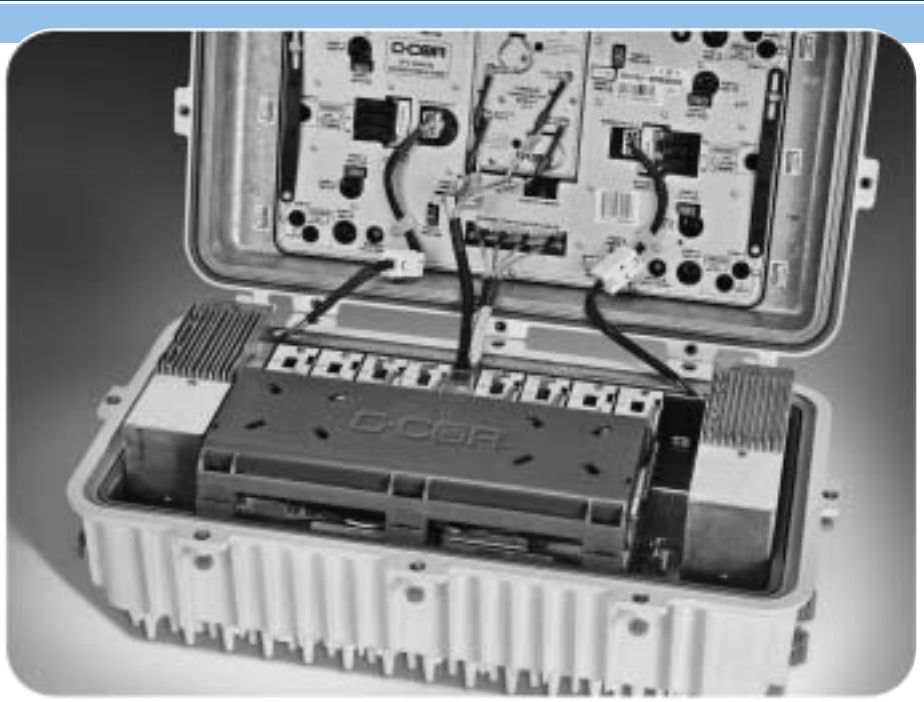
Opti Max4100

1 GHz Segmentable Nodes



- **1 GHz technology**
- **Future 85/105 MHz architecture support**
- **Full 4 x 4 forward and return segmentation capability**
- **Investment preservation through high level of scalability**
- **1310 nm and 1550 nm transmitters**
- **Analog and digital CWDM return path options to optimize fiber**
- **Major EMS protocol support**
- **Advanced fiber management**

The Opti Max4100 1 GHz Segmentable Node is C-COR's fully segmentable, modular, pay-as-you-grow node platform. The Opti Max4100 facilitates full 4 x 4 forward and return segmentation with an industry-leading port-to-port isolation. 1 GHz will enable broadband service providers to increase forward capacity for HDTV over previous program offerings, thereby allowing a typically 40% increase over current HDTV channels in a lineup.

Our most advanced node platform, the Opti Max4100's modular design allows a high level of scalability, which enables operators to deploy minimal configurations today and expand as subscriber demands increase. Future expansion options include forward and return segmentation and redundancy, analog and digital CWDM return transmitters, network powering redundancy, and element management options with major EMS protocols, including open-standard HMS protocol.

In addition, the Opti Max4100 1 GHz node supports fiber-poor systems with a variety of return transmitter options and the future availability of an 85/105 MHz option, which will double return bandwidth without capital expenditures for additional return transmitters.

Features

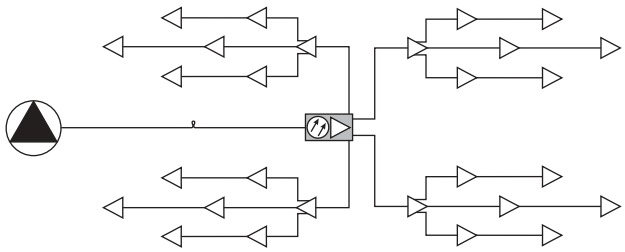
- High port-to-port isolation enables true segmentation upgrades
- Wavelength-stable, analog CWDM and 2:1 TDM digital CWDM return transmitters that meet the ±6.5 nm ITU-T G.695 standard over the full –40 to 60°C temperature range
- Four active output ports with GaAs hybrids to achieve 53.5 dBmV at 1 GHz and –3 dBm minimum optical input
- 85/105 MHz option for future architectures
- 15 ampere power passing and surge termination

