

## Opti Max2000

### Fiber Deep Cabinet Nodes



- **Optimized for fiber deep architectures**
- **109dB $\mu$ V (49dBmV) output level at -6dBm optical input level**
- **Classic HFC model available**
- **Complete CWDM return path offerings**
- **2-output, 2-output redundant, and 3-output options**
- **GaAs technology for improved system performance**
- **EMS support via HMS and proprietary protocol transponders**

C-COR's Opti Max2000 Fiber Deep Cabinet Nodes are part of a family of products designed to provide high quality transmission of analog and digital signals over broadband, multiservice HFC networks. Opti Max2000 Fiber Deep Cabinet Nodes combine advanced RF and optical technology with an RF output level of 109 dB $\mu$ V (49 dBmV) at a -6dBm optical input level, thus allowing longer optical links and nodes placed much deeper in HFC networks.

C-COR's Opti Max2000 Classic HFC Cabinet Nodes are available with an RF output level of 107dB $\mu$ V (47dBmV) with the performance required for standard HFC architectures consisting of a node plus three to five amplifiers in cascade. For existing plant applications where the node fiber counts are limited, 1550nm DFB and CWDM options are available.

The Opti Max2000 Fiber Deep Cabinet Node design is based on three fundamental principles: cost efficiency, scalability, and reliability. With robust GaAs technology, system performance is improved, and plug-in diplex filters allow future upgrades.

Settings for attenuation and equalization can be conducted in each output leg separately, which increases flexibility. In addition, slope correction is built onto the motherboard, enabling the equalization value to be achieved with attenuators, thus enabling operators to carry only one type of plug-in accessory. In 2-output models, an optional control module is available to improve signal flatness and allow an extremely flat launch to the RF portion of the network. The RF tray is swappable and the node unit can be upgraded in the field to a redundant node. Remote feeding is maintained when the RF tray is swapped.

Additional options include a broad range of return transmitters, including up to 16 CWDM wavelengths, and element management transponders with gate level control (GLC), including open-standard HMS protocol modules, which provide system integrity.

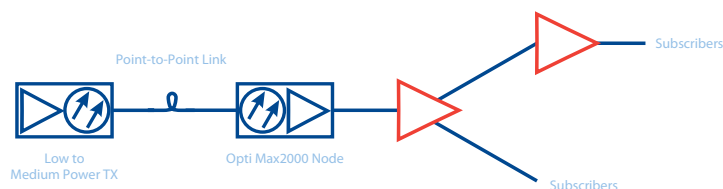
## Features

- GaAs technology enables high operational gain at a low optical input level of  $-6\text{dBm}$ , improving system performance and reducing total system costs
- Modular design and flexibility enable a low initial capital expense and provide an upgrade path for future services while preserving your initial investment
- Plug-in diplex filters allow future upgrades
- Increased return offerings with up to 16 CWDM wavelengths
- Swappable RF tray and power supply unit for lower operational expenses and easy maintenance and service
- Optional housing sealing provides enhanced watertightness for aerial applications and manhole installations per IP67 protection standards
- Improved system reliability with HMS-compliant transponders
- Optional reference carrier generator enables easy return path alignment and can be disabled by EMS

## Applications

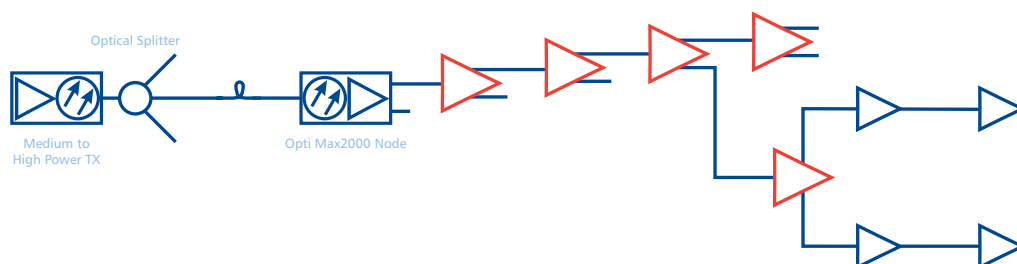
### Fiber Deep Node Application

The Opti Max2000 Fiber Deep Node is dedicated to network architectures that enable advanced services and increased return bandwidth through customized segmentation of node service areas. The Opti Max2000 Fiber Deep Node's high output level [ $109\text{dB}\mu\text{V}$  ( $49\text{dBmV}$ )] enables operators to reach a high number of subscribers while its low input power ( $-6\text{dBm}$ ) allows long point-to-point fiber links with low to medium power transmitters, limiting capital expenditures per subscriber. These architectures typically have a very short amplifier cascade, or even no amplifier cascade.



