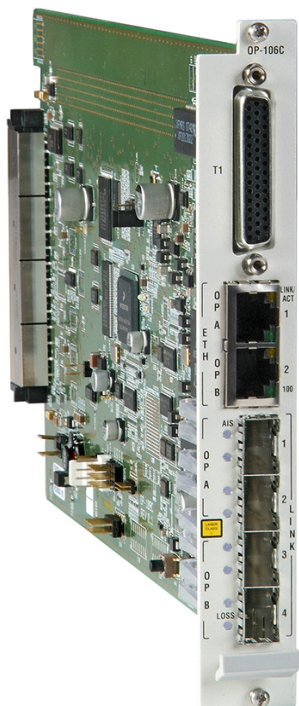


# LRS-102 OP-108C, OP-106C

## Dual Fiber Multiplexer Modules for 4E1/4T1 and Ethernet



- Dual fiber optic multiplexer with four E1/T1 channels and Fast Ethernet link each
- Various fiber interfaces: multimode, single-mode (up to 120 km), and single-mode over single fiber, using SFP optical modules
- Automatic link backup with optional hot-swappable second main link
- Connecting of up to 24 remote units to one LRS-102 rack (12 cards)
- Full management via the LRS-102 management system

The OP-108C and OP-106C multiplexer modules for the LRS-102 chassis combine up to eight E1 (or respectively, T1) channels and two Ethernet links over two fiber optic links from two remote units.

OP-108C and OP-106C include two optical multiplexers. Each OP-108C multiplexer combines up to four E1 streams and 100 Mbps Ethernet traffic. Each OP-106C multiplexer combines up to four T1 streams and 75 Mbps Ethernet traffic.

The LRS-102 chassis with 12 OP-108C or OP-106C modules provides up to 24 optical links. An OP-108C/106C link is a simple and low-cost solution for E1/T1 and Ethernet services extension over distances of up to 120 km (74.5 miles).

Fiber Multiplexers,  
Transmit Any Traffic  
over Fiber



# OP-108C, OP-106C

## Dual Fiber Multiplexer Modules for 4E1/4T1 and Ethernet

market segments and applications

Typical users of the OP-108C/106C fiber multiplexers for 4E1/4T1 and Ethernet include transportation and utility companies, government and universities, Internet Service Providers (ISPs), and carriers extending data and voice from SDH networks or backhauling cellular traffic. *Figure 1, Figure 2 and Figure 3* illustrate LRS-102 with OP-108C/106C modules in typical applications.

### INTEROPERABILITY

OP-108C/106C modules installed in the LRS-102 chassis operate with Optimux-108/Optimux-106 standalone units and Megaplex-4100 access node.

### UPLINK

Various optical interfaces are available:

- 850 nm VCSEL for multimode fiber
- 1310 nm LED for multimode fiber
- 1310/1550 nm laser diode or long haul laser diode for extended range over single-mode fiber
- Single fiber (SFP10A/SF1, SFP10B/SF2 options) using 1310 nm and 1550 nm laser diode transmitter with WDM technology, for transmitting the signal at a different wavelength than the received signal.

The optical interface of the module is provided by a choice of fiber optic SFP transceivers (see *Table I*), inserted into SFP sockets on the module panel. RAD offers several types of SFPs with optical interfaces, for meeting a wide range of operational requirements.

**Note:** *It is strongly recommended to order this device with original RAD SFPs installed. This will ensure that comprehensive functional quality tests on the entire assembled unit, including the SFP devices, have been performed by RAD prior to shipping. RAD cannot guarantee full compliance with product specifications for units using non-RAD SFPs.*

### ETHERNET

The Ethernet services are provided by means of an internal Layer-2 Ethernet switch that fully complies with the IEEE 802.3/Ethernet V.2 standards, including VLAN.