Applications

The Opti Max4100 can be deployed in three basic configurations and two redundant configurations to meet HFC system architecture needs: 1 x 4, 1 x 4 with redundancy, 2 x 2 segmentation, 2 x 2 with redundancy, and 4 x 4 segmentation, in addition to more unique configurations. Regardless of the configuration, the Opti Max4100 supports a variety of 1310 nm, 1550 nm, or CWDM downstream and upstream configurations and achieves the port-to-port isolation performance operators demand for analog and sophisticated digital modulation applications.

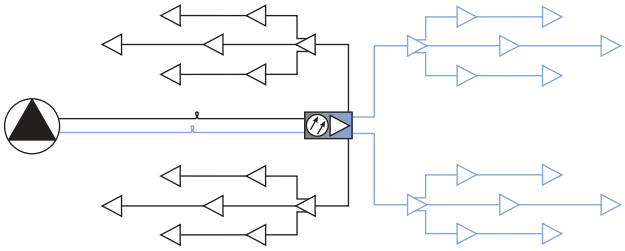
1 x 4 Forward/4 x 1 Return Configuration

The basic 1 x 4/4 x 1 configuration of the Opti Max4100 can be easily configured to provide redundant fiber routes in both the forward and return paths and redundant powering for operators who require increased network reliability.



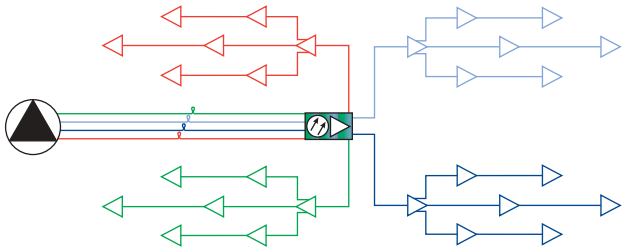
2 x 2 Forward/Return Segmentation

To migrate to the 2 x 2 segmentation configuration, simply activate a spare fiber and install a second forward receiver, a second return transmitter, and the associated configuration modules. The 2 x 2 segmentation configuration can also be easily configured to provide redundant fiber routes in both the forward and return paths and redundant powering for those operators who require increased network reliability.



4 x 4 Forward/Return Segmentation

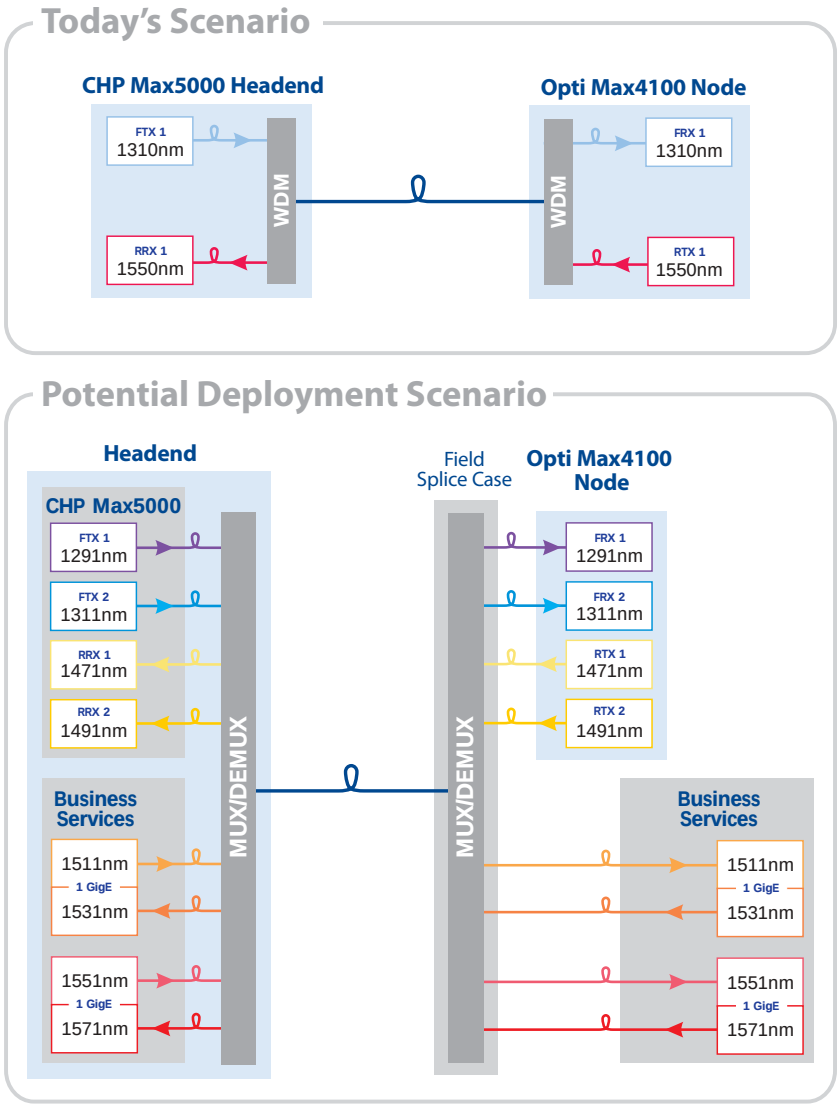
To migrate to the 4 x 4 segmentation configuration, activate two additional spare fibers and install two additional forward receivers, two additional return transmitters, and the associated configuration modules.



