1.25 Gbps		2.5 Gbps	
Regeneration	3R		3R		3R	
FEC	No		No		No	
Threshold	Average		Average		Average	
Maximum BER	10^{-12}		10^{-12}		10^{-12}	
OSNR sensitivity	14 dB	11 dB	13 dB	8 dB	14 dB	9 dB
Power sensitivity	–27 dBm	–23 dBm	–28 dBm	–18 dBm	–28 dBm	–22 dBm
Power overload	–9 dBm		–7 dBm		–9 dBm	
Transmitted Power Range[1]						
TXP_MR_2.5G	—		—		—	
TXPP_MR_2.5G	—					
MXP_MR_2.5G	–2.0 to 0 dBm					
MXPP_MR_2.5G	—					
OC-48 ELR 100 GHz	—		—		—	
2/4 port GbE Transponder (GBIC WDM 100GHz)	–1200 to +3300 ps/nm		0 to –8 dBm		—	
2.5 Gbps DWDM ITU-T SPF			—		0 to –11 dBm	
Dispersion compensation tolerance			–1000 to +3600 ps/nm		–800 to +2400 ps/nm	

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

10.1.4 Channel Allocation Plans

ONS 15454 DWDM ROADM cards are designed for use with specific channels in the C band and L band. In most cases, the channels for these cards are either numbered (for example, 1 to 32 or 1 to 40) or delimited (odd or even). Client interfaces must comply with these channel assignments to be compatible with the ONS 15454 system.

. The following cards operate in the C-band:

- 32WSS
- 32DMX
- 32DMX-C
- 40-MUX-C
- 40-WXC-C

- 80-WXC-C
- 40-SMR1-C
- 40-SMR2-C
- MMU

Table 10-10 lists the C-band channel IDs and wavelengths at ITU-T 50-GHz intervals. This is a comprehensive C-band channel table that encompasses present and future card capabilities.

Table 10-10 DWDM C-Band[1] Channel Allocation Plan with 50-GHz Spacing

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
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

Table 10-10 DWDM C-Band[1] Channel Allocation Plan with 50-GHz Spacing (Continued)

Channel Number	Frequency (THz)	Wavelength (nm)	Channel Number	Frequency (THz)	Wavelength (nm)
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

1. Channels on the C-band are 4-skip-1, starting at 1530.33 nm.

The following add drop cards utilize the L-band DWDM channels:

- 32WSS-L
- 32DMX-L

Table 10-11 lists the L-band channel IDs and wavelengths at ITU-T 50-GHz intervals. This is a comprehensive L-band channel table that encompasses present and future card capabilities.

Table 10-11 DWDM L-band[1] Channel Allocation Plan at 50 GHz Spacing

Channel Number	Frequency (THz)	Wavelength (nm)		Channel Number	Frequency (THz)	Wavelength (nm)
1	190.85	1570.83		41	188.85	1587.46
2	190.8	1571.24		42	188.8	1587.88
3	190.75	1571.65		43	188.75	1588.30
4	190.7	1572.06		44	188.7	1588.73
5	190.65	1572.48		45	188.65	1589.15
6	190.6	1572.89		46	188.6	1589.57
7	190.55	1573.30		47	188.55	1589.99
8	190.5	1573.71		48	188.5	1590.41
9	190.45	1574.13		49	188.45	1590.83
10	190.4	1574.54		50	188.4	1591.26
11	190.35	1574.95		51	188.35	1591.68
12	190.3	1575.37		52	188.3	1592.10
13	190.25	1575.78		53	188.25	1592.52

Table 10-11 DWDM L-band[1] Channel Allocation Plan at 50 GHz Spacing (Continued)

Channel Number	Frequency (THz)	Wavelength (nm)		Channel Number	Frequency (THz)	Wavelength (nm)
14	190.2	1576.20		54	188.2	1592.95
15	190.15	1576.61		55	188.15	1593.37
16	190.1	1577.03		56	188.1	1593.79
17	190.05	1577.44		57	188.05	1594.22
18	190	1577.86		58	188	1594.64
19	189.95	1578.27		59	187.95	1595.06
20	189.9	1578.69		60	187.9	1595.49
21	189.85	1579.10		61	187.85	1595.91
22	189.8	1579.52		62	187.8	1596.34
23	189.75	1579.93		63	187.75	1596.76
24	189.7	1580.35		64	187.7	1597.19
25	189.65	1580.77		65	187.65	1597.62
26	189.6	1581.18		66	187.6	1598.04
27	189.55	1581.60		67	187.55	1598.47
28	189.5	1582.02		68	187.5	1598.89
29	189.45	1582.44		69	187.45	1599.32
30	189.4	1582.85		70	187.4	1599.75
31	189.35	1583.27		71	187.35	1600.17
32	189.3	1583.69		72	187.3	1600.60
33	189.25	1584.11		73	187.25	1601.03
34	189.2	1584.53		74	187.2	1601.46
35	189.15	1584.95		75	187.15	1601.88
36	189.1	1585.36		76	187.1	1602.31
37	189.05	1585.78		77	187.05	1602.74
38	189	1586.20		78	187	1603.17
39	188.95	1586.62		79	186.95	1603.60
40	188.9	1587.04		80	186.9	1604.03

1. Channels on the L-band are contiguous, starting at 1577.86 nm. The channels listed in this table begin with 1570.83 nm for backward compatibility with other ONS products.

10.2 Safety Labels

For information about safety labels, see the "G.1.2 Class 1M Laser Product Cards" section on page G-4.

10.3 32WSS Card

(Cisco ONS 15454 only)

Note For 32WSS card specifications, see the "32WSS Card Specifications" section in the Hardware Specifications document.

The two-slot 32-Channel Wavelength Selective Switch (32WSS) card performs channel add/drop processing within the ONS 15454 DWDM node. The 32WSS card can be installed in the following pairs of slots:

- Slots 1 and 2
- Slots 3 and 4
- Slots 5 and 6
- Slots 12 and 13
- Slots 14 and 15
- Slots 16 and 17

10.3.1 Faceplate and Block Diagrams

The 32WSS has six types of ports:

- ADD RX ports (1 to 32): These ports are used for adding channels (listed in Table 10-13 on page 10-21). Each add channel is associated with an individual switch element that selects whether that channel is added. Each add port has optical power regulation provided by a variable optical attenuator (VOA). The 32WSS has four physical receive connectors that accept multifiber push-on (MPO) cables on its front panel for the client input interfaces. Each MPO cable breaks out into eight separate cables.
- EXP RX port: The EXP RX port receives an optical signal from another 32WSS card in the same network element (NE).
- EXP TX port: The EXP TX port sends an optical signal to the other 32WSS card within the NE.
- COM TX port: The COM TX (line input) port sends an aggregate optical signal to a booster amplifier card (for example, OPT-BST) for transmission outside of the NE.
- COM RX port: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- DROP TX port: The DROP TX port sends the split-off optical signal containing drop channels to the 32DMX card, where the channels are further processed and dropped.

Figure 10-1 shows the 32WSS card front panel and identifies the traffic flow through the ports.

Figure 10-1 32WSS Faceplate and Ports

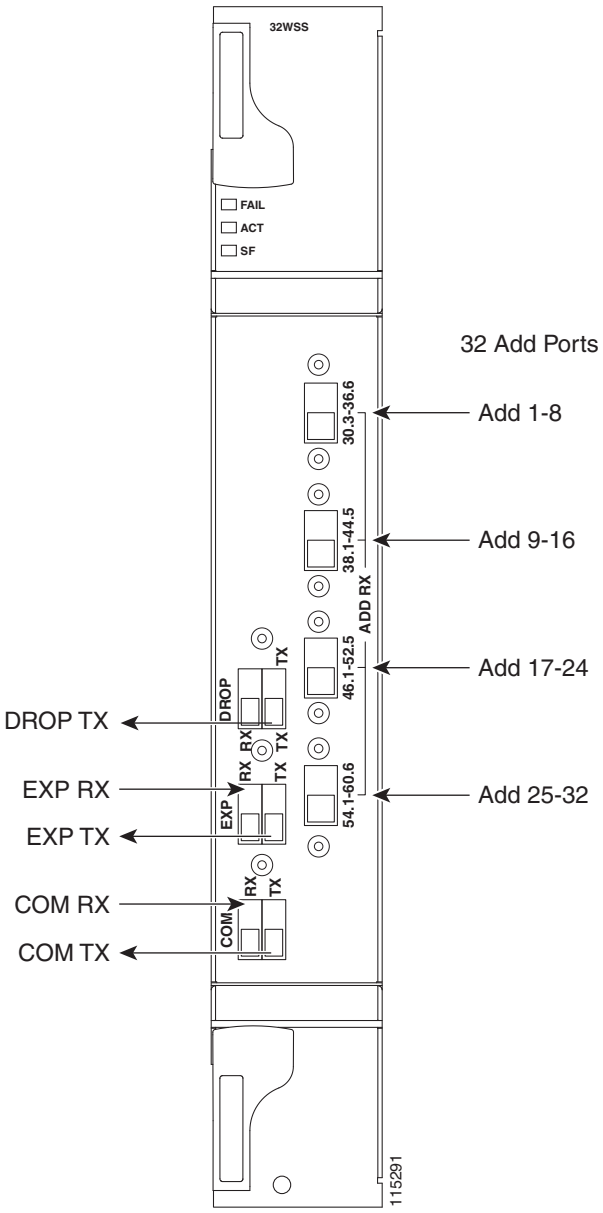
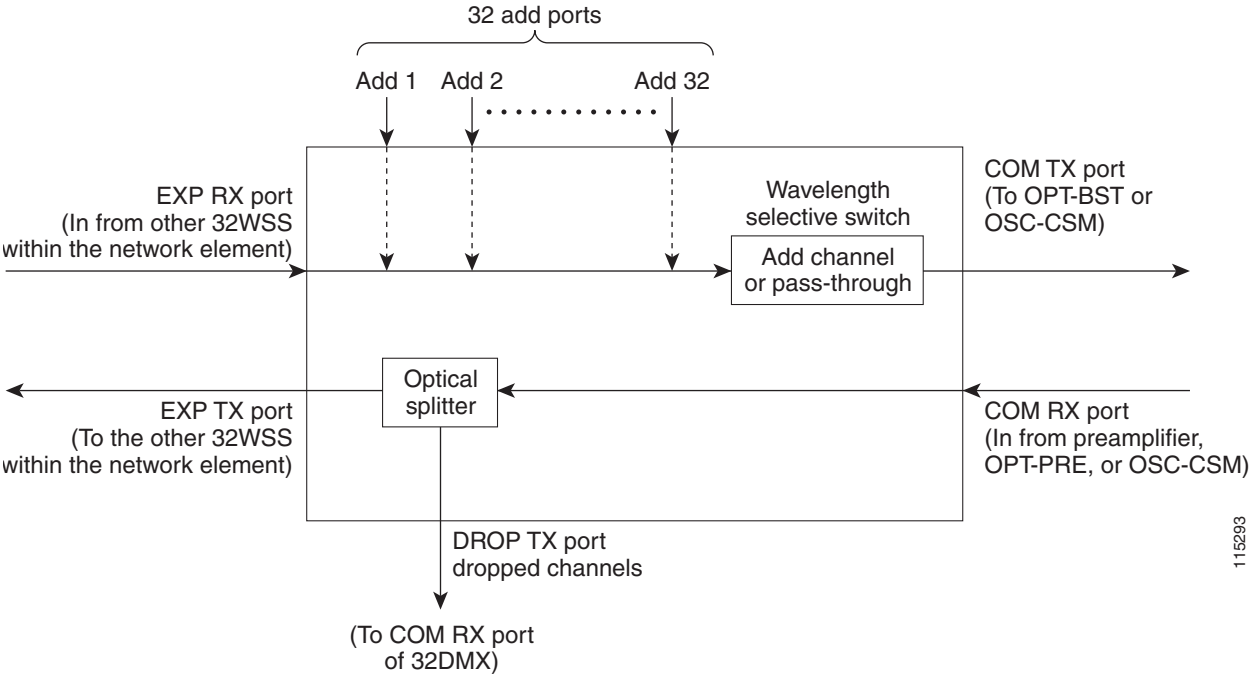


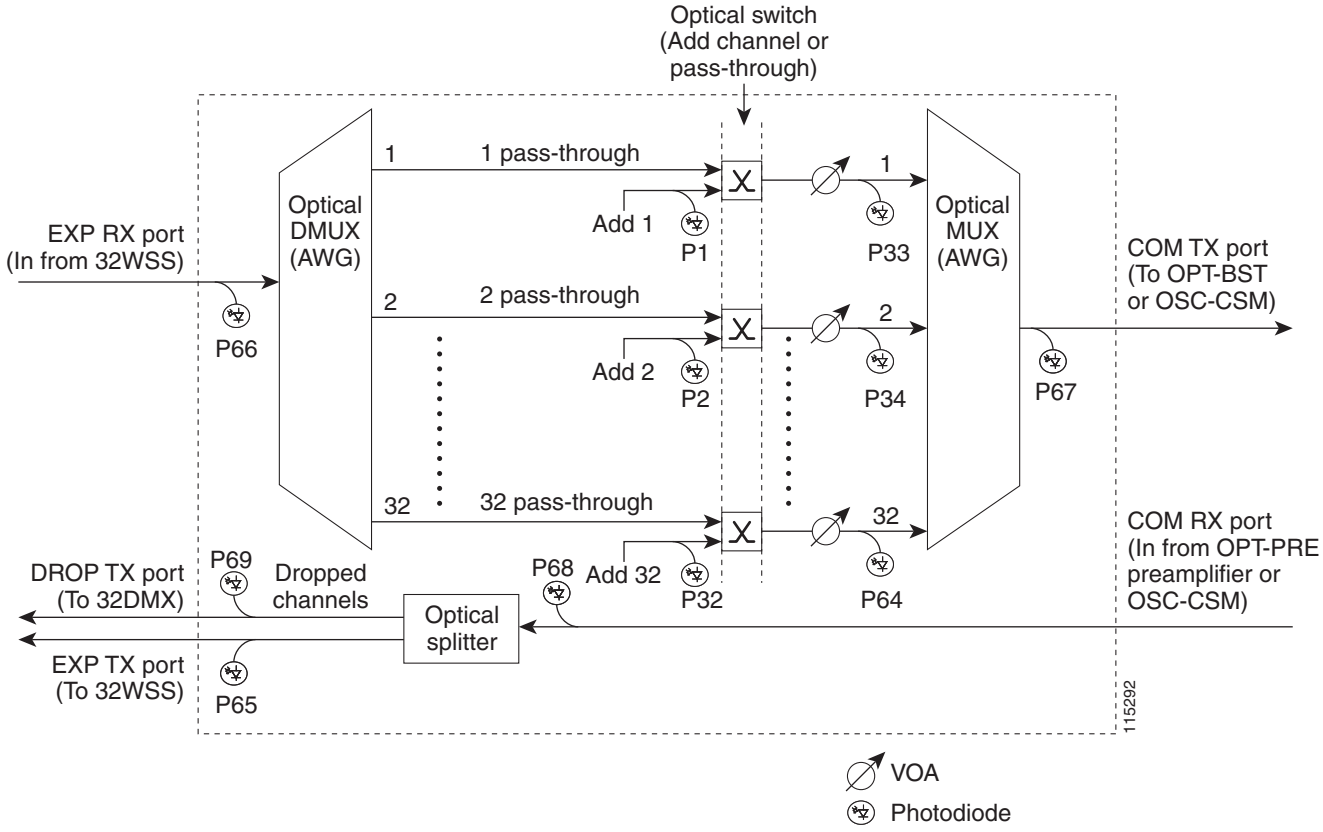
Figure 10-2 provides a high-level functional block diagram of the 32WSS card and Figure 10-3 shows how optical signals are processed on the EXP RX and COM RX ports.

Figure 10-2 32WSS Block Diagram



Aggregate optical signals that enter the EXP RX and COM RX port are processed in two ways: Add channel/pass-through and optical splitter processing. The optical processing stages are shown in Figure 10-3, which provides a detailed optical functional diagram of the 32WSS card.

Figure 10-3 32WSS Optical Block Diagram



The EXP RX PORT and COM RX PORT operate as follows:

- EXP RX Port Add Channel/Pass-through Processing

  The incoming optical signal is received at the EXP RX port from the other 32WSS card within the NE. The incoming aggregate optical signal is demultiplexed into 32 individual wavelengths, or channels. Each channel is then individually processed by the optical switch, which performs add/pass-through processing. By using software controls, the switch either selects the optical channel coming in from the demultiplexer (that is, the pass-through channel) or it selects the external ADD channel. If the ADD port channel is selected this channel is transmitted and the optical signal coming from the demultiplexer is blocked.

  After the optical switch stage, all of the channels are multiplexed into an aggregate optical signal, which is sent out on the COM TX port. The output is typically connected to an OPT-BST or OPT-BST-E card (in the event a booster amplifier is needed) or to an OSC-CSM card (if no amplification is needed).

- COM RX Port Optical Splitter Processing

  The COM RX port receives the incoming optical signal and directs it to the 32WSS card's optical splitter. The splitter optically diverts channels that are designated to be dropped to the DROP TX port. The DROP TX port is typically connected to the COM RX port of the 32DMX where the drop channels are being dropped. Channels that are not dropped pass-through the optical splitter and flow out of the 32WSS card EXP TX port. Typically, this optical signal is connected to the other 32WSS module within the NE.

- COM TX Port Monitoring

The COM TX value can be measured by either a physical or a virtual photodiode of the 15454-32WSS card. If the vendor ID of the 15454-32WSS card is between 1024 (0x400) and 2047 (0x800) the COM TX value is measured by physical photodiode. If the vendor ID of the 15454-32WSS card is greater than 2048 (0x800), the COM TX value is measured by the virtual photodiode. For COM TX values measured by virtual photodiode, check the values at the RX port in the downstream of the COM TX port (COM-RX port on OPT-BST or OSC-CSM card).

10.3.2 32WSS ROADM Functionality

The 32WSS card works in combination with the 32DMX card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco Transport Planner, and Cisco Transport Manager (CTM). ROADM functionality using the 32WSS card requires two 32DMX single-slot cards and two 32WSS double-slot cards (totalling six slots needed in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

Note A terminal site can be configured using only a 32WSS card and a 32DMX card plugged into the east or west side of the shelf.

10.3.3 32WSS Power Monitoring

Physical photodiodes P1 through P69 monitor the power for the 32WSS card. Table 10-12 shows how the returned power level values are calibrated to each port.

Table 10-12 32WSS Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	ADD (Power ADD)	ADD RX
P33–P64[1]	PASS THROUGH	COM TX
	ADD (Power)	COM TX
P65	OUT EXP	EXP TX
P66	IN EXP	EXP RX
P67	OUT COM	COM TX
P68	IN COM	COM RX
P69	DROP	DROP TX

1. P33–P64 monitor either ADD or PASSTHROUGH power, depending on the state of the optical switch

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.*

10.3.4 32WSS Channel Allocation Plan

The 32WSS Card's channel labels, frequencies, and wavelengths are listed in Table 10-13.

Table 10-13 32WSS Channel Allocation Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.1	195.1	1536.61
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.87
	39.7	194.7	1539.77
	40.5	194.6	1540.46
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61

10.3.5 32WSS Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.3.6 Related Procedures for 32WSS Card

The following section lists procedures and tasks related to the configuration of the 32WSS card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G93 Modify the 32WSS, 32WSS-L, 40-WSS-C, or 40-WSS-CE Line Settings and PM Thresholds, page 21-65

10.4 32WSS-L Card

(Cisco ONS 15454 only)

Note For 32WSS-L card specifications, see the "32WSS-L Card Specifications" section in the Hardware Specifications document.

The two-slot 32-Channel Wavelength Selective Switch L-Band (32WSS-L) card performs channel add/drop processing within the ONS 15454 DWDM node. The 32WSS-L card is particularly well suited for use in networks that employ DS fiber or SMF-28 single-mode fiber.The 32WSS-L card can be installed in the following pairs of slots:

- Slots 1 and 2
- Slots 3 and 4
- Slots 5 and 6
- Slots 12 and 13
- Slots 14 and 15
- Slots16 and 17

10.4.1 Faceplate and Block Diagrams

The 32WSS-L card faceplate has six types of ports:

- ADD RX ports (1 to 32): These ports are used for adding channels (which are listed in Table 10-15 on page 10-28). Each add channel is associated with an individual switch element that selects whether the channel is added. Each add port has optical power regulation provided by a VOA.
- EXP RX port: The EXP RX port receives an optical signal from another 32WSS-L card in the same NE.
- EXP TX port: The EXP TX port sends an optical signal to the other 32WSS-L card within the NE.
- COM TX port: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.
- COM RX port: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- DROP TX port: The DROP TX port sends the split-off optical signal with drop channels to the 32DMX-L card, where the channels are further processed and dropped.