### TDM

The OP-108C/106C module includes two sections, where each section is capable of multiplexing four independent E1/T1 data streams. The OP-106 modules are supplied with balanced T1 interfaces. The OP-108C modules can be ordered with balanced (B) or unbalanced (U) E1 interface.

OP-108C/B has E1 ports with user-selectable balanced/unbalanced interfaces terminated in a front-panel 44-pin D-type female connector.

OP-108C/U has E1 ports with unbalanced interfaces. This model does not include a front-panel connector for E1 ports and is intended for installation only in LRS-102 units with the optional BNC patch pane.

## RESILIENCY

In addition to the resiliency offered by LRS-102 (power and CL module redundancy), an optional second link in the OP-108C/106C module provides backup upon link failure.

OP-108C/OP-106C with the redundant link features fully automatic switching between the main and the backup link.

## TIMING AND SYNCHRONIZATION

The OP-108C/OP-106C internal timing subsystem generates the clock and timing signals required by the link transmit paths of the module.

The link receive paths of the module use the clock signals recovered from the corresponding received link signal.

Each E1/T1 port has its own timing circuits, which recover the original E1/T1 clock signal from the corresponding incoming E1/T1 signal.

This timing is transparently transferred through the optical link to the far end equipment (another OP-108C/OP-106C or Optimux-108/108L/106), which supplies the E1/T1 signal with the original timing to the far end user's equipment. The timing of each E1/T1 link is independent of the timing used by the other E1/T1 links, and of the timing used by the optical links.