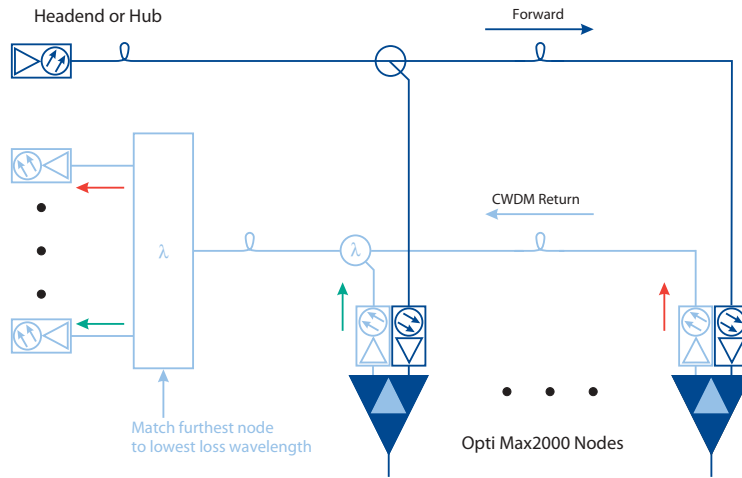
### Classic HFC Application

In traditional applications, the Opti Max2000 Classic HFC Node does not require the higher gain that is required in a fiber deep application, and in fact, the Classic HFC Node's lower gain [ $107\text{dB}\mu\text{V}$  ( $47\text{dBmV}$ )] at a minimum optical input level of  $-3\text{dBm}$  is an advantage. Opti Max2000 Classic HFC Nodes typically feed up to five amplifiers in cascade; therefore, the Classic HFC Node's lower gain maximizes CNR through such traditional cascades.