Figure 10-4 shows the 32WSS-L module front panel and identifies the traffic flow through the ports.

Figure 10-4 32WSS-L Faceplate and Ports

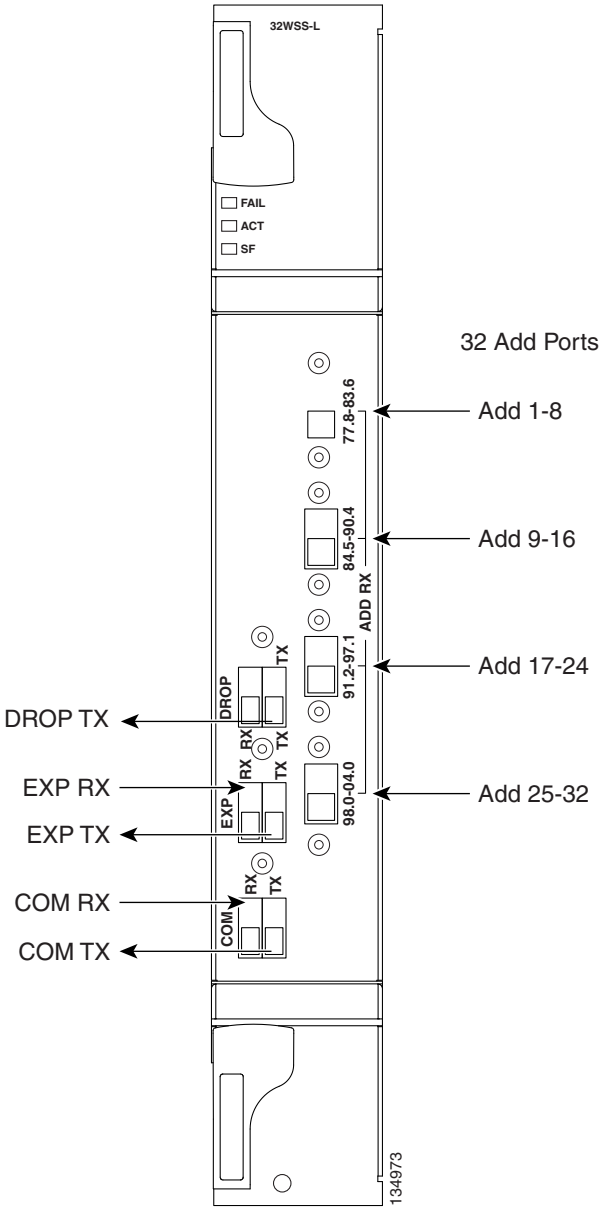
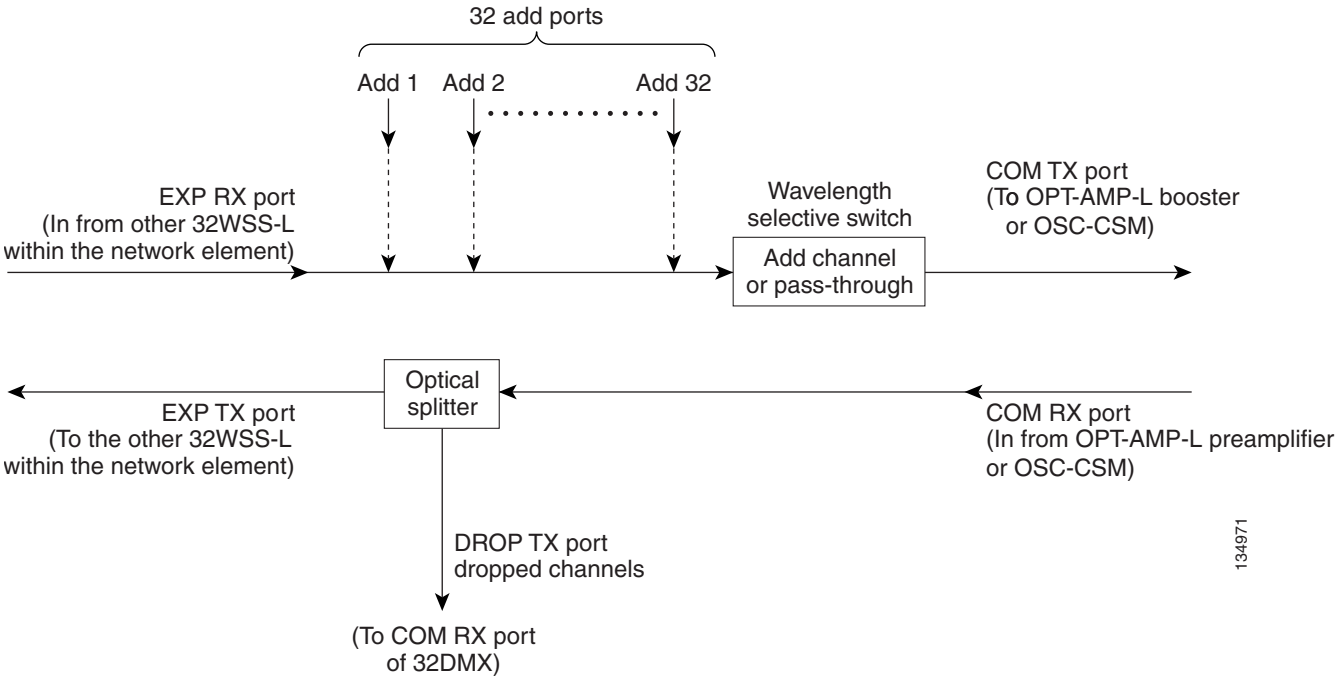


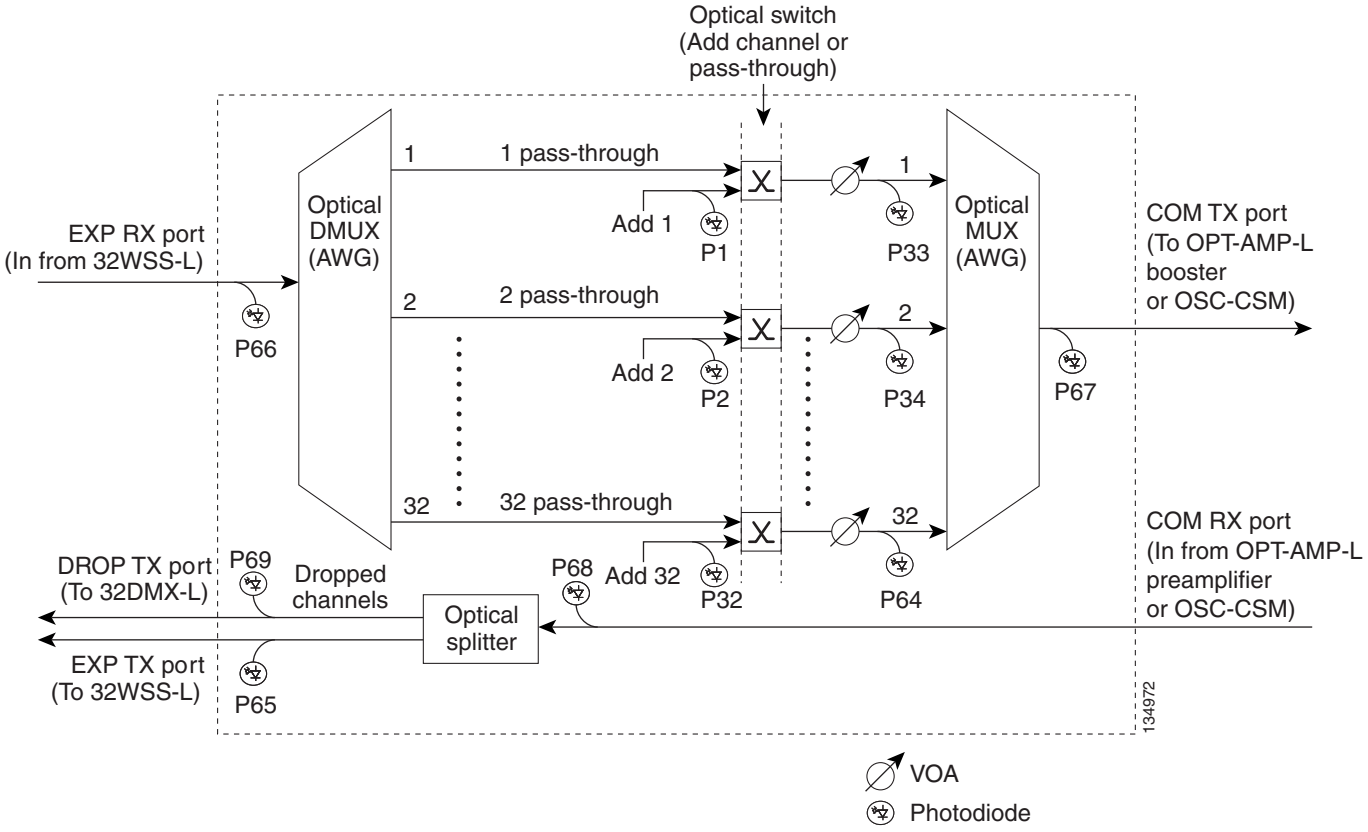
Figure 10-5 provides a high-level functional block diagram of the 32WSS-L card and Figure 10-6 on page 10-26 shows how optical signals are processed on the EXP RX and COM RX ports.

Figure 10-5 32WSS-L Block Diagram



Aggregate optical signals that enter the EXP RX and COM RX ports are processed in two ways: add channel/pass-through and optical splitter processing. The optical processing stages are shown in Figure 10-6, which provides a detailed optical functional diagram of the 32WSS-L card.

Figure 10-6 32WSS-L Optical Block Diagram



The EXP RX PORT and COM RX PORT operate as follows:

- EXP RX Port Add Channel/Pass-through Processing

  The incoming optical signal is received at the EXP RX port from the other 32WSS-L card within the NE. The incoming aggregate optical signal is demultiplexed into 32 individual wavelengths, or channels. Each channel is then individually processed by the optical switch, which performs add/pass-through processing. By using software controls, the switch either selects the optical channel coming in from the demultiplexer (that is, the pass-through channel) or it selects the external ADD channel. If the ADD port channel is selected this channel is transmitted and the optical signal coming from the demultiplexer is blocked.

  After the optical switch stage, all of the channels are multiplexed into an aggregate optical signal, which is sent out on the COM TX port. The output is typically connected to an OPT-AMP-L or OPT-BST-E card (in the event a booster amplifier is needed) or to an OSC-CSM card (if no amplification is needed).

- COM RX Port Optical Splitter Processing

  The COM RX port receives the incoming optical signal and directs it to the 32WSS-L card's optical splitter. The splitter optically diverts channels that are designated to be dropped to the DROP TX port. The DROP TX port is typically connected to the COM RX port of the 32DMX-L where the drop channels are being dropped. Channels that are not dropped pass-through the optical splitter and flow out of the 32WSS-L card EXP TX port. Typically, this optical signal is connected to the other 32WS-L module within the NE.

10.4.2 32WSS-L ROADM Functionality

The 32WSS-L works in combination with the 32DMX-L to implement L-band (1570 to 1620 nm) functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 32WSS-L card requires two 32DMX-L single-slot cards and two 32WSS-L double-slot cards (totalling six slots needed in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

Note A terminal site can be configured using a 32WSS-L card and a 32DMX-L card plugged into the east or west side of the shelf.

10.4.3 32WSS-L Power Monitoring

Physical photodiodes P1 through P69 monitor the power for the 32WSS-L card. Table 10-14 shows the returned power level values calibrated to each port.

Table 10-14 32WSS-L Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	ADD (Power ADD)	ADD RX
P33–P64[1]	PASS THROUGH	COM TX
	ADD (Power)	COM TX
P65	OUT EXP	EXP TX
P66	IN EXP	EXP RX
P67	OUT COM	COM TX
P68	IN COM	COM RX
P69	DROP	DROP TX

1. P33–P64 monitor either ADD or PASSTHROUGH power, depending on the state of the optical switch

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 9.2.1.*

10.4.4 32WSS-L Channel Plan

The 32WSS-L card uses 32 banded channels on the ITU-T 100-GHz grid, as shown in Table 10-15.

Table 10-15 32WSS-L Channel Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B77.8	77.8	190	1577.86
	78.6	189.9	1578.69
	79.5	189.8	1579.52
	80.3	189.7	1580.35
B81.1	81.1	189.6	1581.18
	82.0	189.5	1582.02
	82.8	189.4	1582.85
	83.6	189.3	1583.69
B84.5	84.5	189.2	1584.53
	85.3	189.1	1585.36
	86.2	189	1586.20
	87.0	188.9	1587.04
B87.8	87.8	188.8	1587.88
	88.7	188.7	1588.73
	89.5	188.6	1589.57
	90.4	188.5	1590.41
B91.2	91.2	188.4	591.26
	92.1	188.3	1592.10
	92.9	188.2	1592.95
	93.7	188.1	1593.79
B94.6	94.6	188	1594.64
	95.4	187.9	1595.49
	96.3	187.8	1596.34
	97.1	187.7	1597.19
B98.0	98.0	187.6	1598.04
	98.8	187.5	1598.89
	99.7	187.4	1599.75
	00.6	187.3	1600.60
B01.4	01.4	187.2	1601.46
	02.3	187.1	1602.31
	03.1	187	1603.17
	04.0	186.9	1604.03

10.4.5 32WSS-L Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.4.6 Related Procedures for 32WSS-L Card

The following section lists procedures and tasks related to the configuration of the 32WSS-L card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G93 Modify the 32WSS, 32WSS-L, 40-WSS-C, or 40-WSS-CE Line Settings and PM Thresholds, page 21-65

10.5 32DMX Card

(Cisco ONS 15454 only)

Note For 32DMX card specifications, see the "32DMX Card Specifications" section in the Hardware Specifications document.

The single-slot 32-Channel Demultiplexer (32DMX) card is an optical demultiplexer. The card receives an aggregate optical signal on its COM RX port and demultiplexes it into to (32) ITU-T 100-GHz-spaced channels. The 32DMX card can be installed in Slots 1 to 6 and in Slots 12 to 17.

10.5.1 Faceplate and Block Diagrams

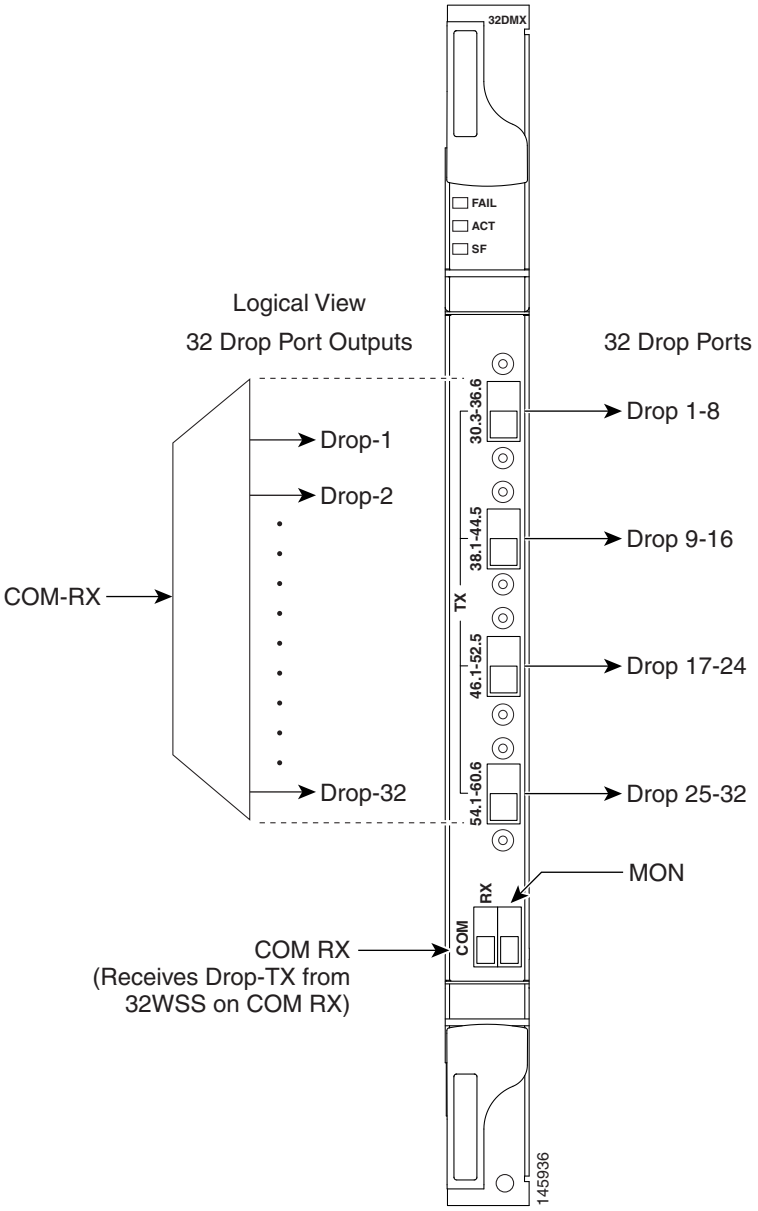
The 32DMX card has two types of ports:

- COM RX port: COM RX is the input port for the aggregate optical signal being demultiplexed. This port is supported by a VOA for optical power regulation and a photodiode for optical power monitoring.
- DROP TX ports (1 to 32): On its output, the 32DMX provides 32 drop ports (listed in Table 10-17 on page 10-32) that are typically used for dropping channels within the ROADM node. These ports are connected using four 8-fiber MPO ribbon connectors. The incoming optical signal to the demultiplexer comes into the COM RX port. This input port is connected using a single LC duplex optical connector.Each drop port has a photodiode for optical power monitoring. Unlike the two-slot

32DMX-O demultiplexer, the drop ports on the 32DMX do not have a VOA per channel for optical power regulation. For a description of the 32DMX-O card, see the "6.4 32DMX-O Card" section on page 6-14.

Figure 10-7 shows the 32DMX card front panel and the basic traffic flow through the ports.

Figure 10-7 32DMX Faceplate and Ports



A block diagram of the 32DMX card is shown in Figure 10-8.