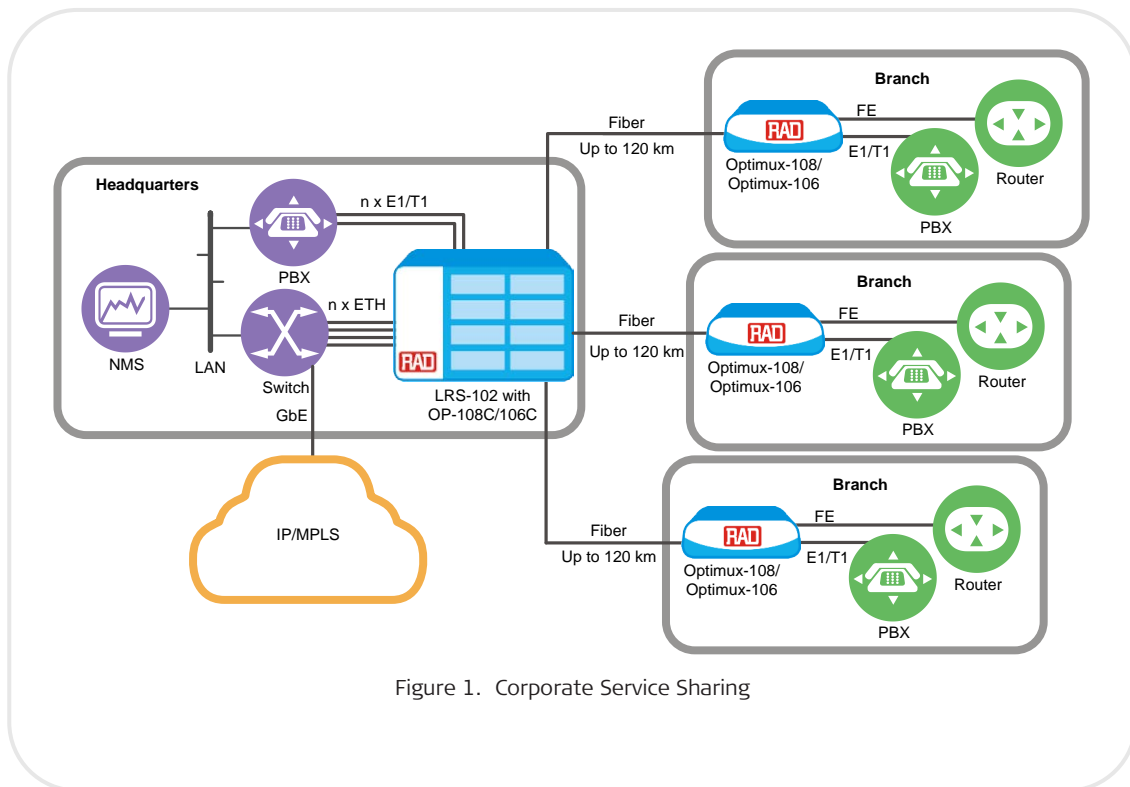


Figure 1. Corporate Service Sharing

# OP-108C, OP-106C

## Dual Fiber Multiplexer Modules for 4E1/4T1 and Ethernet

### MANAGEMENT AND SECURITY

OP-108C/OP-106C is fully managed by means of the LRS-102 management system.

In addition, OP-108C/OP-106C Ethernet ports can also be configured as access ports for management traffic: this traffic is directed by the internal OP-108C/OP-106C Ethernet switch to the LRS-102 management subsystem located on the LRS-102CL module.

To protect network operations against unauthorized access, LRS-102 features SNMP management with authentication.

In addition, the security of the site can be enhanced by limiting remote management to specific management terminals or nodes.

### MONITORING AND DIAGNOSTICS

The performance statistics data is continuously collected, and is stored as long as the equipment operates.

Performance statistics for the E1/T1 and Ethernet ports may be obtained and analyzed via the LRS-102 management system.

Table 1. SFP Fiber Optic Interface Characteristics

Module Name	Wave-length [nm]	Fiber Type	Transmitter Type	Typical Output Power [dBm]	Receiver Sensitivity w/o USER ETH port [dBm]	Receiver Sensitivity with USER ETH port [dBm]	Typical Max Range w/o USER ETH port [km][miles]	Typical Max Range with USER ETH port [km] [miles]	Connector Type
SFP-1	1310	62.5/125 multimode	LED	-18	-31	-30	6.5 4.0	2 1.2	LC
SFP-2	1310	9/125 single mode	Laser	-12	-31	-28	38 23.6	20 12.4	LC
SFP-2H	1310	9/125 single mode	Laser	-12	-31	-28	38 23.6	20 12.4	LC
SFP-3	1310	9/125 single mode	Long haul laser	-2	-34	-34	70 43.4	40 24.8	LC
SFP-3H	1310	9/125 single mode	Long haul laser	-2	-34	-34	70 43.4	40 24.8	LC
SFP-4	1550	9/125 single mode	Long haul laser	-2	-34	-34	120 74.5	80 49.7	LC
SFP-10a	Tx - 1310, Rx - 1550	9/125 single mode (single fiber)	Laser WDM	-12	-30	-28	40 24.8	20 12.4	LC
SFP-10b	Tx - 1550, Rx - 1310	9/125 single mode (single fiber)	Laser WDM	-12	-30	-28	40 24.8	20 12.4	LC
SFP-18A	Tx - 1310, Rx - 1550	9/125 single mode (single fiber)	Laser WDM	-2	-30	-28	60 37.3	40 24.8	LC
SFP-18B	Tx - 1550, Rx - 1310	9/125 single mode (single fiber)	Laser WDM	-2	-30	-28	60 37.3	40 24.8	LC
SFP-24	850	62.5/125 multimode 50/125 multimode	VCSEL	-7	-31	-25	6.5 4.0	1 0.6 2 1.2	LC

**Note:** Typical ranges are calculated according to attenuation of 0.4 dB/km for 1310 nm single mode fiber and 0.25 dB/km for 1550 nm single mode fiber.