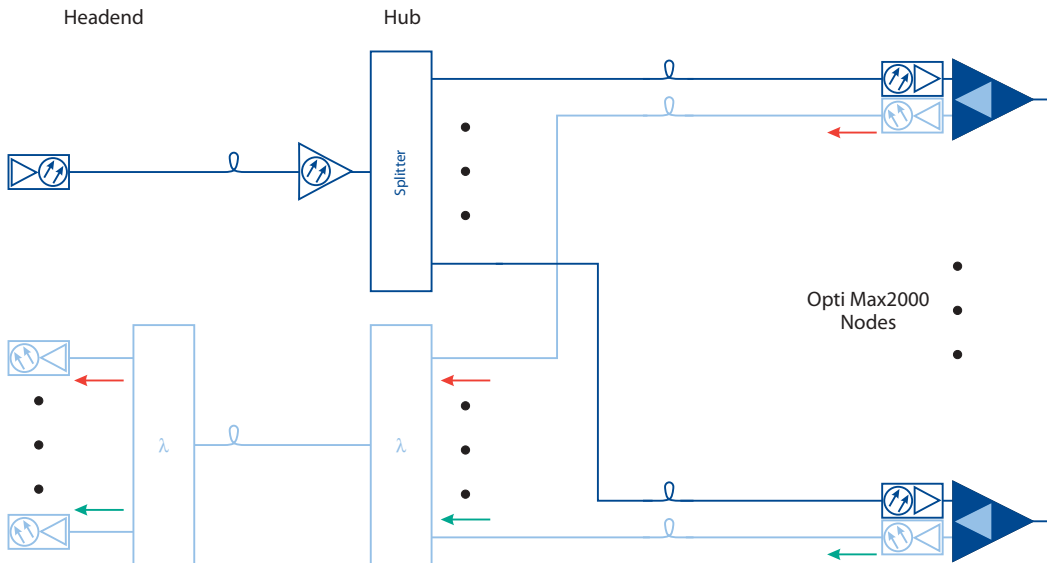


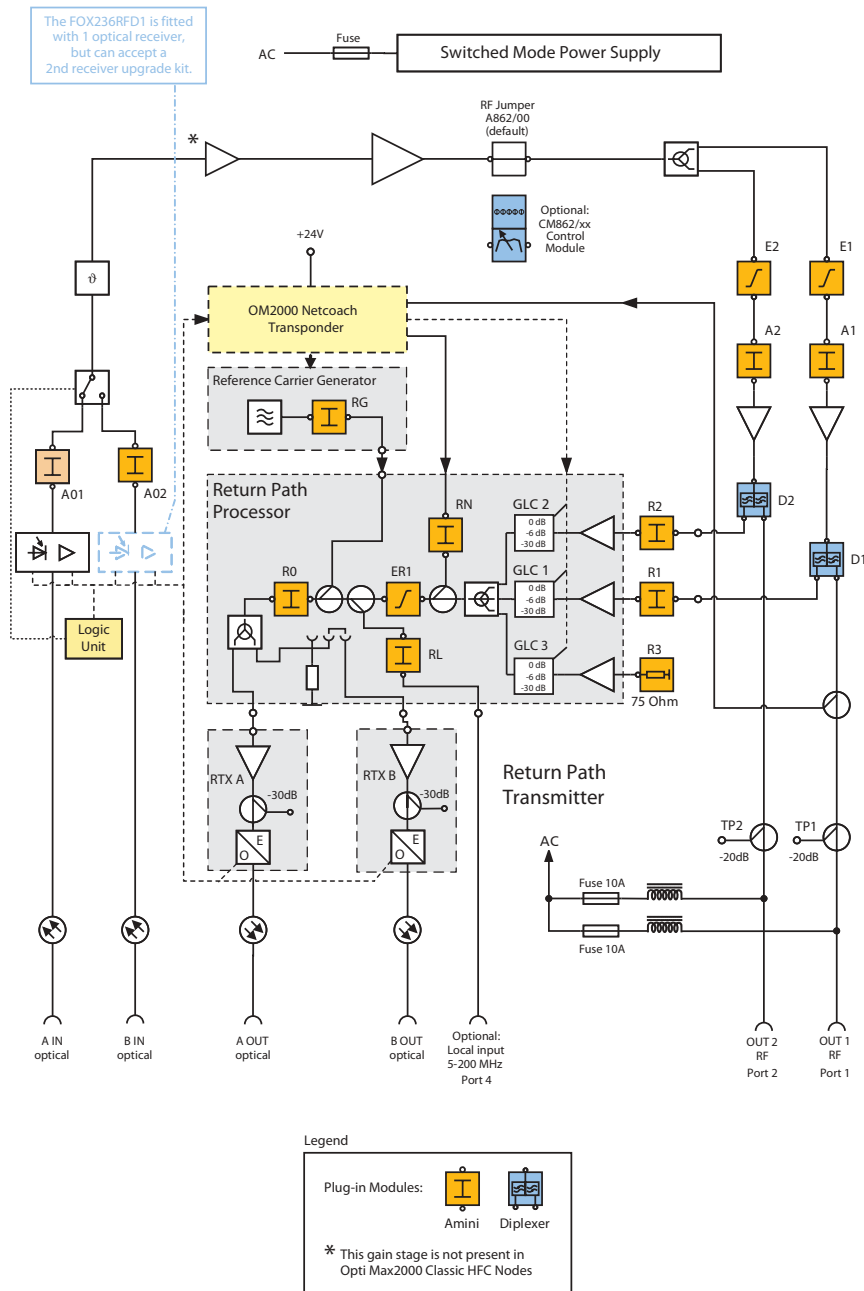
### CWDM Applications

In fiber poor systems, CWDM technology increases return path capability using a single fiber. In the following example, multiple return paths can be combined onto a single fiber from nodes to a headend or hub. Contact your C-COR sales professional for new CWDM features and applications.



In the following 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 advantage with this architecture is that an existing fiber can be used between hub and headend, or only one fiber has to be installed between hub and headend, reducing the cost of such implementation.





### Opti Max2000 2-Output Redundant Node Block Diagram

Note: 2-output and 3-output non-redundant models are also available. Contact your C-COR sales professional for more information.

