METRObility
optical systems
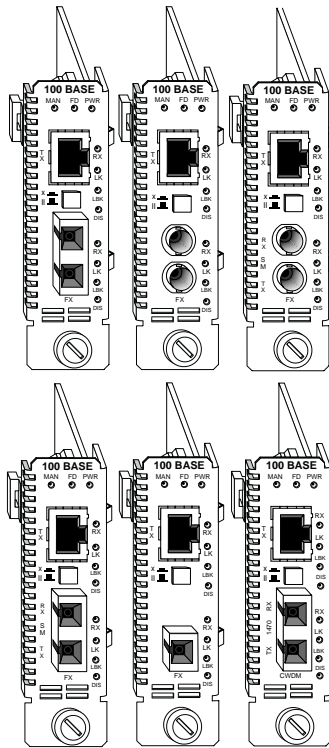
RADIANCE
ACCESS LINE CARDS

Installation & User Guide

Models: R231-13 / R231-14 / R231-15 / R231-16 / R231-17 / R231-1J /
R231-1X / R231-1Y / R231-47 / R231-49 / R231-51 / R231-53 /
R231-55 / R231-57 / R231-59 / R231-61

Radiance Access Line Cards

100Mbps Copper to Fiber:

R231-13 ____ RJ-45 to FX multimode SC
R231-14 ____ RJ-45 to FX singlemode SC with diagnostics
R231-15 ____ RJ-45 to FX multimode ST
R231-16 ____ RJ-45 to FX singlemode ST with diagnostics
R231-17 ____ RJ-45 to FX singlemode SC (40 km) with diagnostics
R231-1J ____ RJ-45 to FX singlemode SC (100 km) with diagnostics
R231-1X ____ RJ-45 to FX singlemode SC bidirectional wavelength division
multiplexed (BWDM) 1550/1310 nm
R231-1Y ____ RJ-45 to FX singlemode SC BWDM 1310/1550 nm
R231-47 ____ RJ-45 to FX singlemode SC (coarse wavelength division multi-
plexed, 80 km, 1470 nm)
R231-49 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1490 nm)
R231-51 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1510 nm)
R231-53 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1530 nm)
R231-55 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1550 nm)
R231-57 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1570 nm)
R231-59 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1590 nm)
R231-61 ____ RJ-45 to FX singlemode SC (CWDM, 80 km, 1610 nm)

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Radiance Access Line Cards Installation & User Guide

Overview

The Metrobility® Radiance 100Mbps Access Line Cards are the industry's first optical Ethernet devices that can reach across a wide area network (WAN) to communicate, test, and reconfigure a remote device, without reducing the available bandwidth to the customer site. This capability is accomplished through the employment of Metrobility's patented Radiance technology.

Radiance access line cards continually exchange information in a master/slave relationship through the fiber optic port. A card can serve as both a master and a slave. While the master card must be under local software control via an SNMP agent such as Metrobility's NetBeacon® or WebBeacon™ management software, the slave card can be located up to 100 km away.

Through NetBeacon, the network administrator can open a dialog with the remote device to reset its hardware switch settings, monitor its environmental parameters, or view port details and statistics. NetBeacon provides extensive real-time and historical graphs to display information such as the packet error rate and packet details. The administrator can also conduct tests on the remote link, without any bandwidth reduction, and isolate problems to prevent downtime. This end-to-end visibility and testing of the network simplifies network management and increases reliability.

The Radiance access line card offers several operational functions that are set by the user through hardware switches, software commands or remote management instructions. Among the features unique to the card are optical power transmit and receive levels; power, voltage, and temperature levels; loopback mode; bandwidth provisioning with adjustable burst size setting; and Far End Fault (FEF).

For updating or expanding an existing network, Metrobility offers 100 Mbps access line cards in various combinations, including fiber optic distance support up to 100 km. All cards are compatible with any Fast Ethernet device.

The Radiance access line card provides the following key features:

• Remote monitoring of the access line card's temperature and voltage levels.