Figure 10-8 32DMX Block Diagram

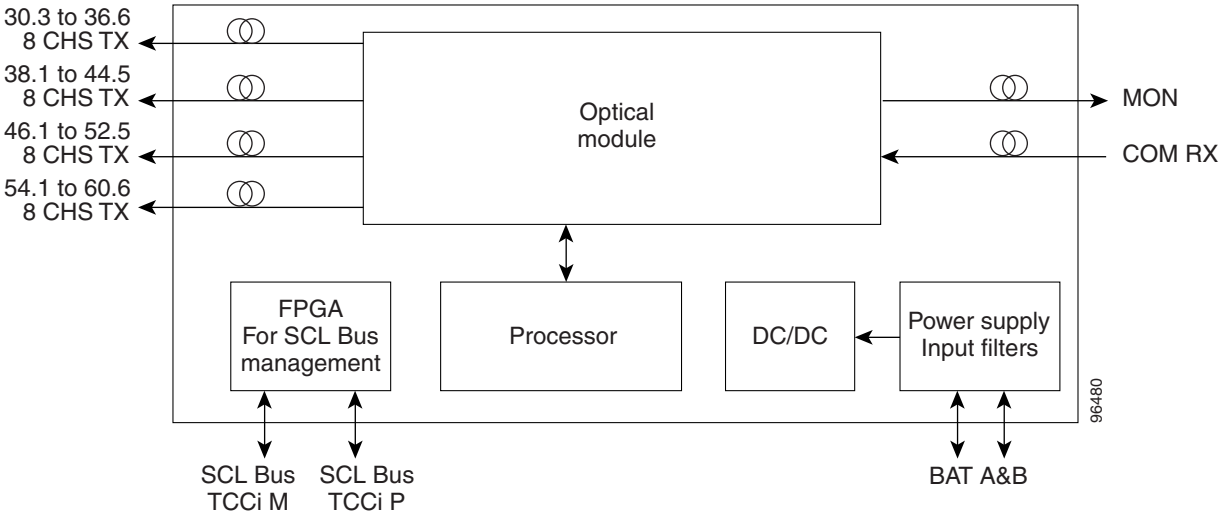
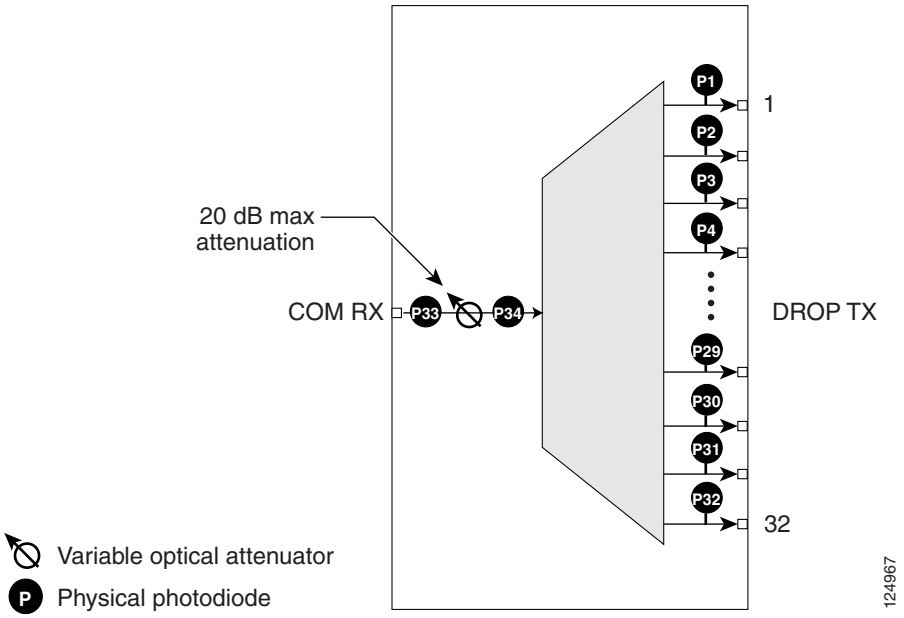


Figure 10-9 shows the 32DMX optical module functional block diagram.

Figure 10-9 32DMX Optical Module Functional Block Diagram



10.5.2 32DMX ROADM Functionality

The 32DMX card works in combination with the 32WSS card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 32DMX card requires two 32DMX single-slot cards and two 32WSS double-slot cards (for six slots total in the ONS 15454 chassis).

For information about the ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

Note A terminal site can be configured using only a 32WSS card and a 32DMX card plugged into the east or west side of the shelf.

10.5.3 32DMX Power Monitoring

Physical photodiodes P1 through P33 monitor the power for the 32DMX card. The returned power level values are calibrated to the ports as shown in Table 10-16.

Table 10-16 32DMX Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	DROP	DROP TX
P33	INPUT COM	COM RX

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 9.2.1*.

10.5.4 32DMX Channel Allocation Plan

The 32DMX card's channel labels, frequencies, and wavelengths are listed in Table 10-17.

Table 10-17 32DMX Channel Allocation Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.1	195.1	1536.61
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.87
	39.7	194.7	1539.77
	40.5	194.6	1540.46

Table 10-17 32DMX Channel Allocation Plan (Continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61

10.5.5 32DMX Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.5.6 Related Procedures for 32DMX Card

The following section lists procedures and tasks related to the configuration of the 32DMX card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards

- NTP-G175 Modify 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, and 4MD-xx.x Line Card Settings and PM Thresholds, page 21-54

10.6 32DMX-L Card

(Cisco ONS 15454 only)

Note For 32DMX-L card specifications, see the "32DMX-L Card Specifications" section in the Hardware Specifications document.

The single-slot 32-Channel Demultiplexer L-Band card (32DMX-L) is an L-band optical demultiplexer. The card receives an aggregate optical signal on its COM RX port and demultiplexes it into to (32) 100-GHz-spaced channels. The 32DMX-L card is particularly well suited for use in networks that employ DS fiber or SMF-28 single-mode fiber. The 32DMX-L card can be installed in Slots 1 to 6 and in Slots 12 to 17.

10.6.1 Faceplate and Block Diagrams

The 32DMX-L card has two types of ports:

- COM RX port: COM RX is the input port for the aggregate optical signal being demultiplexed. This port is supported by both a VOA for optical power regulation and a photodiode for optical power monitoring.
- DROP TX ports (1 to 32): On its output, the 32DMX-L card provides 32 drop ports (listed in Table 10-21 on page 10-42) that are typically used for dropping channels within the ROADM node. These ports are connected using four 8-fiber MPO ribbon connectors. Each drop port has a photodiode for optical power monitoring. Unlike the two-slot 32DMX-O demultiplexer, the drop ports on the 32DMX-L do not have a VOA per channel for optical power regulation. For a description of the 32DMX-O card, see the "6.4 32DMX-O Card" section on page 6-14.

Figure 10-10 shows the 32DMX-L card front panel and the basic traffic flow through the ports.

Figure 10-10 32DMX-L Faceplate and Ports

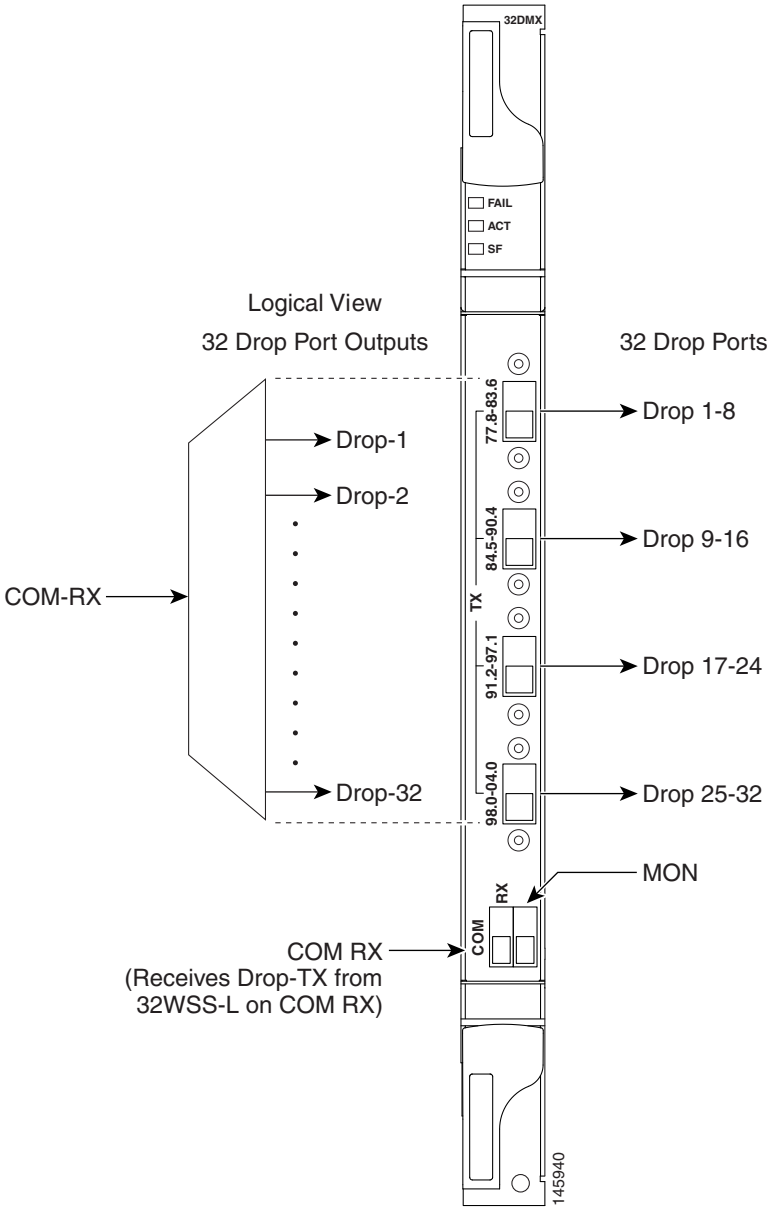


Figure 10-11 shows a block diagram of the 32DMX-L card.

Figure 10-11 32DMX-L Block Diagram

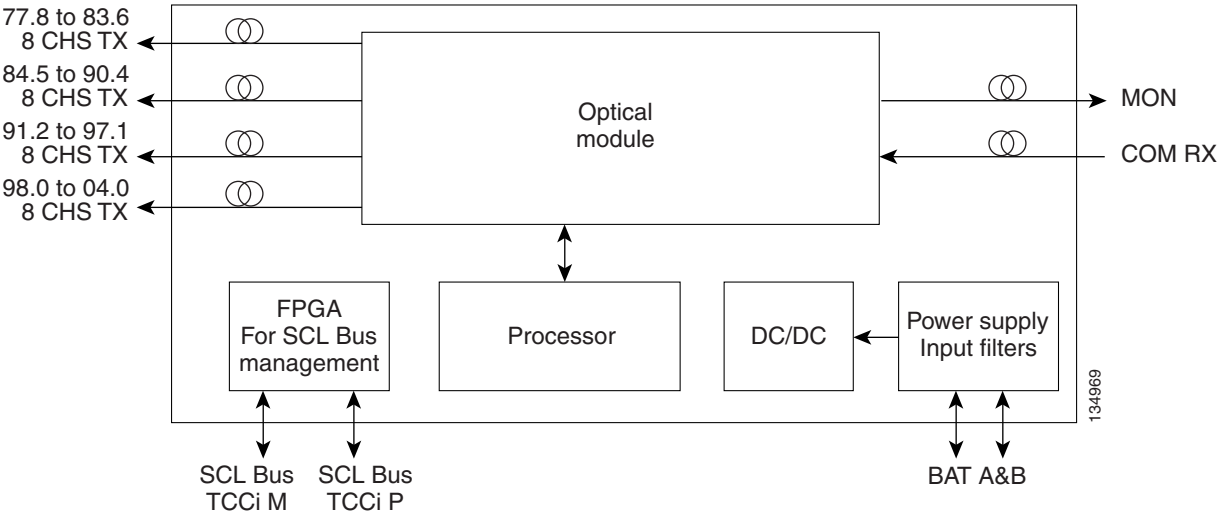
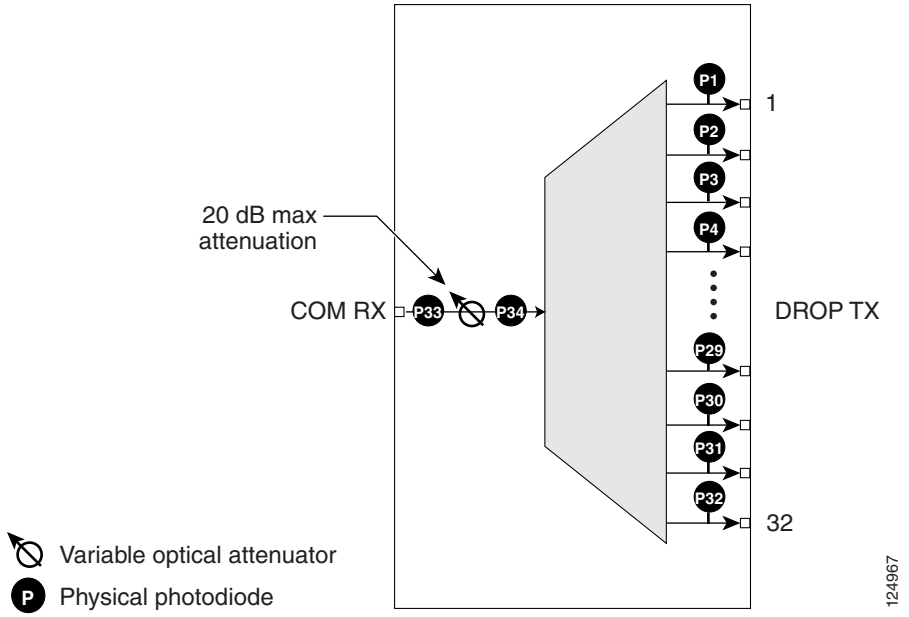


Figure 10-12 shows the 32DMX-L optical module functional block diagram.

Figure 10-12 32DMX-L Optical Module Functional Block Diagram



10.6.2 32DMX-L ROADM Functionality

The 32DMX-L card works in combination with the 32WSS-L card to implement ROADM functionality. AS a ROADM node, the ONS 15454 can be configured to add or drop individual optical channels using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 32DMX-L card requires two 32DMX-L single-slot cards and two 32WSS-L double-slot cards (for a total of six slots in the ONS 15454 chassis).

For information about ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

Note A terminal site can be configured using only a 32WSS-L card and a 32DMX-L card plugged into the east or west side of the shelf.

10.6.3 32DMX-L Power Monitoring

Physical photodiodes P1 through P33 monitor the power for the 32DMX-L card. The returned power level values are calibrated to the ports as shown in Table 10-18.

Table 10-18 32DMX-L Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P32	DROP	DROP TX
P33	INPUT COM	COM RX

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 9.2.1.*

10.6.4 32DMX-L Channel Plan

The 32DMX-L card uses 32 banded channels on the ITU-T 100-GHz grid, as shown in Table 10-19.

Table 10-19 32DMX-L Channel Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B77.8	77.8	190	1577.86
	78.6	189.9	1578.69
	79.5	189.8	1579.52
	80.3	189.7	1580.35
B81.1	81.1	189.6	1581.18
	82.0	189.5	1582.02
	82.8	189.4	1582.85
	83.6	189.3	1583.69
B84.5	84.5	189.2	1584.53
	85.3	189.1	1585.36
	86.2	189	1586.20
	87.0	188.9	1587.04

Table 10-19 32DMX-L Channel Plan (Continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
B87.8	87.8	188.8	1587.88
	88.7	188.7	1588.73
	89.5	188.6	1589.57
	90.4	188.5	1590.41
B91.2	91.2	188.4	1591.26
	92.1	188.3	1592.10
	92.9	188.2	1592.95
	93.7	188.1	1593.79
B94.6	94.6	188	1594.64
	95.4	187.9	1595.49
	96.3	187.8	1596.34
	97.1	187.7	1597.19
B98.0	98.0	187.6	1598.04
	98.8	187.5	1598.89
	99.7	187.4	1599.75
	00.6	187.3	1600.60
B01.4	01.4	187.2	1601.46
	02.3	187.1	1602.31
	03.1	187	1603.17
	04.0	186.9	1604.03

10.6.5 32DMX-L Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.6.6 Related Procedures for 32DMX-L Card

The following section lists procedures and tasks related to the configuration of the 32DMX-L card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards

- NTP-G175 Modify 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, and 4MD-xx.x Line Card Settings and PM Thresholds, page 21-54

10.7 40-DMX-C Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-DMX-C card specifications, see the "40-DMX-C Card Specifications" section in the Hardware Specifications document.

The single-slot 40-Channel Demultiplexer C-band (40-DMX-C) card demultiplexes 40 100-GHz-spaced channels identified in the channel plan (Table 10-21 on page 10-42), and sends them to dedicated output ports. The overall optical power can be adjusted using a single VOA that is common to all channels. The 40-DMX-C card is unidirectional, optically passive, and can be installed in Slots 1 to 6 and 12 to 17.

10.7.1 Faceplate and Block Diagrams

The 40-DMX-C has two types of ports:

- COM RX port: COM RX is the line input port for the aggregate optical signal being demultiplexed. This port is supported by a VOA for optical power regulation and a photodiode for per channel optical power monitoring.

  Note By default, the VOA is set to its maximum attenuation for safety purposes (for example, electrical power failure). A manual VOA setting is also available.

- DROP TX ports (1 to 40): On its output, the 40-DMX-C card provides 40 drop ports that are typically used for dropping channels within the ROADM node. These ports are connected using five physical connectors on the front panel that accept MPO client input cables. (MPO cables break out into eight separate cables.) The 40-DMX-C card also has one LC-PC-II optical connector for the main input.

Figure 10-13 shows the 40-DMX-C card faceplate.

Figure 10-13 40-DMX-C Faceplate

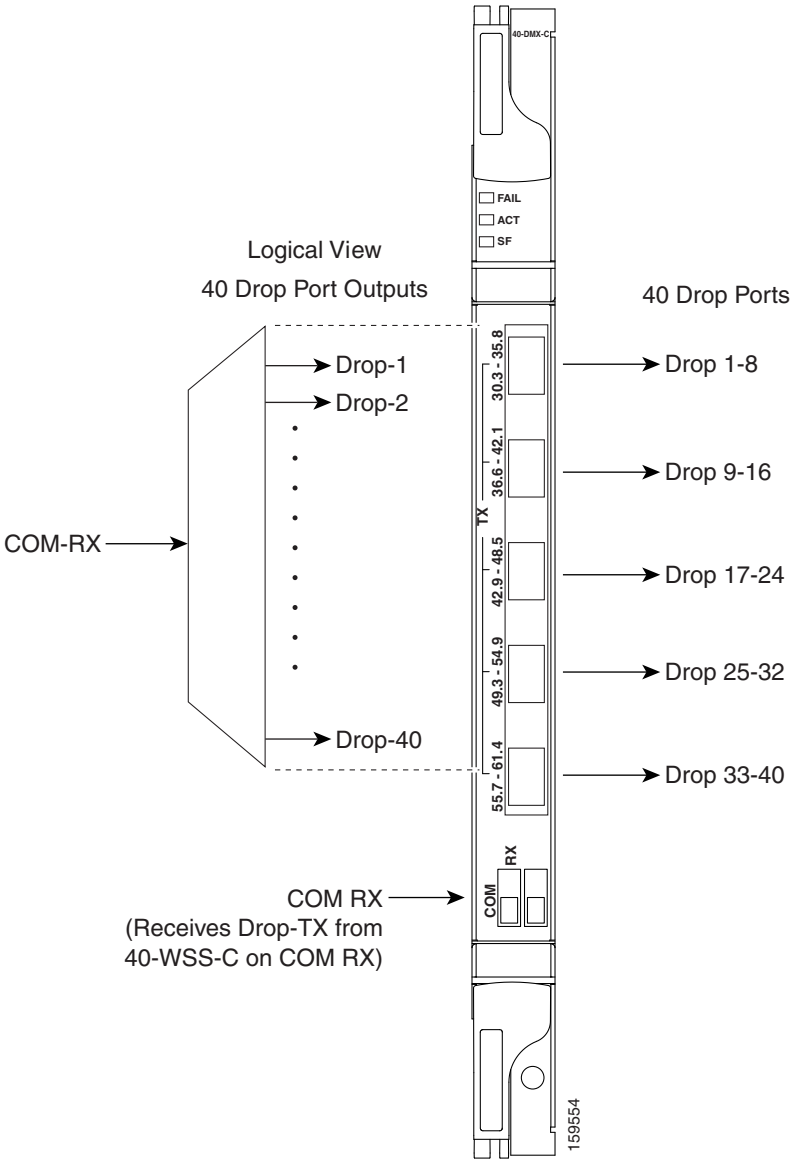


Figure 10-14 shows a block diagram of the 40-DMX-C card.