CWDM Applications

MSOs are continually pressured to increase the capacity of their HFC networks as subscribers demand HDTV, ever-increasing data download speed, business services, VoIP, and digital simulcast. The existing fiber infrastructure is rapidly becoming inadequate, if not already so, and at a cost of $10,000/mile or more, new fiber construction may not be an option. CWDM technology is the way to go. By implementing CWDM, MSOs can combine multiple return paths onto a single return fiber, or in a star architecture, point-to-point links between each node and a hub are possible with short fiber lengths, while maintaining a single, long fiber between the hub and headend.

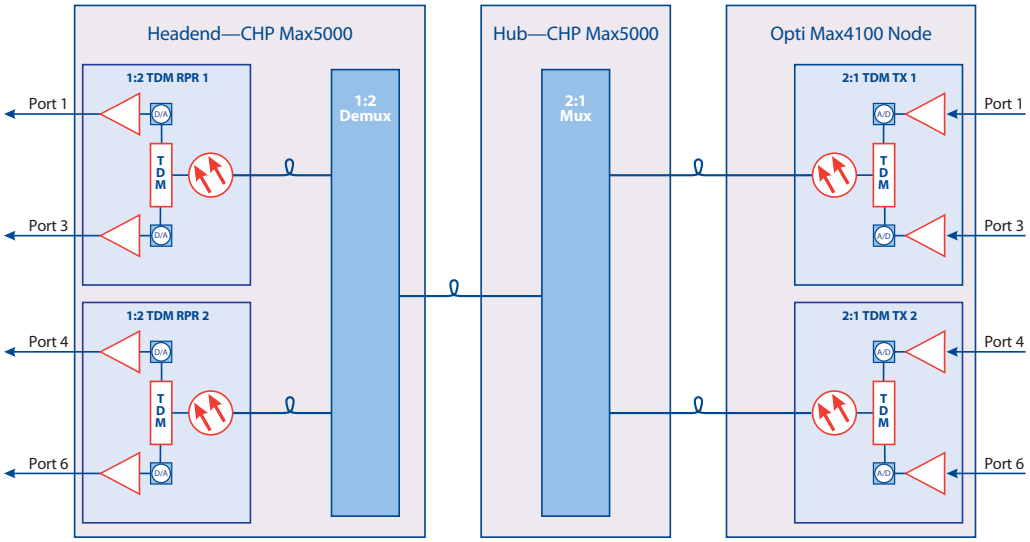
The real advantage of CWDM technology can be seen in C-COR's CWDM Multi-Wavelength Access Network, which is an even more targeted solution enabling MSOs to offer the full range of next-generation residential and business services by leveraging their existing network. Rigorously tested and field-proven, this new system delivers up to 10 multiplexed 20 nm spaced CWDM wavelengths of analog forward, return, and GigE services on a single fiber.



Note: Updating from Today's Scenario to the Potential Deployment Scenario results in one spare fiber.

Digital Return Application

C-COR also offers a digital return solution using CWDM technology. 2:1 TDM digital return transmitters can be used in the Opti Max4100 to digitally combine two independent return path inputs onto a single fiber. With the use of CWDM transmitters, four independent return path signals can be multiplexed onto a single fiber from the Opti Max4100. In addition to allowing reduced node fiber counts, digital return technology can allow operators to achieve high performance over very long fiber links, thus eliminating potential distance problems in certain system architectures.