## Opti Max2000 Specifications—Fiber Deep Application

### Forward Path Receiver

Nominal Optical Input Power	-3dBm
Level Range	-6 to 0dBm @ 109dB $\mu$ V (49dBmV) output
Spectral Noise Density	8.5 pA/Hz <sup>0.5</sup>
Wavelength	1280 to 1600nm
Optical Return Loss	> 40dB

### Forward RF Specifications

RF Coverage	47/54/70/85 to 862MHz
Impedance	75 Ohm
Testpoints	-20dB
Frequency Response	$\pm$ 0.5 dB

### Performance Specifications (Note 1)

	42 CENELEC	77 NTSC	110 NTSC
Channel Loading	48/862 MHz	48/862 MHz	48/862 MHz
Reference Frequency	8dB	12dB	12dB
Reference Slope, linear	109dB $\mu$ V	106.5dB $\mu$ V	100dB $\mu$ V
Reference Output Level, all ports	52dB	50dB	50dB
CNR	62/65dB	64/66dB	64/66dB
CTB, min./typ.	62/64dB	64/66dB	60/62dB
CSO, min./typ.	60/62dB	60/62dB	60/62dB
XMOD, min./typ.	-3dBm	-3dBm	-3dBm
Optical Input Power			

### Return Path Transmitter

Band Coverage	up to 200MHz with local input
Isolated FP Lasers	1310 $\pm$ 40nm; -3 and 0dBm (0.5 and 1 mW)
Uncooled Isolated DFB Lasers	1310 $\pm$ 20nm and 1550 $\pm$ 3nm; 0 and 2dBm (1.0 and 1.6mW)
Uncooled Isolated CWDM Lasers	1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610nm; 0 and 2dBm (1.0 and 1.6mW)
RF Input Level	70dB $\mu$ V (10dBmV)
RF Testpoint	-30dB
Optical Power Testpoint	1V/mW

### Physical and Environmental Specifications

Dimensions (W x H x D)	314 x 132 x 303 mm (12.56 x 5.28 x 12.12 in.)
Weight	7.9kg (17.9lbs)
Temperature Range	-20 to 55°C (-4 to 130°F)

### Reliability

MTBF	> 20 years
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### Plug-in Modules

Diplex Filters	D30/47MHz, D42/54MHz, D55/70MHz, D65/85MHz
Attenuators	Amini pads 0 to 20dB
Control Modules	CM862/00MHz, CM862/47MHz, CM862/54MHz, CM862/85MHz
Transponder Module Net Coach	NET COACH OM2000 (AM), NET COACH OM2000 (HMS-compliant)
Reference Carrier Generators	RCG 42MHz, RCG 65MHz Frequencies: 42MHz and 65MHz Output Level: 103dB $\mu$ V Stability: $\pm$ 0.25dB @ 0 to 80°C $\pm$ 50ppm

### Powering Specifications

AC Input Voltage	28 to 65V rms and 40 to 90V rms, 47 to 63Hz
Local Powering	90 to 250VAC, 47 to 63Hz
AC Bypass Current	7A per port; 15A total
Power Consumption, includes PS efficiency	FOX236FD: 42W; FOX236RFD: 43W; FOX336FD: 50W

1. According to EN 50083-3, CENELEC 42 channel loading, and with diplex filters and 8dB slope. Variation of CTB/CSO/CNR values according to different optical connectors possible.

## Opti Max2000 Specifications—Classic HFC Application

### Forward Path Receiver

Nominal Optical Input Power	0 dBm
Level Range	-3 to 2 dBm @ 107 dBμV (47 dBmV) output
Spectral Noise Density	8.5 pA/Hz <sup>0.5</sup>
Wavelength	1280 to 1600 nm
Optical Return Loss	> 40 dB

### Forward RF Specifications

RF Coverage	47/54/70/85 to 862 MHz
Impedance	75 Ohm
Testpoints	-20 dB
Frequency Response	±0.5 dB

### Performance Specifications (Note 1)

	42 CENELEC	77 NTSC	110 NTSC
Channel Loading	48/862 MHz	48/862 MHz	48/862 MHz
Reference Frequency	8 dB	12 dB	12 dB
Reference Slope, linear	107 dBμV	106.5 dBμV	100 dBμV
Reference Output Level, all ports	55 dB	53 dB	53 dB
CNR	66/68 dB	64/66 dB	64/66 dB
CTB, min./typ.	64/66 dB	64/66 dB	64/66 dB
CSO, min./typ.	62/64 dB	60/62 dB	60/62 dB
XMOD, min./typ.	0 dBm	0 dBm	0 dBm
Optical Input Power			