Figure 10-14 40-DMX-C Block Diagram

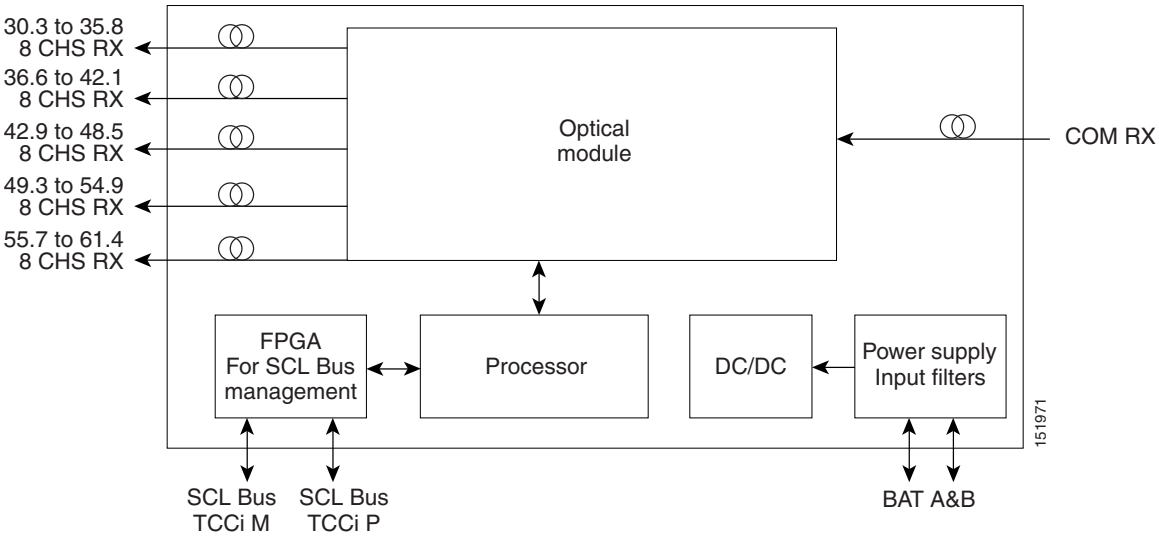
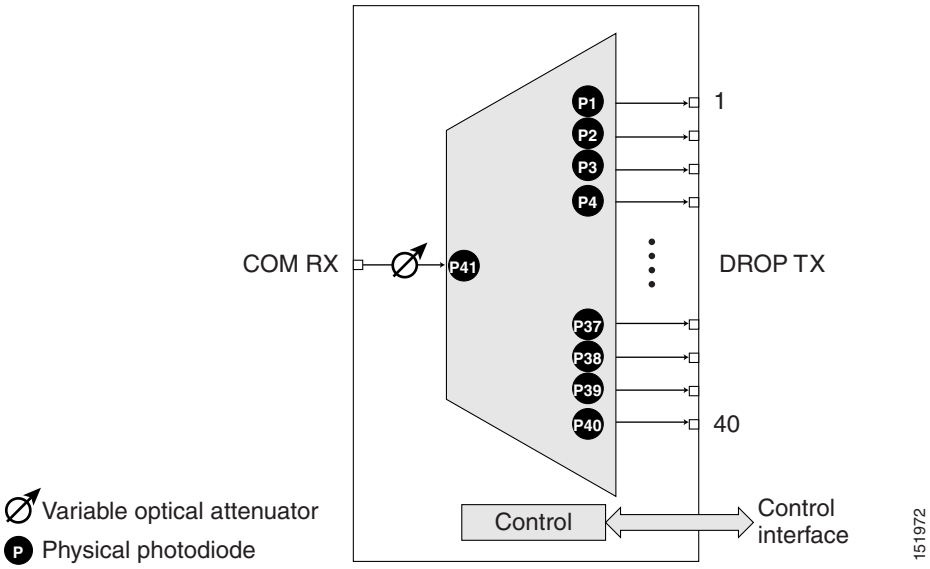


Figure 10-15 shows the 40-DMX-C optical module functional block diagram.

Figure 10-15 40-DMX-C Optical Module Functional Block Diagram



10.7.2 40-DMX-C ROADM Functionality

The 40-DMX-C card works in combination with the 40-WSS-C card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 40-DMX-C card requires two single-slot 40-DMX-C cards and two 40-WSS-C double-slot cards (for a total of six slots in the ONS 15454 chassis).

For other cards' ROADM functionality, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

10.7.3 40-DMX-C Power Monitoring

Physical photodiodes P1 through P40 monitor the power at the outputs of the 40-DMX-C card. P41 monitors the total multiplexed power at the input, calibrated to the COM-RX port. Table 10-20 shows the returned power level values calibrated to each port.

Table 10-20 40-DMX-C Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P40	DROP	DROP TX
P41	INPUT COM	COM RX

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 9.2.1.*

10.7.4 40-DMX-C Channel Plan

Table 10-21 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are demultiplexed by the 40-DMX-C card.

Table 10-21 40-DMX-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35

Table 10-21 40-DMX-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

10.7.5 40-DMX-C Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.7.6 Related Procedures for 40-DMX-C Card

The following section lists procedures and tasks related to the configuration of the 40-DMX-C card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113

- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G175 Modify 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, and 4MD-xx.x Line Card Settings and PM Thresholds, page 21-54

10.8 40-DMX-CE Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-DMX-CE card specifications, see the "40-DMX-CE Card Specifications" section in the Hardware Specifications document.

The single-slot 40-Channel Demultiplexer C-band, even channels (40-DMX-CE) card demultiplexes 40 100-GHz-spaced even-numbered channels identified in the channel plan (Table 10-23 on page 10-47), and sends them to dedicated output ports. The overall optical power can be adjusted using a single VOA that is common to all channels. The 40-DMX-CE card is unidirectional, optically passive, and can be installed in Slots 1 to 6 and 12 to 17.

10.8.1 Faceplate and Block Diagrams

The 40-DMX-CE card has two types of ports:

- COM RX port: COM RX is the line input port for the aggregate optical signal being demultiplexed. This port is supported by a VOA for optical power regulation and a photodiode for per channel optical power monitoring.

  Note By default, the VOA is set to its maximum attenuation for safety purposes (for example, electrical power failure). A manual VOA setting is also available.

- DROP TX ports (1 to 40): On its output, the 40-DMX-CE card provides 40 drop ports that are typically used for dropping channels within the ROADM node. These ports are connected using five physical connectors on the front panel that accept MPO client input cables. (MPO cables break out into eight separate cables.) The 40-DMX-CE card also has one LC-PC-II optical connector for the main input.

Figure 10-16 shows the 40-DMX-CE card faceplate.

Figure 10-16 40-DMX-CE Card Faceplate

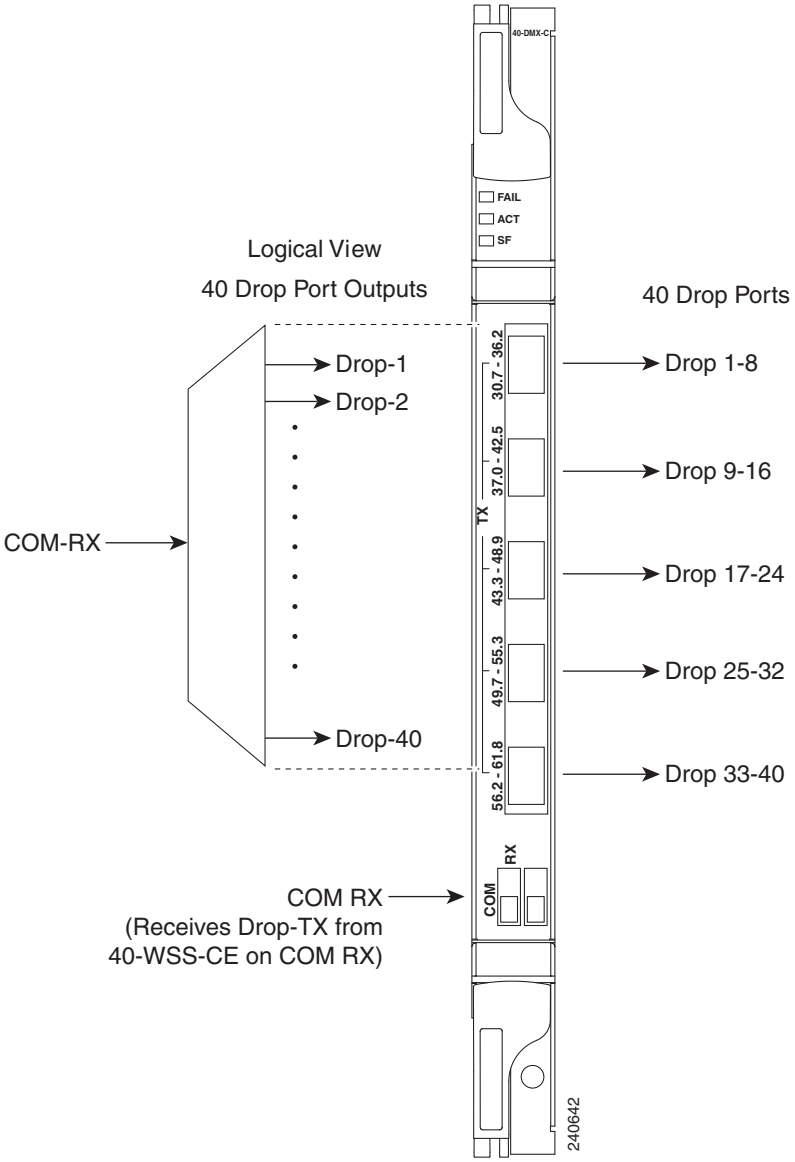


Figure 10-17 shows a block diagram of the 40-DMX-CE card.

Figure 10-17 40-DMX-CE Card Block Diagram

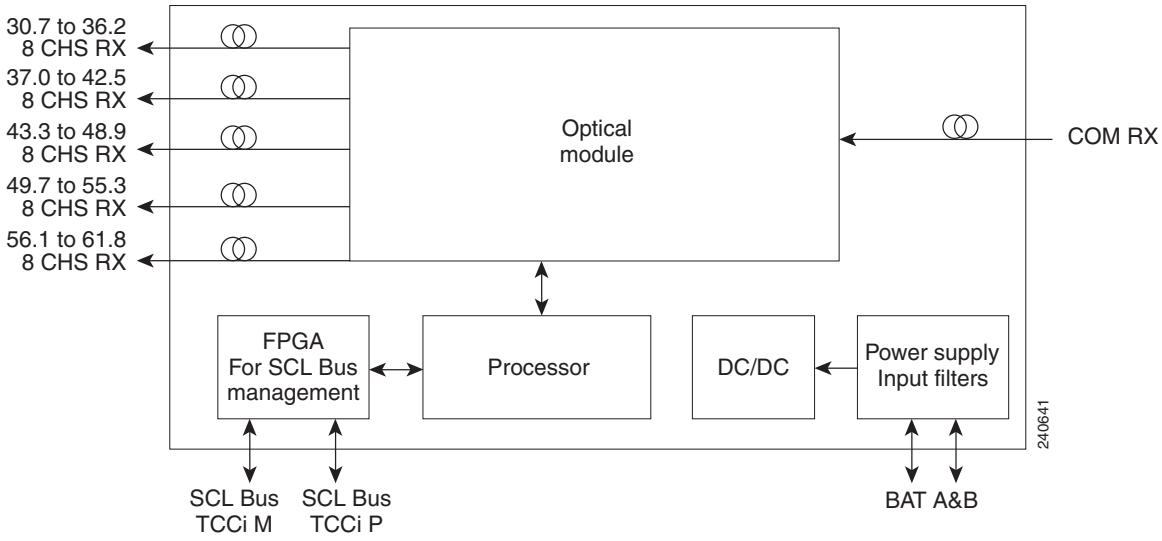
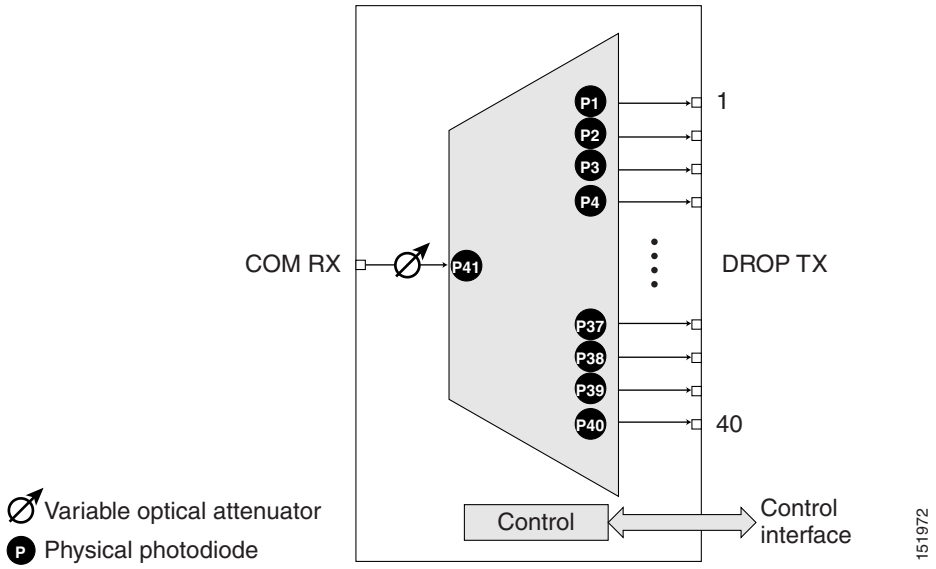


Figure 10-18 shows the 40-DMX-CE card optical module functional block diagram.

Figure 10-18 40-DMX-CE Card Optical Module Functional Block Diagram



10.8.2 40-DMX-CE Card ROADM Functionality

The 40-DMX-CE card works in combination with the 40-WSS-CE card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 40-DMX-CE card requires two single-slot 40-DMX-CE cards and two 40-WSS-CE double-slot cards (for a total of six slots in the ONS 15454 chassis).

For the ROADM functionality of other cards, see the description of that card in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

10.8.3 40-DMX-CE Card Power Monitoring

Physical photodiodes P1 through P40 monitor the power at the outputs of the 40-DMX-CE card. P41 monitors the total multiplexed power at the input, calibrated to the COM-RX port. Table 10-22 shows the returned power level values calibrated to each port.

Table 10-22 40-DMX-CE Card Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P40	DROP	DROP TX
P41	INPUT COM	COM RX

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 9.2.1.*

10.8.4 40-DMX-CE Card Channel Plan

Table 10-23 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are demultiplexed by the 40-DMX-CE card.

Table 10-23 40-DMX-CE Card Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.7	30.7	195.85	1530.72
	31.5	195.75	1531.51
	32.3	195.65	1532.29
	33.1	195.55	1533.07
	33.9	195.45	1533.86
B34.6	34.6	195.35	1534.64
	35.4	195.25	1535.43
	36.2	195.15	1536.22
	37.0	195.05	1537.00
	37.8	194.95	1537.79
B38.6	38.6	194.85	1538.58
	39.4	194.75	1539.37
	40.1	194.65	1540.16
	40.9	194.55	1540.95
	41.8	194.45	1541.75

Table 10-23 40-DMX-CE Card Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B42.5	42.5	194.35	1542.54
	43.3	194.25	1543.33
	44.1	194.15	1544.13
	44.9	194.05	1544.92
	45.7	193.95	1545.72
B46.5	46.5	193.85	1546.52
	47.3	193.75	1547.32
	48.1	193.65	1548.11
	48.9	193.55	1548.91
	49.7	193.45	1549.72
B50.5	50.5	193.35	1550.52
	51.3	193.25	1551.32
	52.1	193.15	1552.12
	52.9	193.05	1552.93
	53.7	192.95	1553.73
B54.4	54.4	192.85	1554.54
	55.3	192.75	1555.34
	56.1	192.65	1556.15
	56.9	192.55	1556.96
	57.8	192.45	1557.77
B58.6	58.6	192.35	1558.58
	59.4	192.25	1559.39
	60.2	192.15	1560.20
	61.0	192.05	1561.01
	61.8	191.95	1561.83

10.8.5 40-DMX-CE Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.8.6 Related Procedures for 40-DMX-CE Card

The following section lists procedures and tasks related to the configuration of the 40-DMX-CE card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113

- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G175 Modify 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, and 4MD-xx.x Line Card Settings and PM Thresholds, page 21-54

10.9 40-MUX-C Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-MUX-C card specifications, see the "40-MUX-C Card Specification" section in the Hardware Specifications document.

The single-slot 40-Channel Multiplexer C-band (40-MUX-C) card multiplexes forty ITU-T 100-GHz-spaced channels identified in the channel plan in Table 10-21 on page 10-42. The 40-MUX-C card can be installed in Slots 1 to 6 and 12 to 17. The 40-MUX-C card is typically used in hub nodes.

10.9.1 Faceplate and Block Diagrams

The 40-MUX-C card has two types of ports:

- COM TX port: COM TX is the line output port for the aggregate optical signal being multiplexed. This port is supported by both a VOA for optical power regulation and a photodiode for per channel optical power monitoring.

  Note By default, the VOA is set to its maximum attenuation for safety purposes (for example, electrical power failure). A manual VOA setting is also available.

- DROP RX ports (1 to 40): The 40-MUX-C card provides 40 input optical channels. These ports are connected using five physical receive connectors on the card's front panel that accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. The 40-DMX-C card also has one LC-PC-II optical connector for the main output. For the wavelength range, see Table 10-21 on page 10-42.

Figure 10-19 shows the 40-MUX-C card faceplate.

Figure 10-19 40-MUX-C Card Faceplate

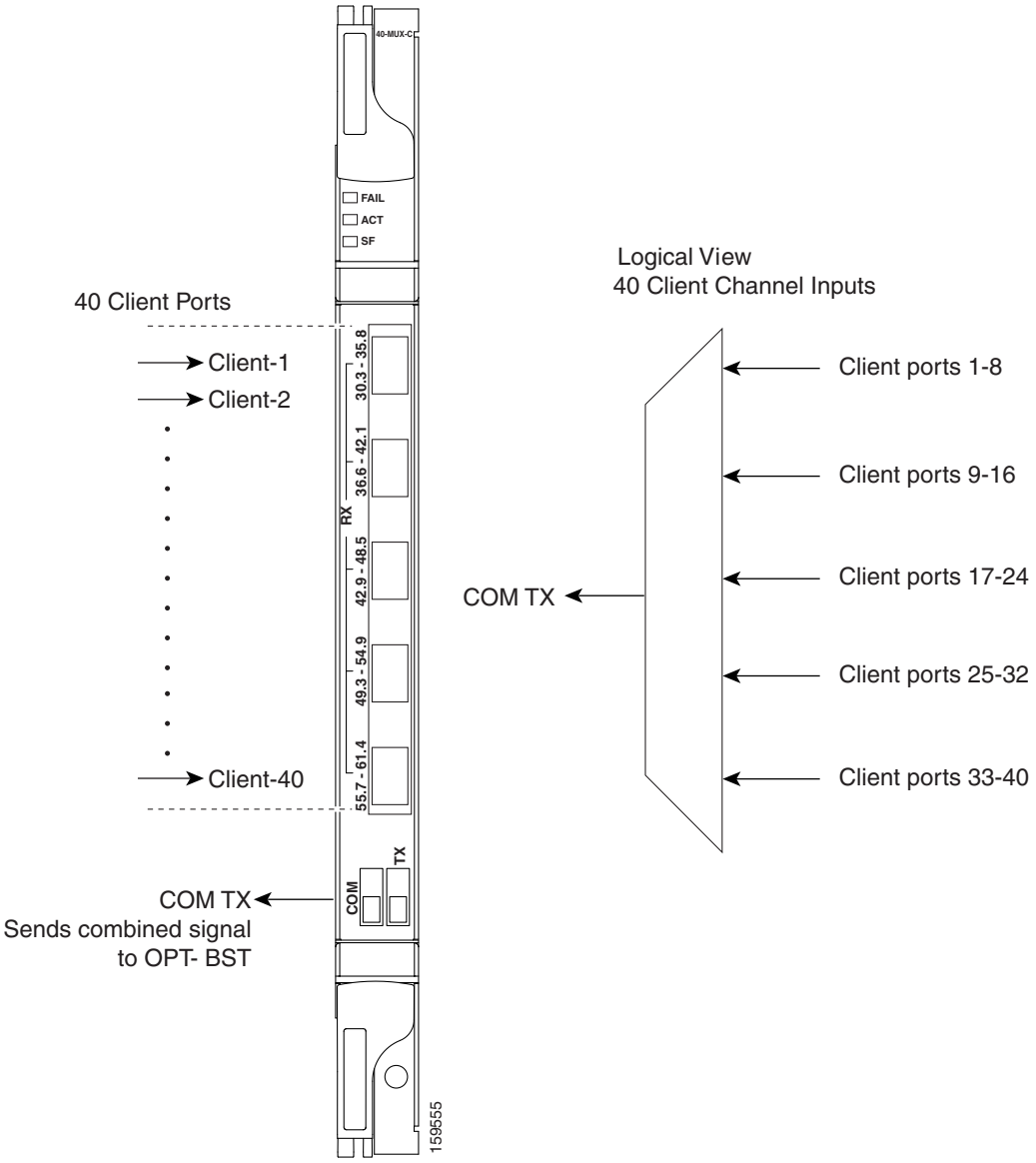


Figure 10-20 shows a block diagram of the 40-MUX-C card.