## Specifications

### FIBER OPTIC INTERFACES

**Number**

2

**Characteristics**

See *Table 1*

**Compliance**

G.955, G.742 (OP-108C without Ethernet ports)

### E1/T1 USER INTERFACES

**Number of Ports**

8 (4 per section)

**Line Rate**

E1: 2048 kbps

T1: 1544 kbps

**Line Coding**

E1: HDB3

T1: B8ZS

**Impedance**

E1 balanced: 120Ω

T1 balanced: 100Ω

E1 unbalanced: 75Ω

**Jitter**

ITU-T Rec. G.823

**Connectors**

*OP-108C/B*

44-pin D-type female connector

*OP-108C/U*

BNC on LRS-102 patch panel

*OP-106C*

44-pin D-type female connector

**Compliance**

G.703, G.823(E1), G.824(T1)

### ETHERNET USER INTERFACE

**Type**

10/100BaseT

**Connector**

Shielded RJ-45

**Throughput**

OP-108C: 100 Mbps

OP-106C: 75 Mbps

**Max. Frame Size**

1536 bytes

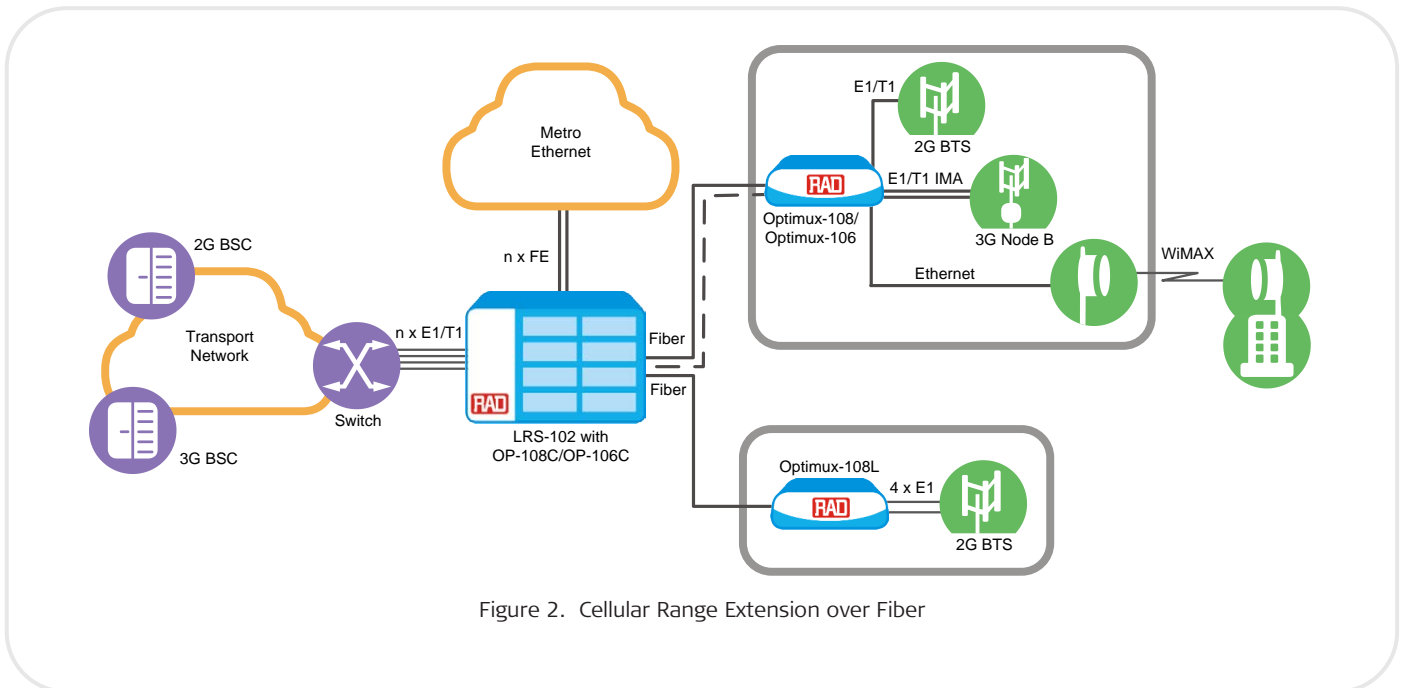


Figure 2. Cellular Range Extension over Fiber

# OP-108C, OP-106C

## Dual Fiber Multiplexer Modules for 4E1/4T1 and Ethernet

### TIMING

#### Uplink

Internal timing mode

#### E1/T1 Channel

Transparent, independent for each channel

### RESILIENCY

Uplink redundancy