### Return Path Transmitter

Band Coverage	up to 200 MHz with local input
Isolated FP Lasers	1310 ± 40 nm; -3 and 0 dBm (0.5 and 1 mW)
Uncooled Isolated DFB Lasers	1310 ± 20 nm and 1550 ± 3 nm; 0 and 2 dBm (1.0 and 1.6 mW)
Uncooled Isolated CWDM Lasers	1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm; 0 and 2 dBm (1.0 and 1.6 mW)
RF Input Level	70 dBμV (10 dBmV)
RF Testpoint	-30 dB
Optical Power Testpoint	1 V/mW

### Physical and Environmental Specifications

Dimensions (W x H x D)	314 x 132 x 303 mm (12.56 x 5.28 x 12.12 in.)
Weight	7.9 kg (17.9 lbs)
Temperature Range	-20 to 55°C (-4 to 130°F)

### Reliability

MTBF	> 20 years
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### Plug-in Modules

Diplex Filters	D30/47 MHz, D42/54 MHz, D55/70 MHz, D65/85 MHz
Attenuators	Amini pads 0 to 20 dB
Control Modules	CM862/00 MHz, CM862/47 MHz, CM862/54 MHz, CM862/85 MHz
Transponder Module Net Coach	NET COACH OM2000 (AM), NET COACH OM2000 (HMS-compliant)
Reference Carrier Generators	RCG 42 MHz, RCG 65 MHz Frequencies: 42 MHz and 65 MHz Output Level: 103 dBμV Stability: ±0.25 dB @ 0 to 80°C ± 50 ppm

### Powering Specifications

AC Input Voltage	28 to 65 V rms and 40 to 90 V rms, 47 to 63 Hz
Local Powering	90 to 250 VAC, 47 to 63 Hz
AC Bypass Current	7 A per port; 15 A total
Power Consumption, includes PS efficiency	FOX236: 41 W; FOX236R: 42 W; FOX336: 49 W

1. According to EN 50083-3, CENELEC 42 channel loading, and with diplex filters and 8 dB slope. Variation of CTB/CSO/CNR values according to different optical connectors possible.

Specifications subject to change without notice

### Opti Max2000 Ordering Information—Fiber Deep Node

			1				2				3	4	5			6				7	8	9	10				11	12	13	14	15
F	O	X	2	3	6	R1FD	-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	x	-	x	0	x	x	G		
F	O	X	2	3	6	RFD	-	x	x	x	0	x	-	x	x	x	x	-	x	0	x	x	x	-	x	0	x	x	G		
F	O	X	2	3	6	FD	-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	x	-	x	0	x	x	G		
F	O	X	3	3	6	FD	-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	x	-	x	0	x	x	G		

1 Ports	
2	2-port model
3	3-port model

2 Forward Redundancy	
R1FD	Fiber deep node fitted with one RX, but can accept a second RX
RFD	Fiber deep node fitted with two RXs
FD	Fiber deep node fitted with one RX, and cannot accept a second RX

3 Power Supply		
0	Remote Powering Europe (28–65 VAC)	a
1	Remote Powering USA (40–90 VAC)	
2	Local Powering Europe (230 VAC)	
4	Remote Powering Europe (28–65 VAC), no external entry	
a) Select "2" in #9 block, <b>Fuse</b> .		

4 Return Transmitter A			
0	No return transmitter	a	
4	DFB laser, 1310 nm, 0 dBm (1.0 mW)		
5	DFB laser, 1310 nm, 2 dBm (1.6 mW)		
6	DFB laser, 1550 nm, 0 dBm (1.0 mW)		
7	Isolated FP laser, 1310 nm, -3 dBm (0.5 mW)		
8	Isolated FP laser, 1310 nm, 0 dBm (1.0 mW)		
9	DFB laser, 1550 nm, 2 dBm (1.6 mW)		
a) Select this option if ordering a node with no transmitter or with a CWDM transmitter. Contact your C-COR sales professional for details.			

5 Return Transmitter B	
Same options as <b>Return Transmitter A</b> .	

6 Return Path Processing Module		
0	No return path processing	a
1	Return path unit 5–42 MHz	
2	Return path unit 5–65 MHz	
3	Return path unit 5–55 MHz	
a) Required with return path.		

7 RF Adapters	
0	IEC type
1	3.5/12 type
2	F-type
3	5/8-inch
4	PG11 entry only; no adapter

8 Fuse		
0	Standard fuse 10A	a
1	Short circuit	
2	No fuse (in case of local powering)	
a) Select "2" in #3 block, <b>Power Supply</b> .		