General Node Specifications

General Node Specifications		
Number of Active RF/AC Ports	4	
Number of AC Only Ports	2	
AC Current Passing, A (All Ports)	15	
Physical Dimensions, (W x H x D), in (cm)	20 x 11.7 x 10.2 (50.8 x 29.7 x 25.9)	
Weight, lbs (kg)	43 (19.5)	
Operating Temperature Range, °C	–40 to 60	
Forward Path Specifications		
Optical Specifications		
Optical Input Wavelength, nm	1290 to 1600	
Optical Input Range, dBm	–3 to 3	
RF Specifications		
Operating Passband, MHz	54/70/85 to 1002	
Output Level @ 1002 MHz, –3dBm input, 3% OMI, dBmV, min.	53.5	
Level Stability, dB, max.	±1.5	
Gain Slope, dB (Note 1)	17.0 ± 1.0	
Flatness @ Gain Slope, dB (Note 2)	±1.5	
Return Loss, dB, min. (all RF ports)	16.0	
Port to Port Isolation, dB, typ. (870/1002 MHz)	70/60	
NTSC Channel Performance (Note 3)	**79 Channels (42/54 split)**	**76 Channels (55/70 split)**
Reference Frequency, MHz	1002/870/550/54	1002/870/550/70
Output Level, dBmV	53.5/51.2/45.4/36.5	53.5/51.2/45.4/36.8
Carrier to Noise Ratio, 4 MHz, 75 Ohm, dB	58.5	58.5
Composite Triple Beat, –dBc	73	73
Composite 2IM, –dBc	67	67
Cross Modulation (per NTCTA std.), –dB	65	65
Composite Intermodulation Noise, dB (Note 4)	62.5	62.5
PAL/CENELEC Channel Performance (Note 3)	**60 PAL Channels (65/85 split)**	**42 CENELEC Channels (65/85 split)**
Reference Frequency, MHz	1002/600/85	870/600/85
Output Level, dBmV	53.5/46.3/37.1	51.2/46.3/37.1
Carrier to Noise Ratio, 4 MHz, 75 Ohm, dB	57.5	57.5
Composite Triple Beat, –dBc	71	67
Composite 2IM, –dBc	69	65
Cross Modulation (per NTCTA std.), –dB	61	60
Composite Intermodulation Noise, dB (Note 4)	62	—
Return Path Specifications		
RF Specifications		
Operating Passband, MHz	5 to 42/55/65	
Optimum RF Input Level, dBmV/6 MHz	12	
Gain Slope, dB	±1.0	
Flatness @ Gain Slope, dB	±1.0	
Level Stability, dB	±2.5	
Return Loss, dB (all RF ports)	16.0	
Port to Port Isolation, dB, typ.	70	

General Node Specifications (cont'd)

Opti Max4100 w/ Isolated 1310 nm and 1550 nm DFB TX Specifications	
Transmitted Wavelength, nm	1310 ± 20, 1550 ± 25
Output Power, @ output of connector, dBm	3.0 ± 1.0
NPR Dynamic Range, dB	41/12
Peak NPR, dB, typ.	48
BER Dynamic Range (QPSK), dB	35
Opti Max4100 w/ Isolated DFB Analog CWDM TX Specifications	
Transmitted Wavelength, nm	1471 to 1611 ± 6.5 nm (8 CWDM channels, 20 nm spacing)
Output Power, @ output of connector, dBm	3.0 ± 1.0
NPR Dynamic Range, dB	35/15
Peak NPR, dB, typ.	45
BER Dynamic Range(QPSK/16-QAM), dB	45/35
Opti Max4100 w/ 2:1 TDM Digital TX Specifications (Note 5)	
Transmitted Wavelength, nm	1471 to 1611 ±6.5nm (8 CWDM channels, 20 nm spacing)
Output Power, @ output of connector, dBm	3.5 ± 0.5
NPR @ 12 dBmV TX Input, dB, typ.	50, with 0 dB attenuation
Peak NPR, dB, min.	48
Dynamic Range @ 40 dB NPR, dB, typ./min.	18/16
BER Dynamic Range(QPSK), dB	45
Link Gain, dB	32, with 0 dB TX attenuation and max. gain at RX