• Remote monitoring of the laser's transmit and receive optical power on singlemode units with diagnostics.

• Complete Remote Monitoring (RMON) Group 1 Ethernet Statistics support.

• Remote link testing capability, or loopback, that does not affect available bandwidth.

- User-selectable maximum burst size and bandwidth allocation.

- Individual port enable/disable.

- Far End Fault functionality to detect a loss of the remote card's fiber port receiver.

- Duplex auto-negotiation on the copper port.

- Half and full duplex support on the copper port.

- Write protect to enable or disable a remote line card from controlling a locally managed card.

- Copper-to-fiber media conversion.

- Optional ITU-grid CWDM optics.

- Push-button MDI-II/MDI-X switch on the front panel to eliminate the need for crossover cables on the copper port.

- Fused power on each line card to protect the rest of the cards in the chassis from a short circuit. The power (PWR) LED on an affected card is not lit if its fuse is blown.

- Hot swap circuitry.

- Auto-polarity on the copper port.

- Compliance with applicable sections of IEEE 802.3.

- Data frame size transparency.

Installation Guide

**Follow the simple steps outlined in this section to install and start using the
Radiance access line cards.**

*NOTE: Electrostatic discharge precautions should be taken when handling any
line card. Proper grounding is recommended (i.e., wear a wrist strap).*

1 Unpack the Line Cards

Your order has been provided with the safest possible packaging, but
shipping damage does occasionally occur. Inspect your line card(s)
carefully. If you discover any shipping damage, notify your carrier and
follow their instructions for damage and claims. Save the original
shipping carton if return or storage of the cards is necessary.

2 Set the Switches
MDI-II to MDI-X Switch (twisted-pair ports only)

To eliminate the need for crossover cables, the access line card has an
MDI-II to MDI-X switch on its twisted-pair port. The switch is located
on the center of the front panel. Use this switch to configure the port for
either a straight-through or crossover connection.

• The parallel symbol (II) indicates a straight-through or parallel
  connection. The switch is up. *(default)*

• The cross symbol (X) indicates a crossover connection. The switch is
  down (depressed).

Use the following table as a guide.

A device that is wired straight through needs one crossover connection:	
If the cable is	the MDI-II to MDI-X switch setting should be
straight through	**X**
crossover	**II**

A device that is wired crossover needs a parallel connection:	
If the cable is	the MDI-II to MDI-X switch setting should be
straight through	**II**
crossover	**X**

DIP Switches

A bank of six DIP switches is located on the back of the card. Switches 1, 3, 5 and 6 allow you to select from several modes of operation. These switches are clearly marked on the card's circuit board. Refer to the table below for the proper setting of the DIP switches.[*]

When setting DIP switches, the UP position is when the lever of the DIP switch is pushed away from the circuit board. The DOWN position is when the lever is pushed toward to the board.

Default Switch Settings
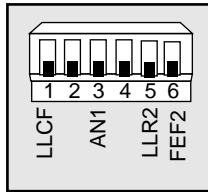
Switch Label	Position	Function
LLCF	UP	Link Loss Carry Forward is enabled on the card.
	DOWN (default)	Link Loss Carry Forward is disabled on the card.
AN1	UP	The copper port advertises full/half duplex capability to its link partner. Speed is not auto-negotiated and is always 100Mbps.
	DOWN (default)	Auto-negotiation is disabled. The copper port is set to full duplex.
LLR2	UP	Link Loss Return is enabled on the fiber optic port.
	DOWN (default)	Link Loss Return is disabled on the fiber optic port.
FEF2	UP	Far End Fault (FEF) is enabled. If FEF is enabled on a remote card and its fiber port loses its receive (RX) link, the card sends an unsolicited alarm to the locally managed card.
	DOWN (default)	Far End Fault is disabled on the fiber optic port.