9–10 Status Monitoring Module	
00	No transponder
1x	NETCOACH OM2000 (AMC)
2x	NETCOACH OM2000 (HMS)
Element Management Frequencies (please specify)	
x = Group (Forward/Return Frequency)	
A	108.50 MHz/6.50 MHz
B	115.25 MHz/9.75 MHz
C	115.25 MHz/18.00 MHz
D	75.00 MHz/8.00 MHz
E	108.50 MHz/15.00 MHz
F	108.50 MHz/5.50 MHz
G	93.00 MHz/10.00 MHz
Frequency range: Forward 48–120 MHz; Return 5–42 MHz.	

11 Optical Connectors	
0	E2000
1	SC/APC
2	FC/APC

12 Optical Connectors	
0	Inside

13 Optical Fiber Patch Cord Entry	
0	PG16
1	5/8-inch

14 Input for Coax Return Channel		
0	No local input	a
1	Local input 5–200 MHz	
a) Cannot select unisolated return TX, "1" or "2" in #4 block, <b>Return Transmitter A</b> and #5 block, <b>Return Transmitter B</b> .		

15 Output Level	
G	109 dBµV (49 dBmV) at -6 to 0 dBm optical input level

Contact your C-COR sales professional for information regarding any unique features.

Opti Max2000 Ordering Information—Classic HFC Node

		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15				
F	O	X	2	3	6	R1	-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	H											
F	O	X	2	3	6	R	-	x	x	x	0	x	-	x	x	x	x	-	x	0	x	x	H											
F	O	X	2	3	6		-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	0											
F	O	X	3	3	6		-	x	x	0	0	x	-	x	x	x	x	-	x	0	x	x	0											

1 Ports	
2	2-port model
3	3-port model

2 Forward Redundancy	
R1	Fitted with one RX, but can accept a second RX
R	Fitted with two RXs
blank	Fitted with one RX, and cannot accept a second RX

3 Power Supply	
0	Remote Powering Europe (28–65VAC)
1	Remote Powering USA (40–90VAC)
2	Local Powering Europe (230VAC)
4	Remote Powering Europe (28–65VAC), no external entry

a) Select "2" in #9 block, **Fuse**.

4 Return Transmitter A	
0	No return transmitter
4	DFB laser, 1310nm, 0dBm (1.0mW)
5	DFB laser, 1310nm, 2dBm (1.6mW)
6	DFB laser, 1550nm, 0dBm (1.0mW)
7	Isolated FP laser, 1310nm, -3dBm (0.5mW)
8	Isolated FP laser, 1310nm, 0dBm (1.0mW)
9	DFB laser, 1550nm, 2dBm (1.6mW)

a) Select this option if ordering a node with no transmitter or with a CWDM transmitter. Contact your C-COR sales professional for details.

5 Return Transmitter B	
Same options as <b>Return Transmitter A</b> .	

6 Return Path Processing Module	
0	No return path processing
1	Return path unit 5–42MHz
2	Return path unit 5–65MHz
3	Return path unit 5–55MHz

a) Required with return path.

7 RF Adapter	
0	IEC type
1	3.5/12 type
2	F-type
3	5/8-inch
4	PG11 entry only; no adapter

8 Fuse	
0	Standard fuse 10A
1	Short circuit
2	No fuse (in case of local powering)

a) Select "2" in #3 block, **Power Supply**.

9–10 Status Monitoring Module	
00	No transponder
1x	NETCOACH OM2000 (AM)
2x	NETCOACH OM2000 (HMS)

Element Management Frequencies (please specify)	
x = Group (Forward/Return Frequency)	
A	108.50MHz/6.50MHz
B	115.25MHz/9.75MHz
C	115.25MHz/18.00MHz
D	75.00MHz/8.00MHz
E	108.50MHz/15.00MHz
F	108.50MHz/5.50MHz
G	93.00MHz/10.00MHz

Frequency range: Forward 48–120MHz; Return 5–42MHz.

11 Optical Connectors	
0	E2000
1	SC/APC
2	FC/APC

12 Optical Connectors	
0	Inside

13 Optical Fiber Patch Cord Entry	
0	PG16
1	5/8-inch

14 Input for Coax Return Channel	
0	No local input
1	Local input 5–200MHz

a) Cannot select unisolated return TX, "1" or "2" in #4 block, **Return Transmitter A** and #5 block, **Return Transmitter B**.

15 Output Level	
H/0	High output, 107 dBµV (47 dBmV), 8dB tilt

Contact your C-COR sales professional for information regarding any unique features.

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