Figure 10-20 40-MUX-C Card Block Diagram

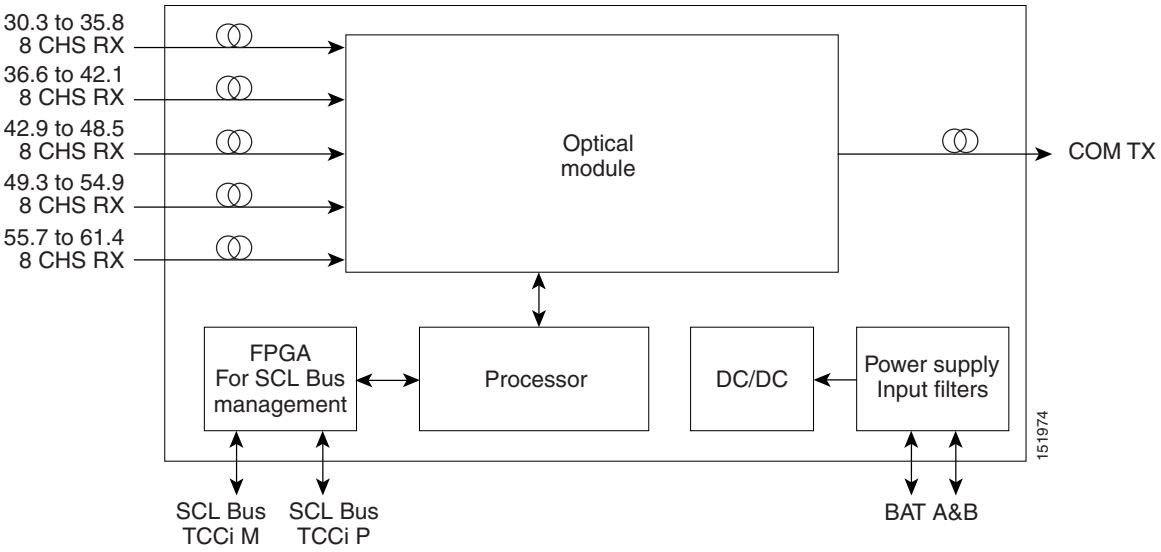
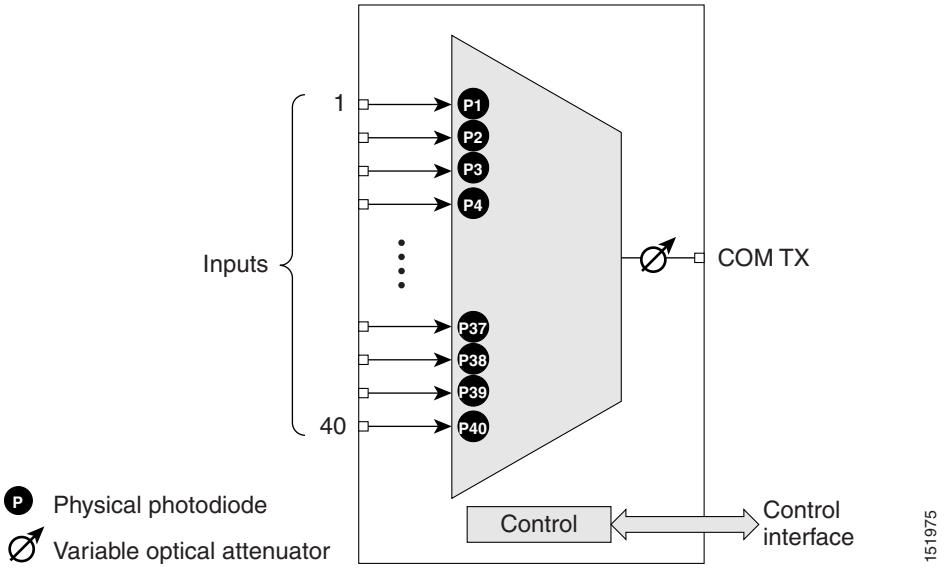


Figure 10-21 shows the 40-MUX-C optical module functional block diagram.

Figure 10-21 40-MUX-C Optical Module Functional Block Diagram



10.9.2 40-MUX-C Card Power Monitoring

Physical photodiodes P1 through P40 monitor the power of the individual input ports to the 40-MUX-C card. P41 monitors the total multiplexed output power, calibrated to the COM-TX port. Table 10-24 shows the returned power level values calibrated to each port.

Table 10-24 40-MUX-C Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1–P40	ADD	ADD RX
P41	OUTPUT 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 9.2.1.*

10.9.3 40-MUX-C Card Channel Plan

Table 10-25 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are multiplexed by the 40-MUX-C card.

Table 10-25 40-MUX-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32

Table 10-25 40-MUX-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

10.9.4 40-MUX-C Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.9.5 Related Procedures for 40-MUX-C Card

The following section lists procedures and tasks related to the configuration of the 40-MUX-C card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2

- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G175 Modify 32MUX-O, 32DMX-O, 32DMX, 32DMX-L, 40-MUX-C, 40-DMX-C, 40-DMX-CE, and 4MD-xx.x Line Card Settings and PM Thresholds, page 21-54

10.10 40-WSS-C Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-WSS-C card specifications, see the "40-WSS-C Card Specifications" section in the Hardware Specifications document.

The double-slot 40-channel Wavelength Selective Switch C-Band (40-WSS-C) card switches 40 ITU-T 100-GHz-spaced channels identified in the channel plan (Table 10-21 on page 10-42) and sends them to dedicated output ports. The 40-WSS-C card is bidirectional and optically passive. The card can be installed in Slots 1 to 6 and 12 to 17

The 40-WSS-C features include:

- Receipt of an aggregate DWDM signal into 40 output optical channels from the Line receive port (EXP RX) in one direction and from the COM-RX port in the other direction.
- Per-channel optical power monitoring using photodiodes.
- Signal splitting in a 70%-to-30% ratio, sent to the 40-DMX-C for dropping signals, then to the other 40-WSS-C card.
- Aggregate DWDM signal monitoring and control through a variable optical attenuator (VOA). In the case of electrical power failure, the VOA is set to its maximum attenuation for safety purposes. A manual VOA setting is also available.

Within the 40-WSS-C card, the first AWG opens the spectrum and each wavelength is directed to one of the ports of a 1x2 optical switch. The same wavelength can be passed through or stopped. If the pass-through wavelength is stopped, a new channel can be added at the ADD port. The card's second AWG multiplexes all of the wavelengths, and the aggregate signal is output through the COM-TX port.

10.10.1 Faceplate and Block Diagrams

The 40-WSS-C has eight types of ports:

- ADD RX ports (1 to 40): These ports are used for adding channels. Each add channel is associated with an individual switch element that selects whether an individual channel is added. Each add port has optical power regulation provided by a VOA. The five connectors on the card faceplate accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. The 40-WSS-C card also has one LC-PC-II optical connector for the main input.
- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- COM TX: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.

- EXP RX port: The EXP RX port receives an optical signal from another 40-WSS-C card in the same NE.
- EXP TX: The EXP TX port sends an optical signal to the other 40-WSS-C card within the NE.
- DROP TX port: The DROP TX port sends the split off optical signal that contains drop channels to the 40-DMX-C card, where the channels are further processed and dropped.

Figure 10-22 shows the 40-WSS-C card faceplate.

Figure 10-22 40-WSS-C Faceplate

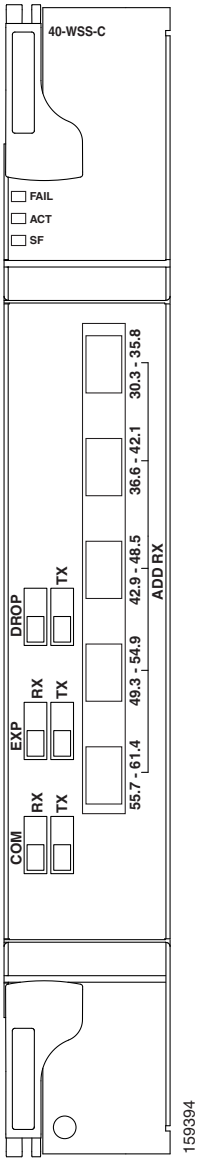


Figure 10-23 shows a block diagram of the 40-WSS-C card.

Figure 10-23 40-WSS-C Block Diagram

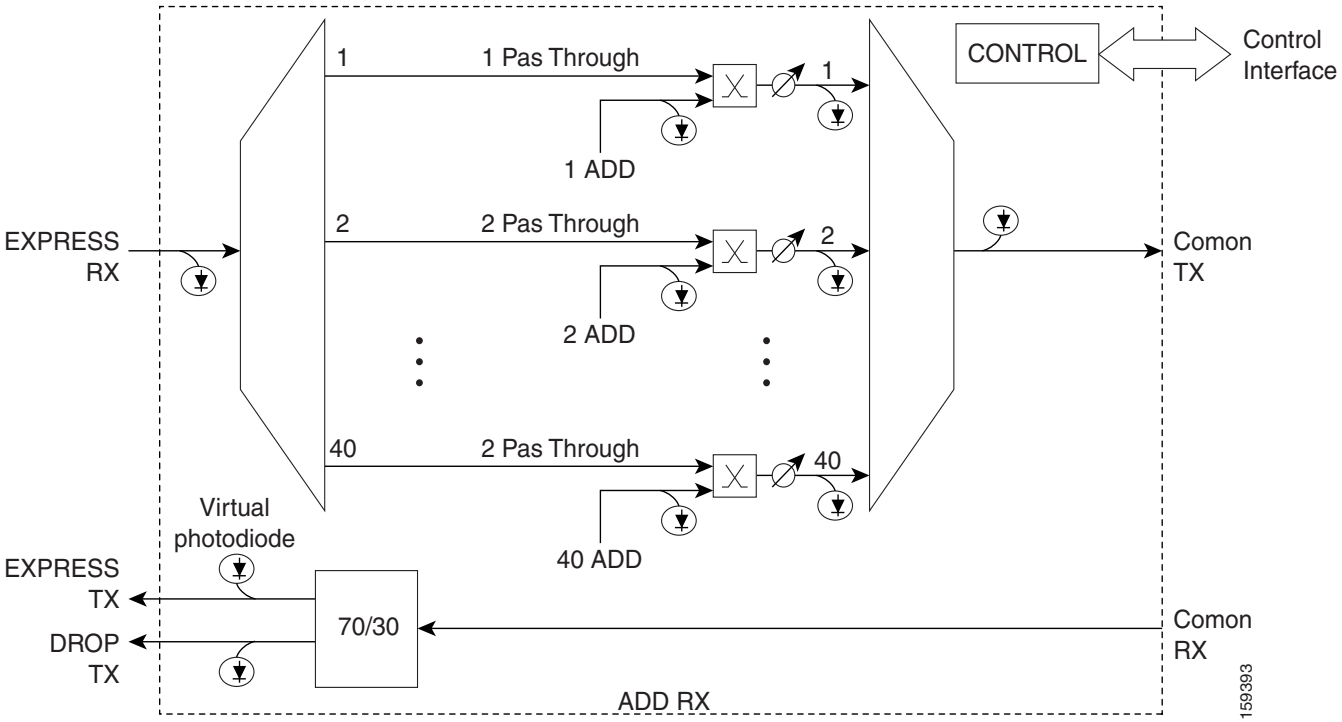
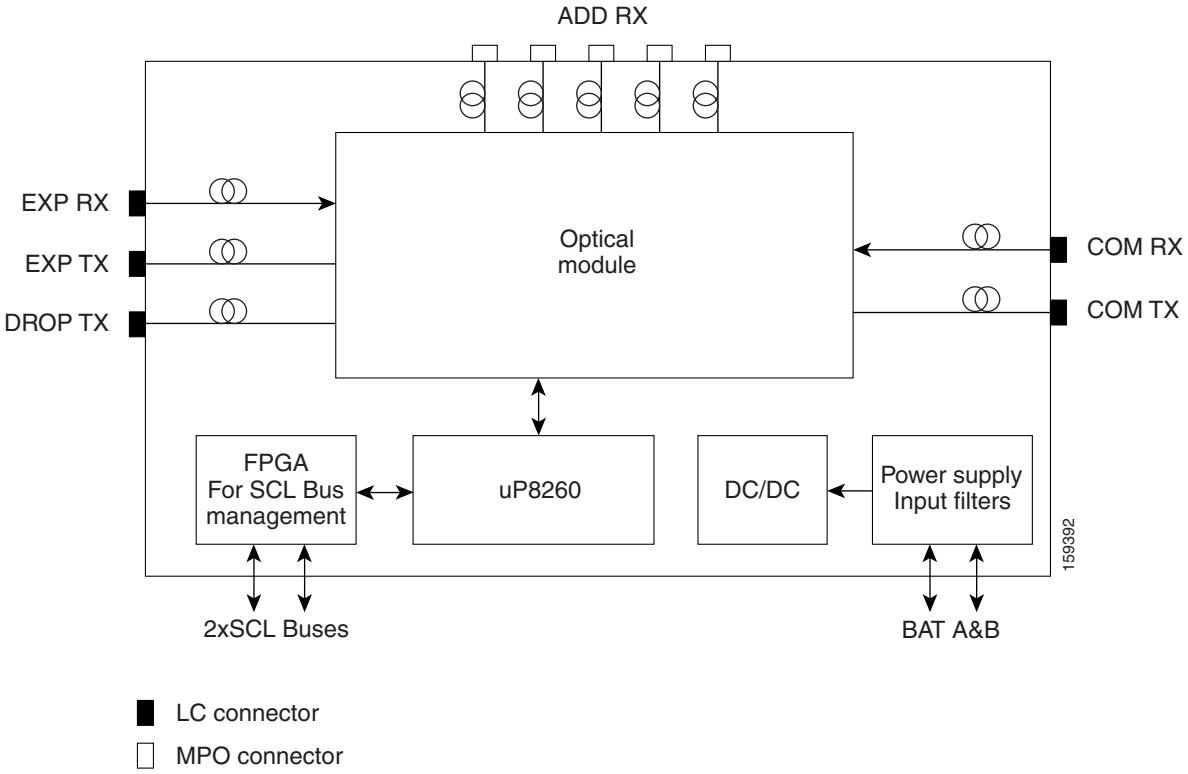


Figure 10-24 shows the 40-WSS-C optical module functional block diagram.

Figure 10-24 40-WSS-C Optical Module Functional Block Diagram



10.10.2 40-WSS-C ROADM Functionality

The 40-WSS-C card works in combination with the 40-DMX-C card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 40-WSS-C card requires two 40-WSS-C double-slot cards and two 40-DMX-C single-slot cards (for a total of six slots in the ONS 15454 chassis).

For information about ROADM functionality for other cards, see that card's description in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

10.10.3 40-WSS-C Power Monitoring

The 40-WSS-C has physical diodes that monitor power at various locations on the card. Table 10-26 lists the physical diode descriptions.

Table 10-26 40-WSS-C Physical Photodiode Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
P1	DROP	DROP TX
P2	EXP	EXP RX
PD*i*3[1]	RX	Add *i* RX ports (that is, channel input Add *i* RX power), up to 40 ports and therefore 40 PDs[1]
PD*i*4[1]	TX	COM TX port (that is, per channel output COM TX power) up to 40 channels and therefore 40 PDs
PD5	COM	COM TX port (that is, total output COM TX power)

1. *i* indicates any channel from 01 through 40.

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 9.2.1.*

Additionally, the 40-WSS-C has two virtual diodes. Virtual diodes are monitor points for each physical photodiode; they are identified with a physical diode relative to the way that the physical diode is identified with one of the two interlink (ILK) ports. Table 10-27 lists the virtual diodes.

Table 10-27 40-WSS-C Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD1	COM	COM RX port (total input COM RX power)
VPD2	EXP	EXP TX port (total output EXP TX power)

10.10.4 40-WSS-C Channel Plan

Table 10-28 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are switched by the 40-WSS-C card.

Table 10-28 40-WSS-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40

Table 10-28 40-WSS-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

10.10.5 40-WSS-C Card Functions

- Card level indicators—Table G-4 on page G-9
- “G.4 Port-Level Indicators” section on page G-9

10.10.6 Related Procedures for 40-WSS-C Card

The following section lists procedures and tasks related to the configuration of the 40-WSS-C card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G93 Modify the 32WSS, 32WSS-L, 40-WSS-C, or 40-WSS-CE Line Settings and PM Thresholds, page 21-65

10.11 40-WSS-CE Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-WSS-CE card specifications, see the "40-WSS-CE Card Specifications" section in the Hardware Specifications document.

The double-slot 40-channel Wavelength Selective Switch Even-Channel C-Band (40-WSS-CE) card switches 40 ITU-T 100-GHz-spaced channels identified in the channel plan (Table 10-31 on page 10-65) and sends them to dedicated output ports. The 40-WSS-CE card is bidirectional and optically passive. The card can be installed in Slots 1 to 6 and 12 to 17.

The 40-WSS-CE features include:

- Receipt of an aggregate DWDM signal into 40 output optical channels from the Line receive port (EXP RX) in one direction and from the COM-RX port in the other direction.
- Per-channel optical power monitoring using photodiodes.
- Signal splitting in a 70-to-30 percent ratio, sent to the 40-DMX-CE card for dropping signals, then to the other 40-WSS-CE card.
- Aggregate DWDM signal monitoring and control through a VOA. In the case of electrical power failure, the VOA is set to its maximum attenuation for safety purposes. A manual VOA setting is also available.

Within the 40-WSS-CE card, the first AWG opens the spectrum and each wavelength is directed to one of the ports of a 1x2 optical switch. The same wavelength can be passed through or stopped. If the pass-through wavelength is stopped, a new channel can be added at the ADD port. The card's second AWG multiplexes all of the wavelengths, and the aggregate signal is output through the COM-TX port.

10.11.1 Faceplate and Block Diagrams

The 40-WSS-CE card has eight types of ports:

- ADD RX ports (1 to 40): These ports are used for adding channels. Each add channel is associated with an individual switch element that selects whether an individual channel is added. Each add port has optical power regulation provided by a VOA. The five connectors on the card faceplate accept MPO cables for the client input interfaces. MPO cables break out into eight separate cables. The 40-WSS-CE card also has one LC-PC-II optical connector for the main input.
- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- COM TX: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.
- EXP RX port: The EXP RX port receives an optical signal from another 40-WSS-CE card in the same NE.
- EXP TX: The EXP TX port sends an optical signal to the other 40-WSS-CE card within the NE.
- DROP TX port: The DROP TX port sends the split off optical signal that contains drop channels to the 40-DMX-C card, where the channels are further processed and dropped.

Figure 10-25 shows the 40-WSS-CE card faceplate.

Figure 10-25 40-WSS-CE Faceplate

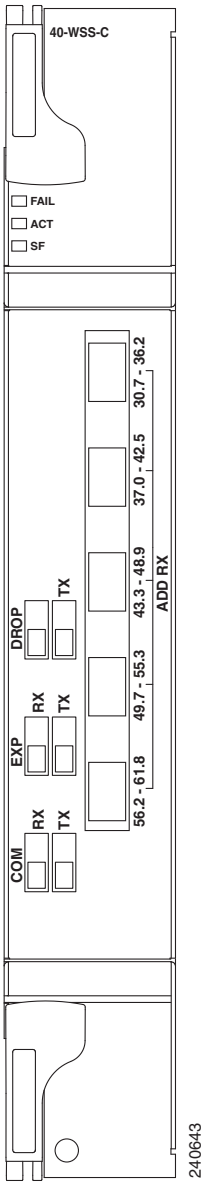


Figure 10-26 shows a block diagram of the 40-WSS-CE card.