Powering Requirements (Note 6)	**DC Current (mA, max.)**			**DC Power**	**AC I/P Current**	**AC I/P Power**
	@ 5V	**@ 12V**	**@ 24V**	**(W)**	**@ 60/90V (A)**	**@ 60/90V (W)**
1 x 4/4 x 1 w/ 1310/1550 IDFB TX	15	745	2275	63.6	1.360/1.020	74.0/75.0
1 x 4/4 x 1 w/ 1310/1550 IDFB TX & EMT	315	745	2400	68.2	1.430/1.060	79.0/83.0
1 x 4/4 x 1 Redundant w/ 1310/1550 IDFB TX	20	805	2400	67.4	1.410/1.060	78.0/80.0
1 x 4/4 x 1 Redundant w/ 1310/1550 IDFB TX & EMT	320	805	2525	71.9	1.550/1.130	87.0/84.0
2 x 2 w/ 1310/1550 IDFB TX	20	1320	2870	84.8	1.790/1.250	100.0/100.0
2 x 2 w/ 1310/1550 IDFB TX & EMT	320	1320	2995	89.3	1.820/1.290	102.0/102.0
2 x 2 Redundant w/ 1310/1550 IDFB TX	30	1440	3120	92.3	1.960/1.360	110.0/109.0
2 x 2 Redundant w/ 1310/1550 IDFB TX & EMT	330	1440	3245	96.8	2.050/1.390	112.0/112.0
4 x 4 w/ 1310/1550 IDFB TX	30	410	4060	102.5	2.150/1.490	122.0/122.0
4 x 4 w/ 1310/1550 IDFB TX & EMT	330	410	4185	107.1	2.250/1.530	124.0/124.0
2 x 2 Redundant or 4 x 4 w/ 2:1 TDM TX	4610	1300	3630	125.8	2.77/1.85	148.0/148.0

Notes:

1. GEQL-1G-110 typically installed at each RF port at the factory to achieve specified tilt (17.0 dB, 42/54 split; 16.7 dB, 55/70 split; 16.4 dB, 65/85 split).
2. Maximum roll-off of 1 dB at 51.5 MHz.
3. Analog NTSC channels occupying the forward path frequency range up to 550 MHz (42/54 and 55/70 splits) or PAL B/G video channels occupying the 85 to 600 MHz frequency range (65/85 split) with digitally compressed channels or equivalent broadband noise to 1002 MHz at levels 6 dB below equivalent video channels. The distortion values listed are for the node only. To obtain a particular link performance, combine the listed node performance values with the applicable transmitter performance values.
4. Systems operating with digitally compressed channels or equivalent broadband noise from 550 to 1002 MHz at levels 6 dB below equivalent video channels will experience a composite distortion (CIN) appearing as noise in the 54 to 550 MHz frequency spectrum.
5. Digital CWDM TXs are only available with the 42/54 MHz bandsplit.
6. DC current draw requirements for analog CWDM TXs: add 350 mA @12V and 75 mA @ 24V for each additional TX. DC current draw requirements for 2:1 TDM digital CWDM transmitters: add 1.5 A @ 5V and 130 mA @ 12V for each additional transmitter.
7. See specification document numbers 1500166 (42/54 split), 1501149 (65/85 split), 1501153 (55/70 split), 1500422 (forward RX), 1500237 (1310 nm TX), 601241 (1550 nm TX), 1500893 (analog CWDM TX), 1500189 (2:1 TDM digital CWDM TX), and 1500481 (power supply) for more detailed specifications.

Specifications subject to change without notice

Ordering Information

			1	2	3		4	5	6	7	8		9	10	11	12	13	14	15	16	17		18	19
O	M	4	1	G	x	–	x	x	x	x	5	–	x	x	x	x	x	x	x	x	x	–	x	x

1	Series
1	Opti Max4100 series

2	Bandwidth
G	1 GHz with 53.5 dBmV O/P level

3	Frequency Split
J	42/54 MHz
H	65/85 MHz
Q	55/70 MHz

4	Return Switch	
6, 7	(6) None, (7) return switches	a
	a) Operation of return switches requires a transponder.	

5	Output Configuration	
A	Four active outputs and –20 dB internal testpoints	a
B	Four active outputs and –20 dB external testpoints	b
	*a) Must select "**C**" in #7 block,* **Housing**.	
	*b) Must select "**B**" in #7 block,* **Housing**.	