### DIAGNOSTICS

#### Loopback Tests

Local and remote loopbacks on each link interface (only the TDM payload), and on each E1/T1 port

### GENERAL

#### Environment

Temperature: 0° to 45°C (32° to 113°F)

Humidity: Up to 90%, non-condensing

### Indicators

OP A/B LOSS

On (red): Sync/Signal Loss on OP A/B

Off: Normal operation

OP A/B AIS

On (yellow): AIS detected (only when used with Optimux-108/106 that does not have an Ethernet port)

Off: Normal operation

*Note: OP A/B LOSS and AIS are On if the SFP is not inserted.*

OP A/B LINK/ACT

On (yellow): link is up

Off: link is down

Flashes: frames are transmitted

OP A/B 100

On (green): 100 Mbps mode

Off: 10 Mbps mode

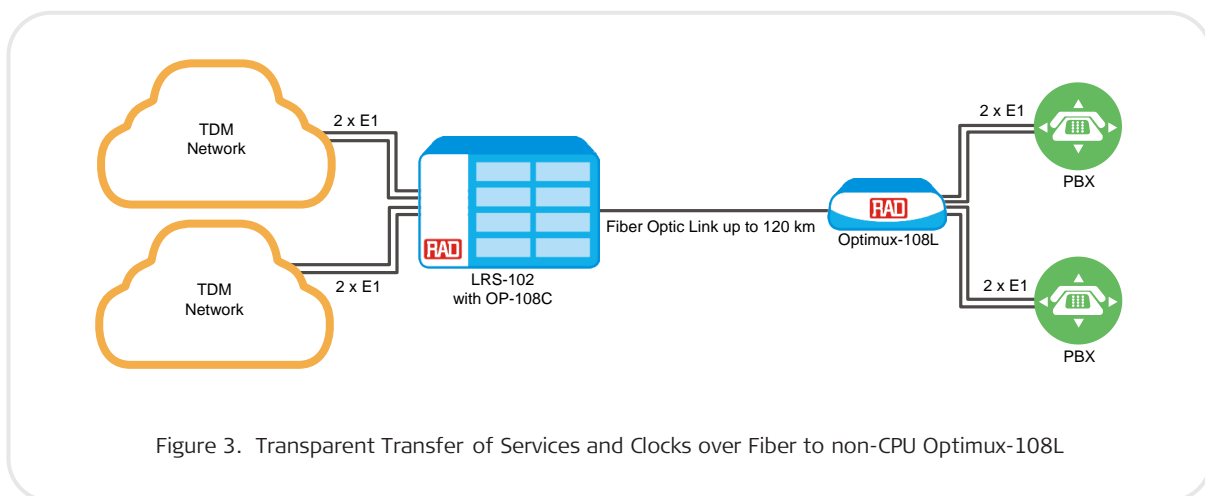


Figure 3. Transparent Transfer of Services and Clocks over Fiber to non-CPU Optimux-108L

## Ordering

### RECOMMENDED CONFIGURATIONS

OP-108C/U/ETH/2XSFP10A  
 OP-108C/U/ETH/2XSFP2  
 OP-108C/B/ETH/2XSFP2  
 OP-106C/ETH/SFP10B  
 OP-106C/4XSFP24

### SPECIAL CONFIGURATIONS

**Note:** For OP-108C modules operating in the Megaplex-4100 enclosure, refer to a separate OP-108C data sheet included into the Megaplex-4100 folder.