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[*] DIP switches can also be managed via console commands or through Metrobility's NetBeacon or WebBeacon management software. Refer to the *Command Line Interface Reference Guide*, *NetBeacon Element Management Software Installation & User Guide* or *WebBeacon Management Software Installation & User Guide* for software management information.

Link Loss Carry Forward

Link Loss Carry Forward (LLCF) is provided as an aid in troubleshooting a remote connection. When LLCF is enabled, loss of the receive signal at the TX port prevents the FX port from transmitting an idle signal onto the cable. Conversely, if the FX port does not detect a receive signal, the TX port does not transmit an idle signal.

When LLCF is disabled (default), the card continually transmits idle signals on both ports.

Link Loss Return

Link Loss Return (LLR) is only applicable to the fiber optic port. When LLR is enabled, loss of the receive signal at the port disables its own transmit link.

When LLR is disabled (default), the fiber port continually transmits an idle signal.

Auto-Negotiation

Auto-negotiation (AN) is only supported on the copper port. Enable AN to establish a full duplex connection with another auto-negotiating device or to force the port to half duplex.

When AN is enabled, the copper port advertises 100Mbps and full/half duplex capability. The line card cannot auto-negotiate speed, which is set to 100Mbps.

When AN is disabled (default), the copper port is set to full duplex.

IMPORTANT: The duplex mode of the device connected to the fiber port must be the same as the copper port's connection.

Far End Fault

Far End Fault (FEF) is only applicable to the fiber optic port. FEF enables the locally managed access line card to detect a break in the remote card's fiber port receiver. The remote card sends an alarm to the locally managed card if the remote card has FEF enabled and it loses its receive (RX) fiber link. No alarms are issued if FEF is disabled.

3 *Install the Line Card*

The Radiance access line card offers the ease of plug-and-play installation and is hot-swappable. The card must be firmly secured to the chassis before network connections are made. Follow the simple steps outlined below to install your line card.

NOTE: Proper grounding is recommended (i.e., wear a wrist strap).

Card Guide

Slot for Management Card

IMPORTANT!
Tighten thumb screw to secure each card firmly to chassis before making network connections.

Thumb Screw

Card Guide

Blank Panel
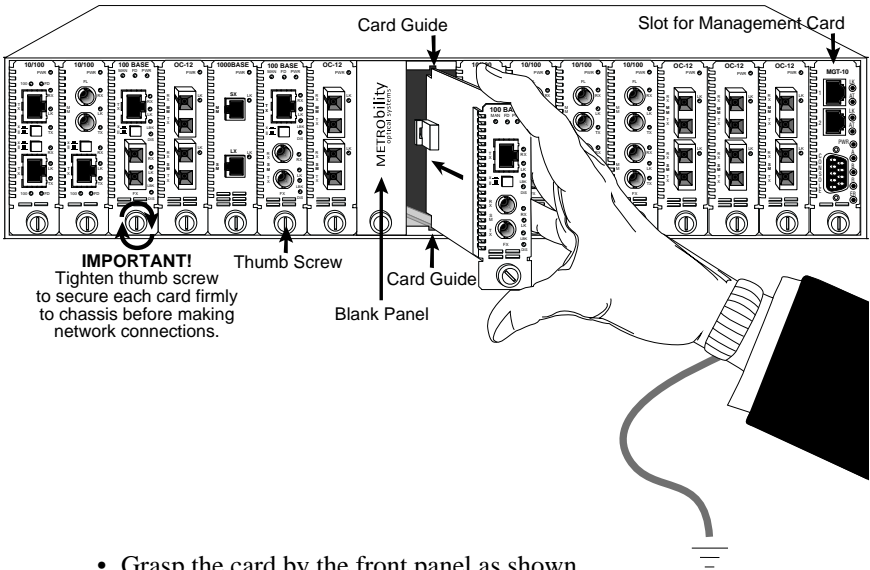
- Grasp the card by the front panel as shown.

- Insert the card into a slot in the chassis making sure that the top and bottom edges of the board are aligned with the top and bottom card guides in the chassis. Do not force the card into the chassis unnecessarily. It should slide in easily and evenly.