6	Powering	
2–3	(2) single, (3) dual	a
	a) 90V, 50/60Hz, high efficiency, transformerless power supply.	

7	Housing	
B	6-port, 1 GHz, external testpoints	a
C	6-port, 1 GHz, internal testpoints	b
	*a) Must select "**B**" in #5 block,* **Output Configuration**.	
	*b) Must select "**A**" in #5 block,* **Output Configuration**.	

8	Housing Finish
5	Corrosion protected

9	Forward Receiver	
A	1 x 4	a
B	1 x 4, optical path redundancy	a
C	2 x 2 segmentation	a
D	2 x 2 segmentation, optical path redundancy	a
E	4 x 4 segmentation	a
	a) Includes RX(s), fwd. config. module, and either jumper module or A/B switch. RF module PADs and EQs must be ordered separately.	

10	Forward Receiver Connector
1–4	(1) FC/APC, (2) SC/APC, (3) FC/UPC, (4) SC/UPC

11–12	Return Configuration	
00	None	
BA	4 x 1, single 1310 nm IDFB TX	a
BB	4 x 1, dual 1310 nm IDFB TX, opt. path redundancy	a
BC	2 x 2 segmentation, dual 1310 nm IDFB TX	a
BD	2 x 2 segmentation, quad 1310 nm IDFB TX, opt. path redundancy	a
BE	4 x 4 segmentation, quad 1310 nm IDFB TX	a
CA	4 x 1, single 1550 nm IDFB TX	a
CB	4 x 1, dual 1550 nm IDFB TX, opt. path redundancy	a
CC	2 x 2 segmentation, dual 1550 nm IDFB TX	a
CD	2 x 2 segmentation, quad 1550 nm IDFB TX, opt. path redundancy	a

11–12	Return Configuration (cont'd)	
CE	4 x 4 segmentation, quad 1550 nm IDFB TX	a
DC	2 x 2 segmentation, CWDM IDFB double-width digital 2:1 TDM TX	b,c
DD	2 x 2 segmentation, CWDM IDFB dig. 2:1 TDM TX, opt. path redundancy	b,c
DE	4 x 4 segmentation, CWDM IDFB double-width digital 2:1 TDM TX	b,c
GA	4 x 1, analog CWDM IDFB TX	c
GB	4 x 1, analog CWDM IDFB TX, opt. path redundancy	c
GC	2 x 2 segmentation, analog CWDM IDFB TX	c
GD	2 x 2 segmentation, analog CWDM IDFB TX, opt. path redundancy	c
GE	4 x 4 segmentation, analog CWDM IDFB TX	c
	a) Includes TX(s) and return configuration module. TX(s) ship with appropriate configuration PAD(s). RF module PADs and EQs must be ordered separately.	
	*b) Must select "**J**" in #3 block,* **Frequency Split** *and "**1**" or "**2**" in #17 block,* **Return Transmitter Connector**. *2:1 TDM digital transmitters are dual-width 2-channel modules. Must order CHP Max5000 digital return receiver(s) to complete the Opti Max4100 digital return solution.*	
	c) Includes return configuration module. CWDM TX(s) must be ordered separately. Node ships with appropriate CWDM TX configuration PAD(s). RF module PADs and EQs must be ordered separately.	

13–16	Transmitter Options	
0000	None	a
000z	One single-width transmitter for 4 x 1 segmentation (slot 6)	b,d
00yz	Two single-width transmitters for 2 x 2 and 4 x 1 redundant segmentations (slots 5 and 6)	b,d,e
wxyz	Four single-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (slots 3 through 6)	b,d,e
00yy	One double-width transmitter for 2 x 2 segmentation (slots 5 and 6)	c,d
xxyy	Two double-width transmitters for 4 x 4 and 2 x 2 redundant segmentations (sots 3 through 6)	c,d,e
	*a) Must select either "**00, BA, BB, BC, BD, BE, CA, CB, CC, CD, CE**" in #11-12 blocks,* **Return Configuration**.	
	*b) Must select either "**GA, GB, GC, GD, GE**" in #11-12 blocks,* **Return Configuration**.	
	*c) Must select either "**DC, DD, DE**" in #11-12 blocks,* **Return Configuration**.	
	d) The four characters represent the four transmitter slots in the node from left to right (slots 3 through 6). Single-width analog TX: A=1611 nm, B=1591 nm, C=1571 nm, D=1551 nm, E=1531 nm, F=1511 nm, G=1491 nm, H=1471 nm, 3=1310 nm, 5=1550 nm. Double-width digital CWDM TX: AA=1611 nm, BB=1591 nm, CC=1571 nm, DD=1551 nm, EE=1531 nm, FF=1511 nm, GG=1491 nm, HH=1471 nm.	
	e) Transmitters are to be placed into slots so that the wavelength increases as the slot number increases. For example, "HGBA" represents 1471 nm (slot 3), 1491 nm (slot 4), 1591 nm (slot 5), 1611 nm (slot 6) TXs. Also, "00HG" represents 1471 nm (slot 5) and 1491 nm (slot 6) TXs.	
	f) Transmitters in configurations with redundant wavelengths should be staggered in the slots. For example, two 1471 nm and two 1491 nm transmitters should be located as "HGHG".	