Figure 10-26 40-WSS-CE Block Diagram

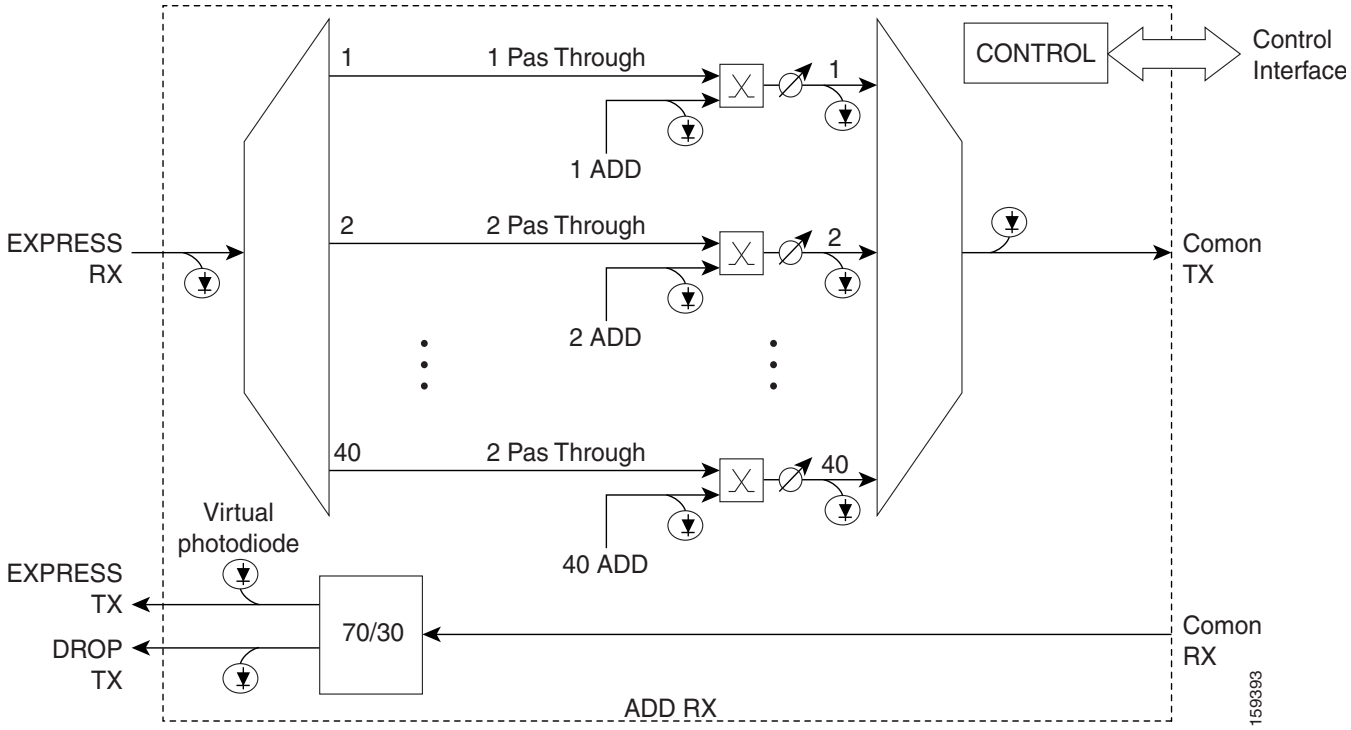
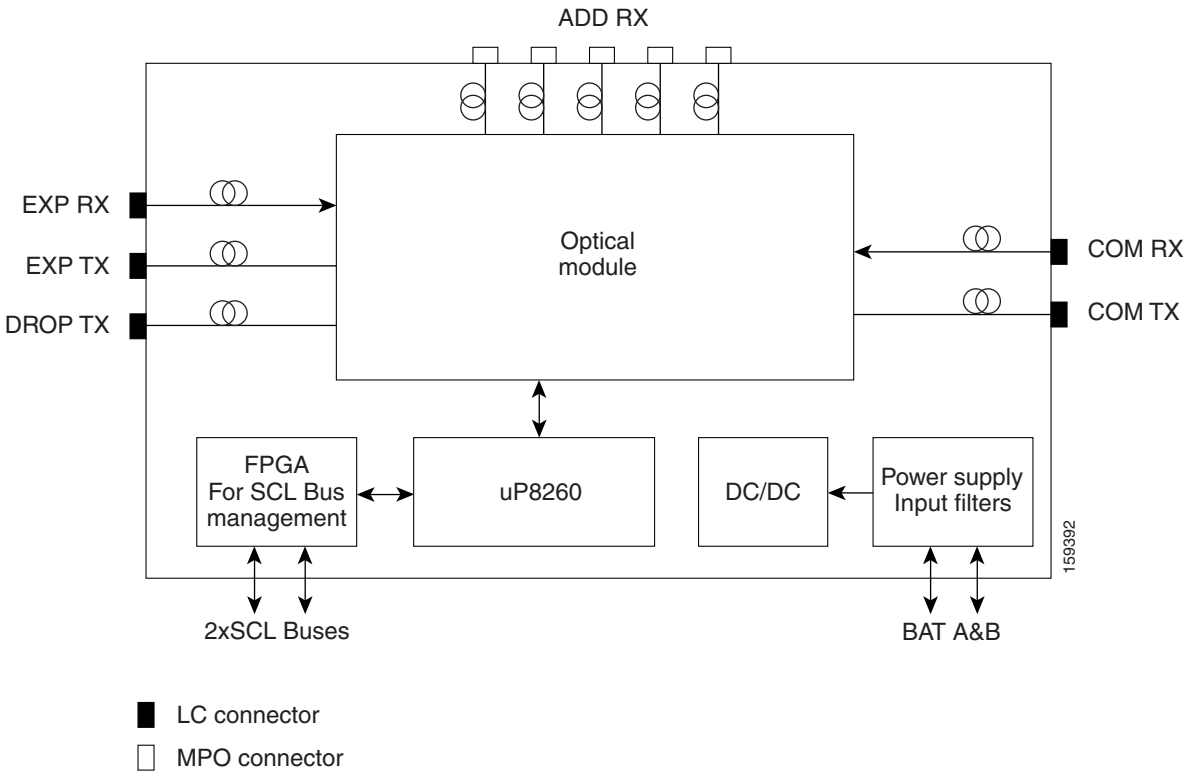


Figure 10-27 shows the 40-WSS-CE optical module functional block diagram.

Figure 10-27 40-WSS-CE Card Optical Module Functional Block Diagram



10.11.2 40-WSS-CE Card ROADM Functionality

The 40-WSS-CE card works in combination with the 40-DMX-CE card to implement ROADM functionality. As a ROADM node, the ONS 15454 can be configured at the optical channel level using CTC, Cisco Transport Planner, and CTM. ROADM functionality using the 40-WSS-CE card requires two 40-WSS-CE double-slot cards and two 40-DMX-CE single-slot cards (for a total of six slots in the ONS 15454 chassis).

For information about ROADM functionality for another cards, see the description of that card in this chapter. For a diagram of a typical ROADM configuration, see the "12.1.3 ROADM Node" section on page 12-11.

10.11.3 40-WSS-CE Card Power Monitoring

The 40-WSS-CE card has physical diodes that monitor power at various locations on the card. Table 10-29 lists the physical diode descriptions.

Table 10-29 40-WSS-CE Physical Photodiode Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
P1	DROP	DROP TX
P2	EXP	EXP RX
PD*i*3[1]	RX	Add *i* RX ports (that is, channel input Add *i* RX power), up to 40 ports and therefore 40 PDs[1]
PD*i*4[1]	TX	COM TX port (that is, per channel output COM TX power) up to 40 channels and therefore 40 PDs
PD5	COM	COM TX port (that is, total output COM TX power)

1. *i* indicates any channel from 01 through 40.

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 9.2.1.*

Additionally, the 40-WSS-CE card has two virtual diodes. Virtual diodes are monitor points for each physical photodiode; they are identified with a physical diode relative to the way that the physical diode is identified with one of the two interlink (ILK) ports. Table 10-30 lists the virtual diodes.

Table 10-30 40-WSS-CE Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD1	COM	COM RX port (total input COM RX power)
VPD2	EXP	EXP TX port (total output EXP TX power)

10.11.4 40-WSS-CE Card Channel Plan

Table 10-31 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are switched by the 40-WSS-CE card.

Table 10-31 40-WSS-CE Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.7	30.7	195.85	1530.72
	31.5	195.75	1531.51
	32.3	195.65	1532.29
	33.1	195.55	1533.07
	33.9	195.45	1533.86
B34.6	34.6	195.35	1534.64
	35.4	195.25	1535.43
	36.2	195.15	1536.22
	37.0	195.05	1537.00
	37.8	194.95	1537.79

Table 10-31 40-WSS-CE Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B38.6	38.6	194.85	1538.58
	39.4	194.75	1539.37
	40.1	194.65	1540.16
	40.9	194.55	1540.95
	41.8	194.45	1541.75
B42.5	42.5	194.35	1542.54
	43.3	194.25	1543.33
	44.1	194.15	1544.13
	44.9	194.05	1544.92
	45.7	193.95	1545.72
B46.5	46.5	193.85	1546.52
	47.3	193.75	1547.32
	48.1	193.65	1548.11
	48.9	193.55	1548.91
	49.7	193.45	1549.72
B50.5	50.5	193.35	1550.52
	51.3	193.25	1551.32
	52.1	193.15	1552.12
	52.9	193.05	1552.93
	53.7	192.95	1553.73
B54.4	54.4	192.85	1554.54
	55.3	192.75	1555.34
	56.1	192.65	1556.15
	56.9	192.55	1556.96
	57.8	192.45	1557.77
B58.6	58.6	192.35	1558.58
	59.4	192.25	1559.39
	60.2	192.15	1560.20
	61.0	192.05	1561.01
	61.8	191.95	1561.83

10.11.5 40-WSS-CE Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.11.6 Related Procedures for 40-WSS-CE Card

The following section lists procedures and tasks related to the configuration of the 40-WSS-CE card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G93 Modify the 32WSS, 32WSS-L, 40-WSS-C, or 40-WSS-CE Line Settings and PM Thresholds, page 21-65

10.12 40-WXC-C Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 40-WXC-C card specifications, see the "40-WXC-C Card Specifications" section in the Hardware Specifications document.

The double-slot 40-channel Wavelength Cross-Connect C-band (40-WXC-C) card selectively sends any wavelength combination coming from nine input ports to a common output port. The device can manage up to 41 channels spaced at 100GHz on each port according to the channel grid in Table 10-10 on page 10-13. Each channel can be selected from any input. The card is optically passive and provides bidirectional capability. It can be installed in Slots 1 to 6 and 12 to 17.

.The 40-WXC-C card provides the following features:

- Demultiplexing, selection, and multiplexing of DWDM aggregate signal from input ports to common output port.
- Aggregate DWDM signal monitoring and control through a VOA.
- VOAs are deployed in every channel path in order to regulate the channel's optical power. In the case of an electrical power failure, VOAs are set to their maximum attenuation value, or to a fixed and configurable one. The VOA can also be set manually.
- Per-channel optical power monitoring using photodiodes.

The 40-WXC-C card acts as a selector element with the following characteristics:

- It is able to select a wavelength from one input port and pass the wavelength through to the common out port. Simultaneously, the card can block the same wavelength coming from the other eight input ports.
- It is able to stop wavelengths from all nine inputs.
- It is able to monitor optical power and control path attenuation using per channel VOA independently of the wavelength input-to-out port connection.

10.12.1 Faceplate and Block Diagram

The 40-WXC-C card has six types of ports:

- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- COM TX: The COM TX port sends an aggregate optical signal to a booster amplifier card (for example, the OPT-BST card) for transmission outside of the NE.
- EXP TX: The EXP TX port sends an optical signal to the other 40-WXC-C card within the NE.
- MON TX: The optical service channel (OSC) monitor.
- ADD/DROP RX: The 40-WXC-C card provides 40 input optical channels. For the wavelength range, see Table 10-34 on page 10-72.
- ADD/DROP TX: The DROP TX port sends the split off optical signal that contains drop channels to the 40-WXC-C card, where the channels are further processed and dropped.

Figure 10-28 shows the 40-WXC-C card faceplate.

Figure 10-28 40-WXC-C Faceplate

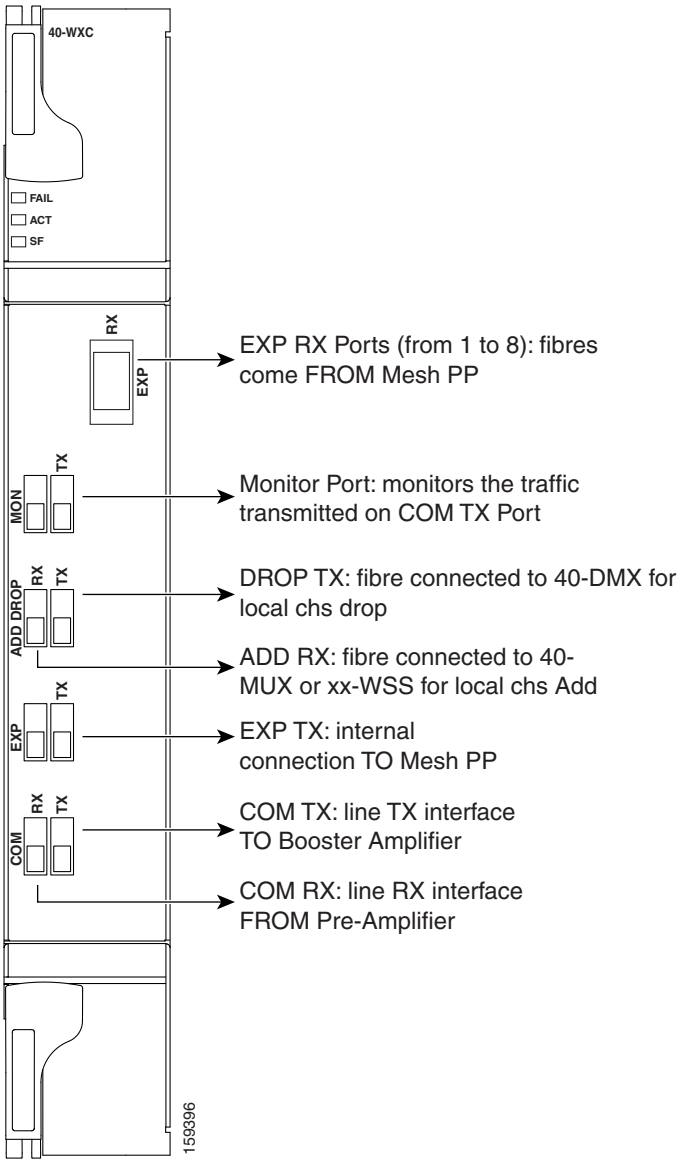
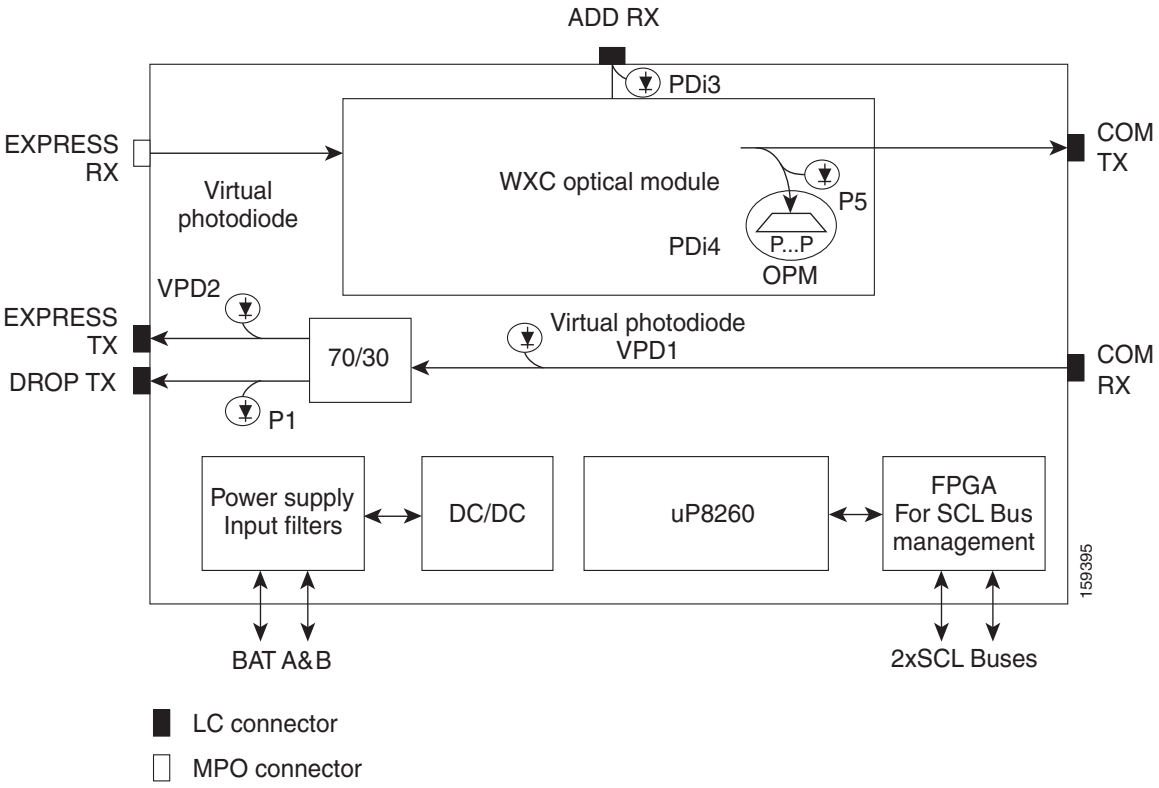


Figure 10-29 shows the 40-WXC-C optical module functional block diagram.

Figure 10-29 40-WXC-C Optical Module Functional Block Diagram



10.12.2 40-WXC-C Power Monitoring

The 40-WXC-C has 83 physical diodes (P1 through P40) that monitor power at the outputs of the card. Table 10-32 describes the physical diodes.

Table 10-32 40-WXC-C Physical Photodiode Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
P1	DROP	DROP TX
P2	EXP	EXP RX
PD*i*3[1]	RX	Add *i* RX ports (that is, channel input Add *i* RX power), up to 40 ports and therefore 40 PDs[1]
PD*i*4[1]	TX	COM TX port (that is, per channel output COM TX power) up to 40 channels and therefore 40 PDs
PD5	COM	COM TX port (that is, total output COM TX power)

1. *i* indicates any channel from 01 through 40.

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 9.2.1.*

Additionally, the 40-WXC-C has two virtual diodes. Virtual diodes are monitor points for each physical photodiode; they are identified with a physical diode relative to the way that the physical diode is identified with one of the two interlink (ILK) ports. Table 10-33 lists the virtual diodes.

Table 10-33 40-WXC-C Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD1	COM	COM RX port (total input COM RX power)
VPD2	EXP	EXP TX port (total output EXP TX power)

The usage of WXC and mesh PP power readings to troubleshoot a LOS-P in WXC COM TX port in Side A is described in the following example. The example is explained assuming a single wavelength 1558.17 in the setup that comes from Side H to Side A. If there is more than one wavelength, then there is a risk of dropping traffic when pulling common fibers. The example is explained below:

When the wavelength from side H is 1558.17, you can check the power reading at WXC EXP TX port of the WXC card and verify the consistency with side H pre output power and WXC COMRX-EXPTX port loss. You can also check with a power meter connected to the 8th fiber (since it is from side H) of an MPO-FC (or LC) cable connected to the TAP-TX port of the MESH-PP. This value should be consistent with the previous reading, less than the insertion loss of the installed PP-MESH. If it is consistent, the issue is with the MPO between side A WXC and PP-MESH. If it is not consistent, the issue is with the PP-MESH or the LC-LC from side H. With only the PP-MESH already tested during installation, the only issue can be with the patch cord b.

You can check if the 1558.17 wavelength from side H is unequalized (that is, if the channel is not aligned with the linear fit of the power values of the other channels) by keeping the DMX COM-RX port of side H in maintenance, and checking both the signal and ASE levels of CHAN-TX ports of the DMX card. If the channel is equalized (that is, if the channel is aligned with the linear fit of the power values of the other channels), then the issue is in the WXC side A that cannot properly regulate the VOA for such channel. If the channel is unequalized, then the issue is on a remote node.

Note With an OSA or a spare 40 DMX, you can see the light coming from all the sides from TAP-TX of the PP-MESH.

10.12.3 40-WXC-C Channel Plan

Table 10-34 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) that are cross connected by the 40-WXC-C card.