- Slide the card in until the top and bottom edges of the front panel are flush and even with the top and bottom edges of the chassis.

- To secure the line card to the chassis, turn the thumbscrew clockwise until it is snug. The card is now properly installed and ready for connection to the network.

- It is not necessary to install a management card in the remote chassis containing an access line card. Management of the remote access line card is provided through the local management card and the fiber link connecting the two access line cards.

4 Connect to the Network

To connect the card to the network, insert the cables into the appropriate connectors as illustrated below. Make sure the card is secured to the chassis before making network connections. Once power is applied to the unit, correct connectivity can be verified via the link (LK) LED.
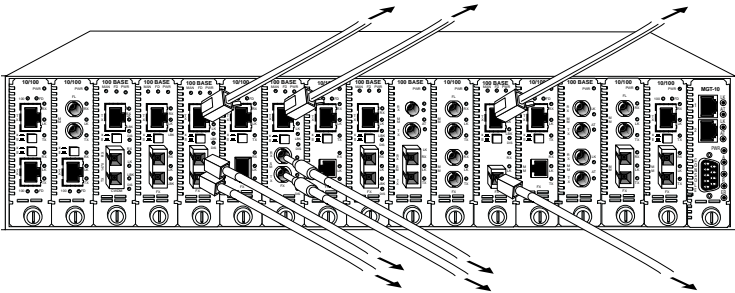
Twisted-Pair Interface

The twisted-pair port provides a shielded RJ-45 connector that supports a maximum segment length of 100 meters. Use only Category 5 cables.

Fiber Optic Interface

The fiber optic interface's receiver is located above its transmitter. When making network connections, make sure that the fiber receiver of the card connects to the transmitter of the connected device. Make sure that the receiver port of the connected device connects to the fiber transmitter of the line card.

The R231-13 and R231-15 fiber optic multimode interface supports a maximum segment length of 2 km for remote links.

The singlemode (SM) connector supports a maximum segment length of 20, 40, 60, or 100 km, depending on the model.

NOTE: To enable remote management, make sure the management (MAN) LED is ON after connecting the fiber cable to the remote access line card. If not, reset one of the access line cards via software or a power cycle of the card.

BWDM Interface
The bidirectional wavelength division multiplexed (BWDM) port provides one pair of singlemode SC connectors that supports a maximum segment length of 20 km. BWDM line cards must always be used in complementary pairs. That is, a -1X model must always be connected to a -1Y. The -1X cards are designed to transmit data at a wavelength of 1550 nm and receive at 1310 nm. Correspondingly, the -1Y cards transmit data at 1310 nm and receive at 1550 nm.

CWDM Interface
The coarse wavelength division multiplexed (CWDM) port provides one pair of singlemode SC connectors that supports a maximum segment length of 80 km. The port's wavelength (in nm) is printed on the front panel.

Network Connections
R231-13 RJ-45 to FX multimode SC _____ 100 m/2 km
R231-14 RJ-45 to FX singlemode SC_____ 100 m/20 km
R231-15 RJ-45 to FX multimode ST _____ 100 m/2 km
R231-16 RJ-45 to FX singlemode ST _____ 100 m/20 km
R231-17 RJ-45 to FX singlemode SC_____ 100 m/40 km
R231-1J RJ-45 to FX singlemode SC _____ 100 m/100 km
R231-1X RJ-45 to FX singlemode BWDM SC _____ 100 m/20 km
R231-1Y RJ-45 to FX singlemode BWDM SC _____ 100 m/20 km
R231-47 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-49 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-51 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-53 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-55 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-57 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-59 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km
R231-61 RJ-45 to FX singlemode CWDM SC _____ 100 m/80 km

User Guide

This section contains information about the operating features of the Radiance access line cards.

LED Indicators

The Radiance access line cards provide several LEDs on the front panel for the visible verification of unit status and proper functionality. These LEDs can help with troubleshooting and overall network diagnosis and management. There are separate receive (RX), link (LK), loopback (LBK) and disable (DIS) indicators for each port.