17	Return Transmitter Connector	
1	FC/APC	a,b
2	SC/APC	a,b
3	FC/UPC	a
4	SC/UPC	a
	a) Connector available for analog CWDM, 1310 nm, and 1550 nm return TX.	
	b) Connector available for digital CWDM return TX.	

Continued on next page

18–19	Element Management Transponder (RX/TX Frequencies)	
00	None (Value Max compatible)	a
10	None (Tollgrade compatible)	a
B0	Value Max AM protocol transponder	b
C0	Value Max HMS protocol transponder	b
AK	Tollgrade protocol transponder (51.50/12.00 MHz)	c
AM	Tollgrade protocol transponder (108.50/10.00 MHz)	c
AP	Tollgrade protocol transponder (73.20/13.80 MHz)	c
AQ	Tollgrade protocol transponder (108.50/5.50 MHz)	c
AR	Tollgrade protocol transponder (108.50/6.50 MHz)	c
AS	Tollgrade protocol transponder (93.00/10.00 MHz)	c
AT	Tollgrade protocol transponder (72.60/13.90 MHz)	c
AU	Tollgrade protocol transponder (72.50/10.10 MHz)	c
AV	Tollgrade protocol transponde (52.00/9.00 MHz)	c

a) No transponder; order transponder and daughterboard separately.

b) Includes transponder, Value Max compatible daughterboard, and cable.

c) Includes transponder, Tollgrade compatible daughterboard, and cable. Additional transponder frequencies are available upon request.

CWDM Transmitters

Analog CWDM Transmitters

Part Number	Description	Part Number	Description
1500814-xxx	1471 nm analog CWDM transmitter	1500818-xxx	1551 nm analog CWDM transmitter
1500815-xxx	1491 nm analog CWDM transmitter	1500819-xxx	1571 nm analog CWDM transmitter
1500816-xxx	1511 nm analog CWDM transmitter	1500820-xxx	1591 nm analog CWDM transmitter
1500817-xxx	1531 nm analog CWDM transmitter	1500821-xxx	1611 nm analog CWDM transmitter

Note: xxx = connector type (-001 = SC/APC, -002 = SC/UPC, -003 = FC/APC, -004 = FC/UPC).

CWDM 2:1 TDM Digital Transmitters

Part Number	Description	Part Number	Description
152250-0x	1471 nm CWDM 2:1 TDM digital transmitter	152254-0x	1551 nm CWDM 2:1 TDM digital transmitter
152251-0x	1491 nm CWDM 2:1 TDM digital transmitter	152255-0x	1571 nm CWDM 2:1 TDM digital transmitter
152252-0x	1511 nm CWDM 2:1 TDM digital transmitter	152256-0x	1591 nm CWDM 2:1 TDM digital transmitter
152253-0x	1531 nm CWDM 2:1 TDM digital transmitter	152257-0x	1611 nm CWDM 2:1 TDM digital transmitter

Note: Where 0x is the connector type; -01 = SC/APC, -03 = FC/APC connectors. Only available for 42/54 split Opti Max4100 nodes.

C-COR also offers a comprehensive suite of optical passive solutions to help you take full advantage of our new CWDM transmitters. Contact your C-COR sales professional for more details and to discuss how our exciting new 1 GHz products can add value to your network.

Refer to the C-COR HFC Product Accessories data sheet on our website for detailed ordering information and specifications on the complete set of plug-in accessories used in the Opti Max4100.

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