#### OP-108C/^/!/+

Dual fiber multiplexer module for 4 E1 and Ethernet

#### OP-106C!/+/

Dual fiber multiplexer module for 4 T1 and Ethernet

### Legend

- ^ E1 connector:
  - B Balanced (RJ-45)
  - U Unbalanced (BNC connectors on a special LRS-102 rack, E1 only)
- ! Optional Ethernet user port: (Default=no port)
  - ETH 10/100BaseT Ethernet port
- + SFP fiber optic link interface:
  - SFP1 LED, 1310 nm, multimode, LC only
  - SFP2 Laser, 1310 nm, single mode, LC only
  - SFP2H SFP2 in Extended temperature version
  - SFP3 Long-haul laser, 1310 nm, single mode, LC only
  - SFP3H SFP3 in Extended temperature version
  - SFP4 Long-haul laser, 1550 nm, single mode, LC only

- SFP10A Laser WDM, Tx – 1310 nm, Rx – 1550 nm, single mode, single fiber, LC only (SF1)
- SFP10B Laser WDM, Tx – 1550 nm, Rx – 1310 nm, single mode, single fiber, LC only (SF2)
- SFP18A Laser WDM, Tx – 1310 nm, Rx – 1550 nm, single mode, single fiber, LC only
- SFP18B Laser WDM, Tx – 1550 nm, Rx – 1310 nm, single mode, single fiber, LC only
- SFP24 VSCSEL, 850 nm, multimode, LC only

## OP-108C, OP-106C

## Dual Fiber Multiplexer Modules for 4E1/4T1 and Ethernet

<b>2XSFP1</b>	Dual SFP1 modules
<b>2XSFP2</b>	Dual SFP2 modules
<b>2XSFP2H</b>	Dual SFP2H modules
<b>2XSFP3</b>	Dual SFP3 modules
<b>2XSFP3H</b>	Dual SFP3H modules
<b>2XSFP4</b>	Dual SFP4 modules
<b>2XSFP10A</b>	Dual SFP10A modules
<b>2XSFP10B</b>	Dual SFP10B modules
<b>2XSFP18A</b>	Dual SFP18A modules
<b>2XSFP18B</b>	Dual SFP18B modules
<b>2XSFP24</b>	Dual SFP24 modules
<b>4XSFP1</b>	Quad SFP1 modules
<b>4XSFP2</b>	Quad SFP2 modules
<b>4XSFP2H</b>	Quad SFP2H modules
<b>4XSFP3</b>	Quad SFP3 modules
<b>4XSFP3H</b>	Quad SFP3H modules
<b>4XSFP4</b>	Quad SFP4 modules
<b>4XSFP10A</b>	Quad SFP10A modules
<b>4XSFP10B</b>	Quad SFP10B modules
<b>4XSFP18A</b>	Quad SFP18A modules
<b>4XSFP18B</b>	Quad SFP18B modules
<b>4XSFP24</b>	Quad SFP24 modules

**Notes:** 1. It is strongly recommended to order this device with original RAD SFPs installed. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.

2. For single fiber applications, a device with SFP-10A interface is always used opposite a device with SFP-10B interface, and vice versa.

## OPTIONAL MODULE ACCESSORIES

**CBL-G703-8/RJ45/ST**

Adapter cable to split the 44-pin card connector to 8 E1 or T1 balanced RJ-45 connectors

**CBL-G703-8/RJ45/X**

Splitter cross-cable for splitting the 44-pin module connector to 8 E1 or T1 balanced RJ-45 connectors

**CBL-G703-8/COAX**

Splitter cable for splitting the 44-pin OP-108C module connector to 8 pairs of unbalanced BNC connectors

**CBL-G703-8/OPEN/2M**

Open-ended cable with DB-44 connector on the LRS-102 side for balanced E1 or T1 applications

All cables are 2m (6.6 ft) long.

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