The following table describes the indication of each LED when lit.

LED Label	LED Name	Color (Status)	Indication
MAN	Managed	Green (steady)	Unit is receiving management packets.[*]
FD	Full Duplex	Green (steady)	Unit is operating at full duplex. When unlit, the unit is operating at half duplex.
PWR	Power	Green (steady)	Unit is powered ON.
RX	Receive	Green (blinking)	Port is receiving data.
LK	Link	Green (steady)	Port has a valid link.
LBK	Loopback	Green (steady)	Port is in loopback mode.
DIS	Disable	Green (steady)	Port has been disabled by software.

*NOTE: A management card must be installed in the chassis to enable remote management.

Factory Settings

The Radiance access line card provides several user-selectable options to meet your networking needs. The card's default settings are listed below.

Default Hardware Switch Settings

MDI-II/MDI-X .... Parallel (UP)

The following switches can be overridden through software commands.[*]
Link Loss Carry Forward .... Disabled (DOWN)
Auto-Negotiation .... Disabled (DOWN)
Link Loss Return .... Disabled (DOWN)
Far End Fault .... Disabled (DOWN)

* Refer to the **Command Line Interface Reference Guide**, **NetBeacon Element Management Software Installation & User Guide** or **WebBeacon Management Software Installation & User Guide** for software management information.

Default Software Settings

The following settings can only be changed via software commands.[*]

Bandwidth Allocation 100Mbps

Maximum Burst Size 16K

Loopback Mode .... Disabled

Write Protect ....ReadWrite

Port Enable/Disable ....Enabled

Software Settings

Five operational functions on the access line card can be modified only through software commands,[*] either locally or remotely. Remote management communications only occur on the fiber optic segment.

Bandwidth Allocation

This option allows you to specify the amount of incoming and outgoing data that can be carried over the network. The receive (RX) and transmit (TX) bandwidths are set through the copper port. The bandwidth can be set in 1Mbps increments from 1 to 100. Set both the TX and RX bandwidths to the same rate if you want the input and output bandwidth to be equal. Frames that overrun the allocated bandwidth are blocked, then dropped.

When you set the RX bandwidth, the allocation is applied to traffic received on the copper port. When you set the TX bandwidth, the allocation is applied to traffic transmitted on the copper port.

In addition to the bandwidth allocation, you can maximize performance by choosing the maximum burst size in each direction.

Maximum Burst Size

To accommodate for the fluctuations that commonly occur in network traffic, the Radiance access line card provides an option to specify the maximum burst size permitted in each direction. This allows your customers to have full access to their channel bandwidth until the burst threshold is reached. At that point the channel bandwidth is restricted for a period of time, depending on the bandwidth setting, until more data frames can be accepted. This arrangement benefits the customer who can take advantage of the channel's full bandwidth, as long as the data burst size can be quantified and the burst is followed by a period of inactivity.

The maximum burst size can be adjusted to one of the following settings:
    16, 32, 64, 128 or 256 kilobytes.

Loopback Mode

You can enable loopback on either port on the locally managed card or on the remote fiber port. The loopback function allows a port to return its incoming data back to the sender, while continuing to receive and transmit management packets. The management packets are not looped back to the sender—only the data packets are returned.

Loopback can only be applied to one port at a time (i.e., both ports on a card can never be in loopback mode simultaneously). This is because when you enable loopback on a port, the other port on the card is automatically disabled (no link). Because you would lose the ability to manage the remote access line card, loopback cannot be applied to the remote copper port. If a port is in loopback mode, its LBK LED will be lit.

When loopback is enabled on a port, its incoming data is transmitted through the entire circuitry of the board, not just the port in loopback mode. This allows the entire circuit to be tested. RMON statistics are incremented on both ports—even though the physical interface on the port without loopback is neither transmitting nor receiving traffic.