Table 10-34 40-WXC-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
Ch. 0[1]	29.5	196	1529.55
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33

Table 10-34 40-WXC-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

1. This channel is unused by the 40-WXC-C

10.12.4 40-WXC-C Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.12.5 Related Procedures for 40-WXC-C Card

The following section lists procedures and tasks related to the configuration of the 40-WXC-C card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G185 Install Fiber-Optic Cables between Mesh Nodes, page 14-101
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G174 Modify the 40-WXC-C or 80-WXC-C Line Settings and PM Thresholds, page 21-79

10.13 80-WXC-C Card

(Cisco ONS 15454 and ONS 15454 M6 only)

Note For 80-WXC-C card specifications, see the "80-WXC-C Card Specifications" section in the Hardware Specifications document.

The double-slot 80-channel Wavelength Cross-Connect C-band (80-WXC-C) card manages up to 80 ITU-T 100-GHz-spaced channels identified in the channel plan (Table 10-10 on page 10-13) and sends them to dedicated output ports. Each channel can be selected from any input port to any output port. The card is optically passive, and provides bidirectional capability. It can be installed in Slots 1 to 5 and 12 to 16 the ONS 15454 chassis and Slots 2 to 6 in the ONS 15454 M6 chassis.

The 80-WXC-C card provides the following functionalities:

- When used in the multiplexer or bidirectional mode, the 80-WXC-C card allows selection of a single wavelength or any combination of wavelengths from any of the nine input ports to the common output port.
- When used in the bidirectional mode, the output wavelength from the COM-RX port is split to manage the express and drop wavelengths.
- When used in the demultiplexer mode, the 80-WXC-C card, allows selection of a single wavelength or a combination of wavelengths from the common input port to any of the nine output ports.
- Automatic VOA shutdown (AVS) blocking state on each wavelength and port.
- Per-channel (closed loop) power regulation on the output port based on OCM block feedback.
- Per-channel (open loop) attenuation regulation on the output port which is not based on the OCM feedback.

The OCM unit provides per-channel optical power monitoring on the following ports:

- COM port in output direction
- COM port in input direction
- DROP-TX port in output direction
- Eight Express/Add/Drop (EAD) ports and one Add/Drop (AD) port in both input and output directions

10.13.1 Faceplate and Block Diagram

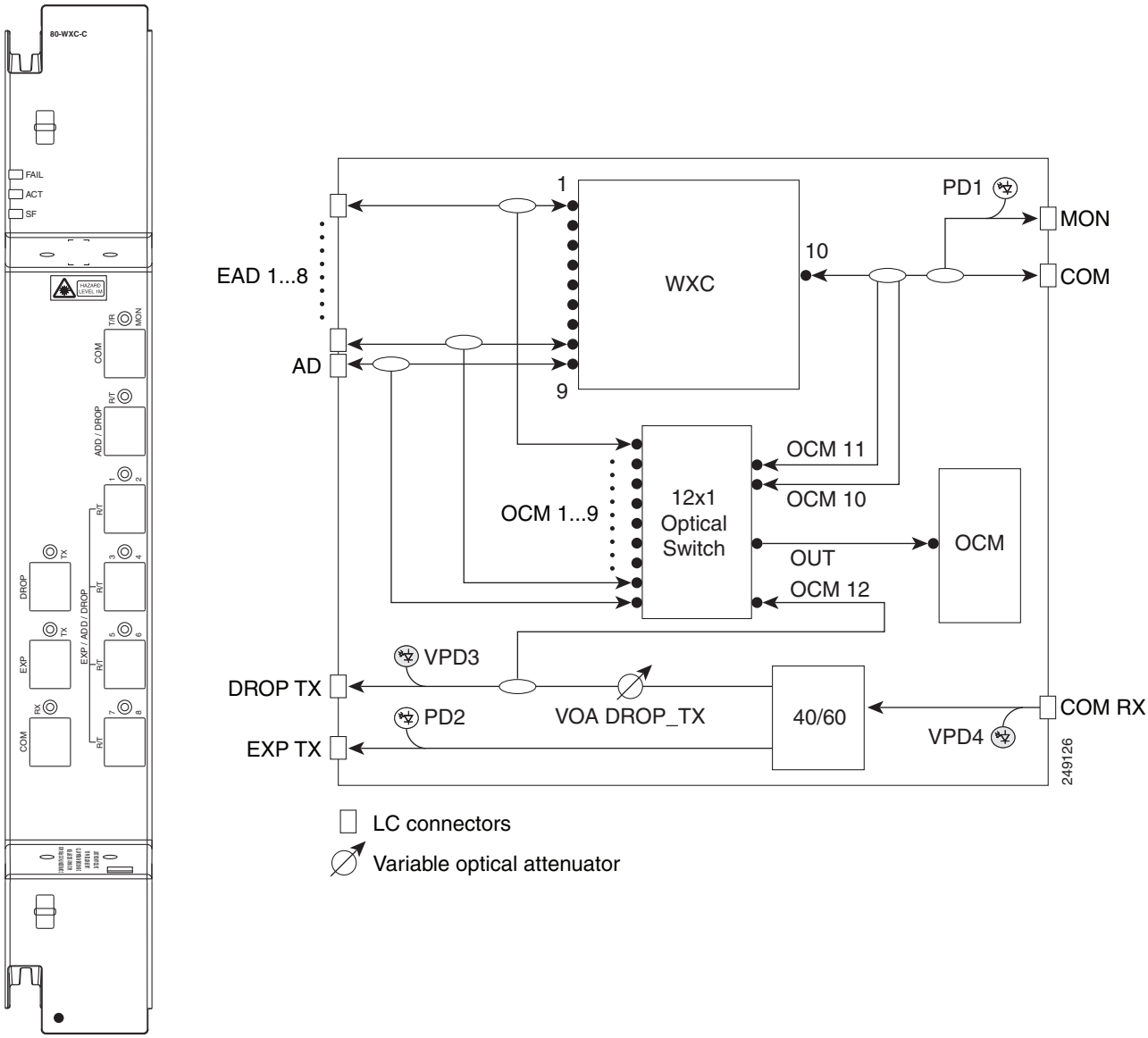
The 80-WXC-C card has 14 types of ports:

- MON: The MON port monitors power on the COM T/R port.
- COM RX: The COM RX port receives the optical signal from a preamplifier (such as the OPT-PRE) and sends it to the optical splitter.
- DROP TX: In the bidirectional mode, the DROP TX port sends the optical signal to the demultiplexer.
- EXP TX: The EXP TX port sends the split off optical signal that contains pass-through channels to the other side of the NE.
- COM T/R: The COM port is bidirectional. It functions as a COM TX port in the multiplexer mode and as a COM RX port in the demultiplexer mode.
- AD T/R: The AD port functions as ADD RX port in bidirectional and multiplexer modes and as a DROP port in the demultiplexer mode.

- EAD T/R *i* (where i = 1 to 8): The EAD ports function as EXP ports in the bidirectional mode, as ADD ports in the multiplexer mode, and as DROP ports in the demultiplexer mode.

Figure 10-30 shows the 80-WXC-C card faceplate and the optical module functional block diagram.

Figure 10-30 80-WXC-C Faceplate and the Optical Module Functional Block Diagram



The different units of the 80-WXC-C card are:

- 40/60 splitter with VOA on drop path—The preamplifier output signal from the preamplifier is split in a 40%-to-60% ratio; 40% is sent on the drop path (DROP-TX port) and 60% is sent on the pass-through path (EXP-TX port). The VOA equipped on the drop path is used to match the power range of the receiver photodiode without the need for bulk attenuation. If a channel is expected to be dropped in the 80-WXC-C card, the pass-through channel is stopped after the EXP-TX port either by a 40-WSS-C or a 40-WXC-C card.
- 50 Ghz 10 port WXC—The WXC block is optically passive and has bidirectional capability. The WXC block can selectively send any wavelength combination coming from the eight input EAD ports and one AD port to a common (COM) output port, when used as a multiplexer, whereas it can selectively send any wavelength combination coming from its common (COM) input port to any of the eight output EAD ports and one AD port, when used as a demultiplexer. The WXC block can manage (on each port) up to 80 channels according to the channel grid reported in Table 10-37. Each channel can be selected from any input and routed to any output.
- 50 Ghz Optical Channel Monitor (OCM)—The OCM provides per channel power monitoring on the COM T/R, DROP-TX, AD, and EAD*i* (*i*=1 to 8) ports. The power value for each wavelength is refreshed after a variable timer depending on the port and card activity.

10.13.2 80-WXC-C Power Monitoring

The 80-WXC-C has two physical photodiodes and an OCM unit that monitors power at the different ports of the card. Table 10-35 describes the physical photodiodes.

Table 10-35 80-WXC-C Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
PD1	COM Total Power	COM
PD2	EXP-TX Total Power	EXP-TX
OCM1	EAD 1 Per-Channel and Total Power	EAD-1
OCM2	EAD 2 Per-Channel and Total Power	EAD-2
OCM3	EAD 3 Per-Channel and Total Power	EAD-3
OCM4	EAD 4 Per-Channel and Total Power	EAD-4
OCM5	EAD 5 Per-Channel and Total Power	EAD-5
OCM6	EAD 6 Per-Channel and Total Power	EAD-6
OCM7	EAD 7 Per-Channel and Total Power	EAD-7
OCM8	EAD 8 Per-Channel and Total Power	EAD-8
OCM9	AD Per-Channel and Total Power	AD
OCM10	Output Per-Channel and Total Power	COM
OCM11	Input Per-Channel and Total Power	COM
OCM12	Drop Per-Channel and Total Power	DROP-TX

For information on the associated TL1 AIDs for the optical power monitoring points, see the “CTC Port Numbers and TL1 Aids” section in the *Cisco ONS SONET TL1 Command Guide, Release 9.2.1*.

Additionally, the 80-WXC-C has two virtual photodiodes. Table 10-36 lists the virtual photodiodes.

Table 10-36 80-WXC-C Virtual Photodiode Port Calibration

Virtual Photodiode	CTC Type Name	Calibrated to Port(s)
VPD3	DROP-TX Total Power	DROP-TX
VPD4	COM-RX Total Power	COM-RX

10.13.3 80-WXC-C Channel Plan

Table 10-37 shows the 80 ITU-T 50-GHz-spaced, C-band channels (wavelengths) that are cross connected by the 80-WXC-C card.

Table 10-37 80-WXC-C Channel Plan

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
Ch. 0[1]	-	196	1529.55
30.3	30.3	195.9	1530.33
	30.7	195.85	1530.72
	31.1	195.8	1531.12
	31.5	195.75	1531.51
	31.9	195.7	1531.90
	32.3	195.65	1532.29
	32.7	195.6	1532.68
	33.1	195.55	1533.07
	33.5	195.5	1533.47
	33.9	195.45	1533.86
34.3	34.3	195.4	1534.25
	34.6	195.35	1534.64
	35.0	195.3	1535.04
	35.4	195.25	1535.43
	35.8	195.2	1535.82
	36.2	195.15	1536.22
	36.6	195.1	1536.61
	37.0	195.05	1537
	37.4	195	1537.40
	37.8	194.95	1537.79

Table 10-37 80-WXC-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
38.2	38.2	194.9	1538.19
	38.6	194.85	1538.58
	39.0	194.8	1538.98
	39.4	194.75	1539.37
	39.8	194.7	1539.77
	40.2	194.65	1540.16
	40.6	194.6	1540.56
	41.0	194.55	1540.95
	41.3	194.5	1541.35
	41.7	194.45	1541.75
42.1	42.1	194.4	1542.14
	42.5	194.35	1542.94
	42.9	194.3	1542.94
	43.3	194.25	1543.33
	43.7	194.2	1543.73
	44.1	194.15	1544.13
	44.5	194.1	1544.53
	44.9	194.05	1544.92
	45.3	194	1545.32
	45.7	193.95	1545.72
46.1	46.1	193.9	1546.12
	46.5	193.85	1546.52
	46.9	193.8	1546.92
	47.3	193.75	1547.32
	47.7	193.7	1547.72
	48.1	193.65	1548.11
	48.5	193.6	1548.51
	48.9	193.55	1548.91
	49.3	193.5	1549.32
	49.7	193.45	1549.72

Table 10-37 80-WXC-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (THz)	Wavelength (nm)
50.1	50.1	193.4	1550.12
	50.5	193.35	1550.52
	50.9	193.3	1550.92
	51.3	193.25	1551.32
	51.7	193.2	1551.72
	52.1	193.15	1552.12
	52.5	193.1	1552.52
	52.9	193.05	1552.93
	53.3	193	1553.33
	53.7	192.95	1553.73
54.1	54.1	192.9	1554.13
	54.5	192.85	1554.54
	54.9	192.8	1554.94
	55.3	192.75	1555.34
	55.7	192.7	1555.75
	56.2	192.65	1556.15
	56.6	192.6	1556.55
	57.0	192.55	1556.96
	57.4	192.5	1557.36
	57.8	192.45	1557.77
58.2	58.2	192.4	1558.17
	58.6	192.35	1558.58
	59.0	192.3	1558.98
	59.4	192.25	1559.39
	59.8	192.2	1559.79
	60.2	192.15	1560.20
	60.6	192.1	1560.61
	61.0	192.05	1561.01
	61.4	192	1561.42
	61.8	191.95	1561.83

1. This channel is unused by the 80-WXC-C

10.13.4 80-WXC-C Card Functions

- Card level indicators—Table G-4 on page G-9
- “G.4 Port-Level Indicators” section on page G-9

10.13.5 Related Procedures for 80-WXC-C Card

The following section lists procedures and tasks related to the configuration of the 80-WXC-C card:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G185 Install Fiber-Optic Cables between Mesh Nodes, page 14-101
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G174 Modify the 40-WXC-C or 80-WXC-C Line Settings and PM Thresholds, page 21-79

10.14 Single Module ROADM (SMR-C) Cards

Note For the 40-SMR1-C or 40-SMR2-C card specifications, see the "40-SMR1-C Card Specifications" or "40-SMR2-C Card Specifications" section in the Hardware Specifications document.

Note For 40-SMR1-C and 40-SMR2-C safety label information, see the "10.2 Safety Labels" section on page 10-15.

The single-slot 40-channel single module ROADM (SMR-C) cards integrate the following functional blocks onto a single line card:

- Optical preamplifier
- Optical booster amplifier
- Optical service channel (OSC) filter
- 2x1 wavelength cross-connect (WXC) or a 4x1 WXC
- Optical channel monitor (OCM)

The SMR-C cards are available in two versions:

- 10.14.2 40-SMR1-C Card
- 10.14.3 40-SMR2-C Card

The SMR-C cards can manage up to 40 channels spaced at 100GHz on each port according to the channel grid in Table 10-10. The cards can be installed in Slots 1 to 6 and 12 to 17.

10.14.1 SMR-C Card Key Features

The optical amplifier units in the SMR-C cards provide the following features:

- Embedded gain flattening filter

- Mid-stage access for dispersion compensation unit (only applicable for preamplifier erbium-doped fiber amplifier [EDFA])
- Fixed output power mode
- Fixed gain mode
- Nondistorting low-frequency transfer function
- Amplified spontaneous emissions (ASE) compensation in fixed gain and fixed output power mode
- Fast transient suppression
- Programmable tilt (only applicable for preamplifier EDFA)
- Full monitoring and alarm handling capability
- Optical safety support through signal loss detection and alarm at any input port, fast power down control, and reduced maximum output power in safe power mode.
- EDFA section calculates the signal power, by taking into account the expected ASE power contribution to the total output power. The signal output power or the signal gain can be used as feedback signals for the EDFA pump power control loop.

The 1x2 WXC unit (40-SMR1-C card) provides the following features:

- Selection of individual wavelength of the aggregated 100GHz signal from either the EXP-RX or ADD-RX ports
- Automatic VOA shutdown (AVS) blocking state on each wavelength and port
- Per-channel power regulation based on external OCM unit
- Open loop path attenuation control for each wavelength and port

The 1x4 WXC unit (40-SMR2-C card) provides the following features:

- Selection of individual wavelength of the aggregated 100GHz signal from either the EXP*i*-RX (where *i* = 1, 2, 3) or ADD-RX ports
- Automatic VOA shutdown (AVS) blocking state on each wavelength and port
- Per-channel power regulation based on external OCM unit
- Open loop path attenuation control for each wavelength and port

The OCM unit provides per channel optical power monitoring at EXP-RX, ADD-RX, DROP-TX, and LINE-TX ports.

10.14.2 40-SMR1-C Card

The 40-SMR1-C card includes a 100Ghz 1x2 WXC unit with integrated preamplifier unit (single EDFA).

10.14.2.1 Faceplate and Block Diagram

The 40-SMR1-C card has the following types of ports:

- MON RX: The MON RX port monitors power on the EXP-TX output port.
- MON TX: The MON TX port monitors power on the LINE-TX output port.
- DC RX: The DC RX port receives the optical signal from the dispersion compensating unit (DCU) and sends it to the second stage preamplifier input.
- DC TX: The DC TX port sends the optical signal from the first stage preamplifier output to the DCU.

- OSC RX: The OSC RX port is the OSC add input port.
- OSC TX: The OSC TX port is the OSC drop output port.
- ADD/DROP RX: The ADD RX port receives the optical signal from the multiplexer section of the NE and sends it to the 1x2 WXC unit.
- ADD/DROP TX: The DROP TX port sends the split off optical signal to the demultiplexer section of the NE.
- LINE RX: The LINE RX port is the input signal port.
- LINE TX: The LINE TX port is the output signal port.
- EXP RX: The EXP RX port receives the optical signal from the other side of the NE and sends it to the 1x2 WXC unit.
- EXP TX: The EXP TX port sends the split off optical signal that contains pass-through channels to the other side of the NE.

Figure 10-31 shows the 40-SMR1-C card faceplate.

Figure 10-31 40-SMR1-C Faceplate

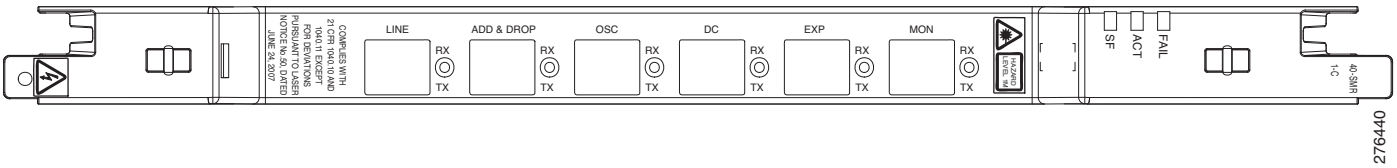
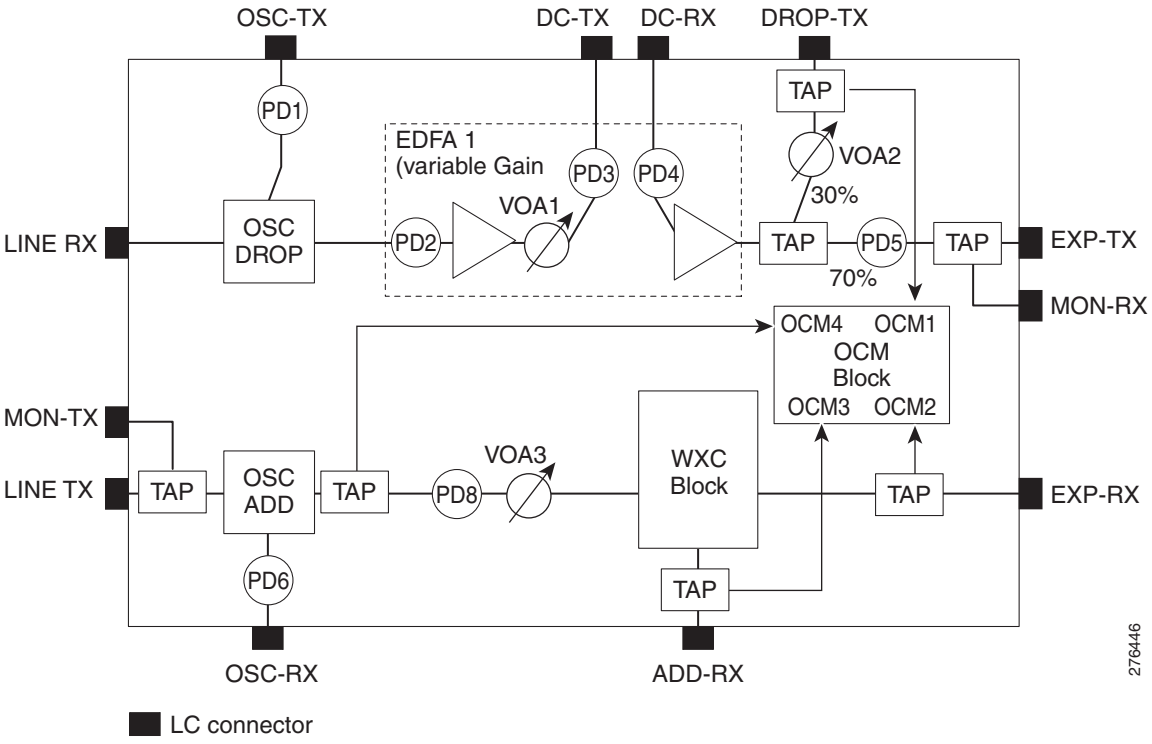


Figure 10-32 shows a block diagram of the 40-SMR1-C card.

Figure 10-32 40-SMR1-C Block Diagram



The different units of the 40-SMR1-C card are:

- OSC filter—The OSC filter allows to add an OSC channel to the C-band in the transmission path and to drop an OSC channel on the receiving path. The OSCM card that is connected to the OSC-TX and OSC-RX ports generates the OSC channel.
- Double-stage variable gain EDFA preamplifier—The double-stage preamplifier allows the insertion of a DCU between the DC-TX and DC-RX ports to compensate for chromatic dispersion. It is also equipped with built-in variable optical attenuator (VOA) and gain flattening filter (GFF) that provides tilt compensation and enables the use of this device over an extended range of span losses (5 dB to 35 dB).
- 70/30 splitter and VOA—The output signal from the preamplifier is split in a 70%-to-30% ratio, 70% is sent on the pass-through path (EXP-TX port) and 30% is sent on the drop path (DROP-TX port). The VOA equipped on the drop path is used to match the power range of the receiver photo diode without the need for bulk attenuation. If a channel is expected to be dropped in the 40-SMR1-C card, the pass-through channel is stopped after the EXP-TX port either by a 40-WSS-C, 40-SMR1-C, or 40-SMR2-C card.
- 1x2 WXC—The 1x2 WXC aggregates on its output port a 100-GHz-spaced optical channel received from either its ADD-RX or EXP-RX port. In addition to the switching function, the 1x2 WXC allows to set a different per channel power for each of the managed wavelengths and also monitor the optical power.
- OCM—The OCM provides per channel power monitoring on the DROP-RX, EXP-RX, ADD-RX, and LINE-TX ports. The power value for each wavelength is refreshed after a variable timer depending on the port and card activity.

10.14.2.2 40-SMR1-C Power Monitoring

The 40-SMR1-C card has seven physical diodes (PD1 through PD6 and PD8) and an OCM unit that monitors power at the input and output ports of the card (see Table 10-38).

Table 10-38 40-SMR1-C Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
PD1	LINE	LINE-RX
PD2	LINE	LINE-RX
PD3	DC	DC-TX
PD4	DC	DC-RX
PD5	EXP	EXP-TX
PD6	OSC	OSC-RX
PD8	LINE	LINE-TX
OCM1	LINE OCH	LINE-TX
OCM2	DROP OCH	DROP-TX
OCM3	ADD OCH	ADD-RX
OCM4	EXP OCH	EXP-RX

10.14.2.3 40-SMR1-C Channel Plan

Table 10-39 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) supported by the 40-SMR1-C card.

Table 10-39 40-SMR1-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40

Table 10-39 40-SMR1-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

10.14.3 40-SMR2-C Card

The 40-SMR2-C card includes a 100Ghz 1x4 WXC unit with integrated preamplifier and booster amplifier units (double EDFA).

10.14.3.1 Faceplate and Block Diagram

The 40-SMR2-C card has the following types of ports:

- MON RX: The MON RX port monitors power on the EXP-TX output port.
- MON TX: The MON TX port monitors power on the LINE-TX output port.
- DC RX: The DC RX port receives the optical signal from the dispersion compensating unit (DCU) and sends it to the second stage preamplifier input.
- DC TX: The DC TX port sends the optical signal from the first stage preamplifier output to the DCU.
- OSC RX: The OSC RX port is the OSC add input port.
- OSC TX: The OSC TX port is the OSC drop output port.
- ADD/DROP RX: The ADD RX port receives the optical signal from the multiplexer section of the NE and sends it to the 1x4 WXC unit.
- ADD/DROP TX: The DROP TX port sends the split off optical signal to the demultiplexer section of the NE.
- LINE RX: The LINE RX port is the input signal port.
- LINE TX: The LINE TX port is the output signal port.
- EXP TX: The EXP TX port sends the split off optical signal that contains pass-through channels to the other side of the NE.
- EXP*i*-RX (where *i* = 1, 2, 3): The EXP*i*-RX port receives the optical signal from the other side of the NE and sends it to the 1x4 WXC unit.

Figure 10-31 shows the 40-SMR2-C card faceplate.

Figure 10-33 40-SMR2-C Faceplate

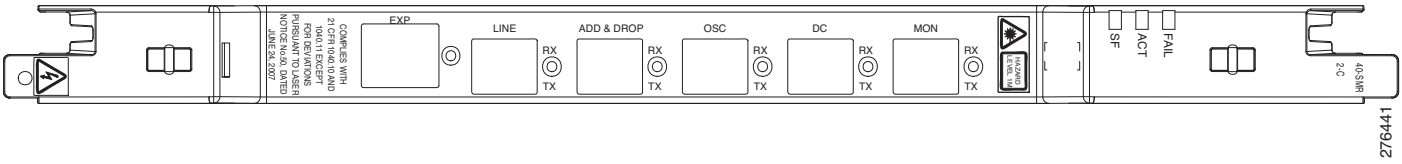
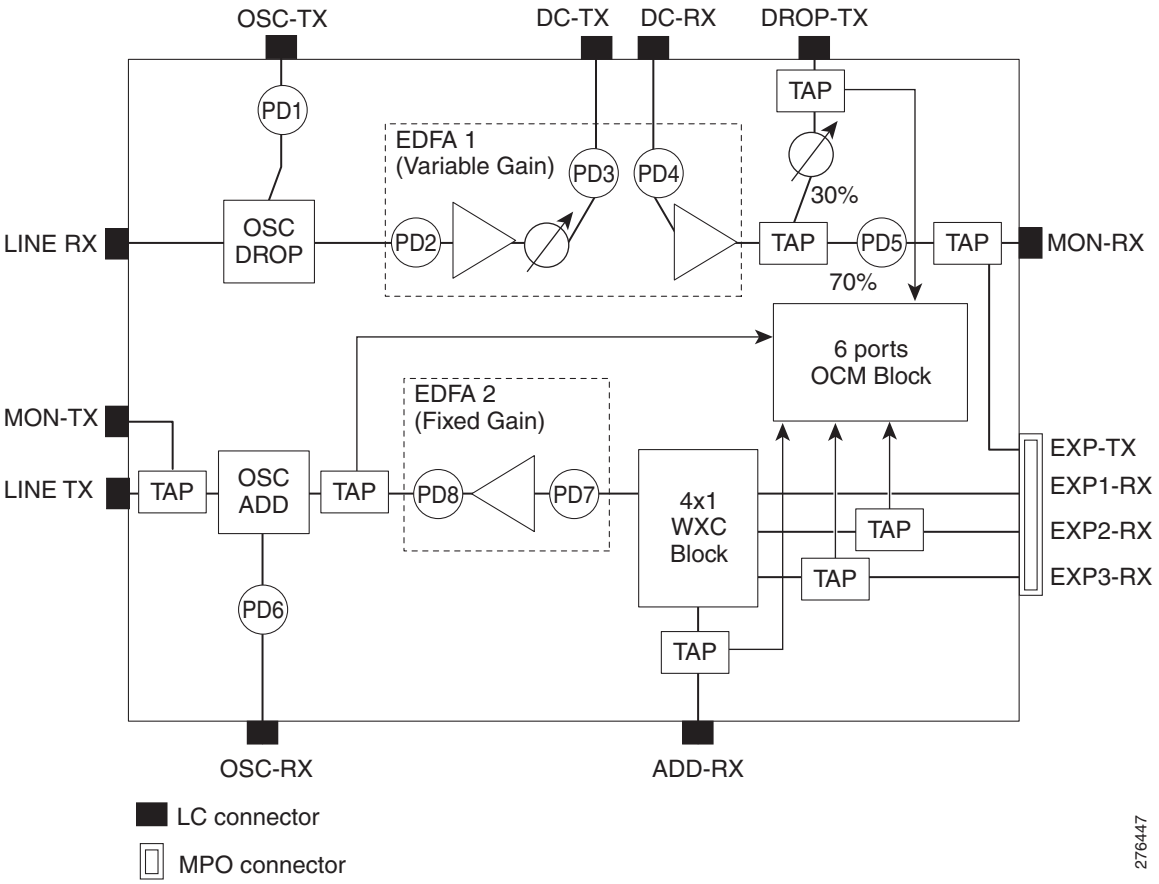


Figure 10-32 shows a block diagram of the 40-SMR2-C card.

Figure 10-34 40-SMR2-C Block Diagram



The different units of the 40-SMR2-C card are:

- OSC filter—The OSC filter allows to add an OSC channel to the C-band in the transmission path and to drop an OSC channel on the receiving path. The OSCM card that is connected to the OSC-TX and OSC-RX ports generates the OSC channel.
- Double-stage variable gain EDFA preamplifier—The double-stage preamplifier allows the insertion of a DCU between the DC-TX and DC-RX ports to compensate for chromatic dispersion. It is also equipped with built-in variable optical attenuator (VOA) and gain flattening filter (GFF) that provides tilt compensation and enables the use of this device over an extended range of span losses (5 dB to 35 dB).
- 70/30 splitter and VOA—The output signal from the preamplifier is split in a 70%-to-30% ratio, 70% is sent on the pass-through path (EXP-TX port) and 30% is sent on the drop path (DROP-TX port). The VOA equipped on the drop path is used to match the power range of the receiver photo diode without the need for bulk attenuation. If a channel is expected to be dropped in the 40-SMR2-C card, the pass-through channel is stopped after the EXP-TX port by a 40-WSS-C, 40-SMR1-C, or 40-SMR2-C card.
- 1x4 WXC—The 1x4 WXC aggregates on its output port a 100-GHz-spaced optical channel received from either its ADD-RX or EXP*i*-RX (where *i* = 1, 2, 3) port. In addition to the switching function, the 1x4 WXC allows to set a different per channel power for each of the managed wavelengths and also monitor the optical power.

- Single-stage fixed gain EDFA booster amplifier—The booster amplifier amplifies the output signal from the 1x4 WXC unit before transmitting it into the fiber. Since it is a fixed gain (17 dB) amplifier, it does not allow gain tilt control.
- OCM—The OCM provides per channel power monitoring on the DROP-RX, EXP*i*-RX (where *i* = 1, 2, 3), ADD-RX, and LINE-TX ports. The power value for each wavelength is refreshed after a variable timer depending on the port and card activity.

10.14.3.2 40-SMR2-C Power Monitoring

The 40-SMR2-C card has eight physical diodes (PD1 through PD8) and an OCM unit that monitors power at the input and output ports of the card (see Table 10-40).

Table 10-40 40-SMR2-C Port Calibration

Physical Photodiode	CTC Type Name	Calibrated to Port(s)
PD1	LINE	LINE-RX
PD2	LINE	LINE-RX
PD3	DC	DC-TX
PD4	DC	DC-RX
PD5	EXP	EXP-TX
PD6	OSC	OSC-RX
PD7	Not reported on CTC	Internal port
PD8	LINE	LINE-TX
OCM1	LINE OCH	LINE-TX
OCM2	DROP OCH	DROP-TX
OCM3	ADD OCH	ADD-RX
OCM4	EXP-1 OCH	EXP1-RX
OCM5	EXP-2 OCH	EXP2-RX
OCM6	EXP-3 OCH	EXP3-RX

10.14.3.3 40-SMR2-C Channel Plan

Table 10-41 shows the 40 ITU-T 100-GHz-spaced, C-band channels (wavelengths) supported by the 40-SMR2-C card.

Table 10-41 40-SMR2-C Channel Plan

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B30.3	30.3	195.9	1530.33
	31.1	195.8	1531.12
	31.9	195.7	1531.90
	32.6	195.6	1532.68
	33.4	195.5	1533.47

Table 10-41 40-SMR2-C Channel Plan (Continued)

Band ID	Channel Label	Frequency (GHz)	Wavelength (nm)
B34.2	34.2	195.4	1534.25
	35.0	195.3	1535.04
	35.8	195.2	1535.82
	36.6	195.1	1536.61
	37.4	195	1537.40
B38.1	38.1	194.9	1538.19
	38.9	194.8	1538.98
	39.7	194.7	1539.77
	40.5	194.6	1540.56
	41.3	194.5	1541.35
B42.1	42.1	194.4	1542.14
	42.9	194.3	1542.94
	43.7	194.2	1543.73
	44.5	194.1	1544.53
	45.3	194	1545.32
B46.1	46.1	193.9	1546.12
	46.9	193.8	1546.92
	47.7	193.7	1547.72
	48.5	193.6	1548.51
	49.3	193.5	1549.32
B50.1	50.1	193.4	1550.12
	50.9	193.3	1550.92
	51.7	193.2	1551.72
	52.5	193.1	1552.52
	53.3	193	1553.33
B54.1	54.1	192.9	1554.13
	54.9	192.8	1554.94
	55.7	192.7	1555.75
	56.5	192.6	1556.55
	57.3	192.5	1557.36
B58.1	58.1	192.4	1558.17
	58.9	192.3	1558.98
	59.7	192.2	1559.79
	60.6	192.1	1560.61
	61.4	192	1561.42

10.14.4 40-SMR1-C and 40-SMR2-C Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.14.5 Related Procedures for 40-SMR1-C and 40-SMR2-C Card

The following section lists procedures and tasks related to the configuration of the 40-SMR-1C and 40-SMR-2C cards:

- NTP-G140 Install Fiber-Optic Cables Between Terminal, Hub, or ROADM Nodes, page 14-82
- NTP-G185 Install Fiber-Optic Cables between Mesh Nodes, page 14-101
- NTP-G152 Create and Verify Internal Patchcords, page 14-113
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G243 Perform the Two-Degree ROADM Node with 40-SMR-1-C and OPT-AMP-17-C Cards Acceptance Test, page 15-149
- NTP-G244 Perform the Four Degree ROADM Node with 40-SMR-2-C Cards Acceptance Test, page 15-153
- NTP-G59 Create, Delete, and Manage Optical Channel Network Connections, page 17-34
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- DLP- G141 View Optical Power Statistics for 32MUX-O, 32WSS, 32WSS-L, 32DMX-O, 32DMX, 32DMX-L, 40-WSS-C, 40-WSS-CE, 40-WXC-C, 80-WXC-C, 40-MUX-C, 40-DMX-C, and 40-DMX-CE Cards
- NTP-G241 Modify the 40-SMR1-C and 40-SMR2-C Line Settings and PM Thresholds, page 21-94

10.15 MMU Card

(Cisco ONS 15454 only)

The single-slot Mesh Multi-Ring Upgrade Module (MMU) card supports multiring and mesh upgrades for ROADM nodes in both the C-band and the L-band. Mesh/multiring upgrade is the capability to optically bypass a given wavelength from one section of the network or ring to another one without requiring 3R regeneration. In each node, you need to install one east MMU and one west MMU. The card can be installed in Slots 1 through 6 and 12 through 17.

Note For MMU card specifications, see the "MMU Card Specifications" section in the Hardware Specifications document.

10.15.1 Faceplate and Block Diagram

The MMU has six types of ports:

- EXP RX port: The EXP RX port receives the optical signal from the ROADM section available on the NE.

- EXP TX port: The EXP TX port sends the optical signal to the ROADM section available on the NE.
- EXP-A RX port: The EXP-A RX port receives the optical signal from the ROADM section available on other NEs or rings.
- EXP-A TX port: The EXP-A TX port sends the optical signal to the ROADM section available on other NEs or rings.
- COM TX port: The COM TX port sends the optical signal to the fiber stage section.
- COM RX port: The COM RX port receives the optical signal from the fiber stage section.

Figure 10-35 shows the MMU card faceplate.

Figure 10-35 MMU Faceplate and Ports

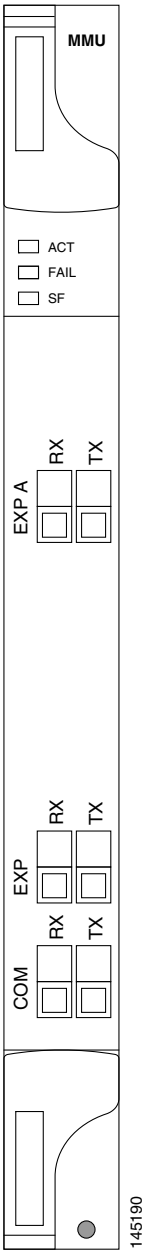
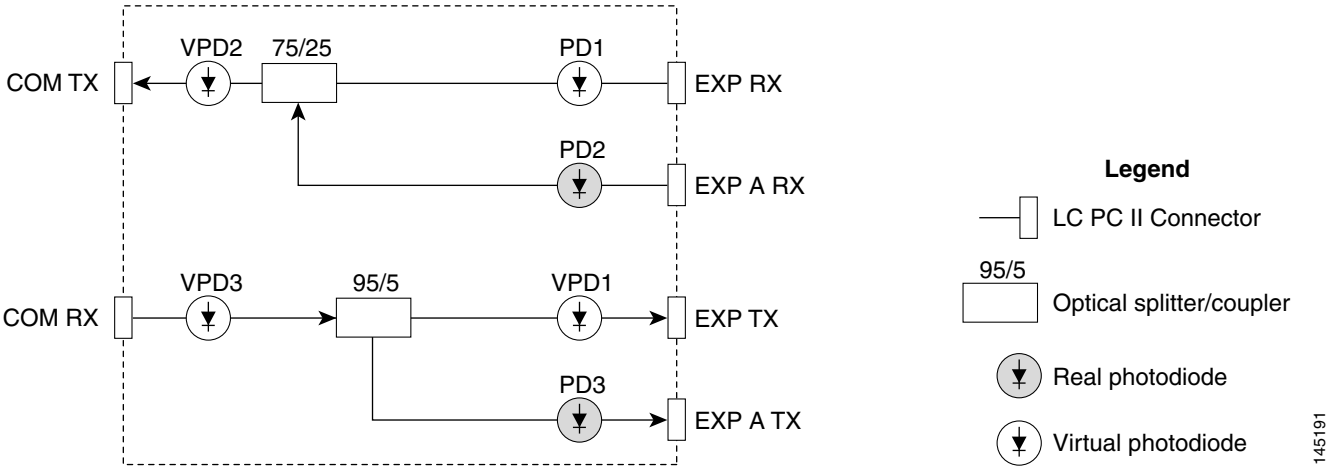


Figure 10-36 provides a high-level functional block diagram of the MMU card.

Figure 10-36 MMU Block Diagram



10.15.2 MMU Power Monitoring

Physical photodiodes P1 through P3 monitor the power for the MMU card. The returned power level values are calibrated to the ports as shown in Table 10-42. VP1 to VP3 are virtual photodiodes that have been created by adding (by software computation) the relevant path insertion losses of the optical splitters (stored in the module) to the real photodiode (P1 to P3) measurement.

Table 10-42 MMU Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1	1 (EXP-RX)	EXP RX
P2	5 (EXP A-RX)	EXP A RX
P3	6 (EXP A-TX)	EXP A TX
VP1	2 (EXP-TX)	EXP TX
VP2	4 (COM-TX)	COM TX
VP3	3 (COM-RX)	COM RX

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 9.2.1.*

10.15.3 MMU Card Functions

- Card level indicators—Table G-4 on page G-9
- "G.4 Port-Level Indicators" section on page G-9

10.15.4 Related Procedures for MMU Card

The following section lists procedures and tasks related to the configuration of the MMU card:

- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs, page 14-78
- NTP-G37 Run Automatic Node Setup, page 14-128
- NTP-G51 Verify DWDM Node Turn Up, page 16-2
- NTP-G149 Modify the MMU Line Settings and PM Thresholds, page 21-114