A full power cycle of the card takes it out of the loopback mode. Removing the card and reinserting it also takes it out of loopback mode because the loopback setting is not saved in the software's persistence data file. Loopback is the only software switch setting that is not saved in this file.

Typically, the remote card's fiber port is placed in loopback mode to test the segment by using any standard packet-generating test equipment.

Write Protect

To prevent the remote access line card from controlling the locally managed card, set Write Protect to ReadOnly. Set Write Protect to ReadWrite if you want the remote card to be able to override software settings on the locally managed access line card.

Port Enable/Disable

Either port on a managed access line card can be enabled or disabled independently. When a port is disabled, its DIS LED is lit.

Disabling a port stops the data flow to and from that port. Although data is neither sent nor received, the disabled port continues to accept, process and

transmit management packets. However, if LLCF is enabled and the opposite port has no link, management packets will not be transmitted.

Remote Management Statistics

Through SNMP management, NetBeacon or WebBeacon, you can view Remote Monitoring (RMON) and Ethernet statistics for the Radiance access line card.

RMON Statistics

Each port on the card supports the complete RMON Group 1 statistics outlined in RFC 1757 and listed below.

EtherStatsOctets	EtherStatsPkts
EtherStatsBroadcastPkts	EtherStatsMulticastPkts
EtherStatsCRCAlignErrors	EtherStatsUndersizePkts
EtherStatsFragments	EtherStatsJabbers
EtherStatsCollisions	EtherStatsPkts64Octets
EtherStatsPkts65to127Octets	EtherStatsPkts128to255Octets
EtherStatsPkts256to511Octets	EtherStatsPkts512to1023Octets
EtherStatsPkts1024to1518Octets	EtherStatsOversizePkts
Dropped Events	

Ethernet Statistics

For the card's fiber port, you can obtain the Ethernet statistics listed in the table below. For a copper port, only the Port Link Status is reported.

Statistic Name	Description
Port Link Status	Indicates whether or not the port has a valid link.
Link Transition Counter	Number of times link was lost since power-up. The value is 0 after the card is reset, even without a link.
Management Counter	Number of management packets received.
Discovery Count	Number of remote devices discovered on the network.

Singlemode Fiber Optic Power Monitors

Through software*, you can read the input and output power levels of the singlemode fiber optic port on the access line cards with diagnostic capabilities.

Input Power Level

The accuracy of the input power monitor is ±1 dBm from -28 dBm to -12 dBm. The accuracy is ±2 dBm from -31 dBm to -29 dBm. The monitor is unresponsive below -31dBm. If there are no cables connected to the fiber port, the software may display a reading of -40 dBm. The access line card peaks at -12 dBm and reaches saturation at -7 dBm.

The singlemode long haul (R231-17) and extended long haul (R231-1J) ports are operational down to -34 dBm, which is too low for the monitor to measure. If the input power level is between -34 dBm and -29 dBm, a valid link will be established, however, the light level displayed by the software will show a reading of -40 dBm. This reading is not a failure indication; it simply means the level is beyond the range of the power monitor.

Input Power Monitor

Model #	Operational Range	Accurate Monitoring Range	Trap Thresholds	Failure Reading
R231-14 R231-16	-29 to -7dBm	-28 to -12dBm	-28dBm and -7dBm	-31dBm
R231-17 R231-1J	-34 to -7dBm	-31 to-12dBm	-31dBm and -7dBm	-40dBm

Output Power Level

The accuracy of the output power monitor is ±3dBm. Failure readings indicate that the card is non-functional and must be replaced. If there are no cables connected to the fiber port, the software may display readings that indicate failure.

Output Power Monitor

| Model #	Operational Range	Typical Reading	Trap Thresholds	Failure Reading
R231-14 R231-16	-15 to -8dBm	-11dBm	-15dBm and -7dBm	-18dBm or -3dBm
R231-17 R231-1J	-5 to 0dBm	-3dBm	-6dBm and 0dBm	-9dBm or +3dBm

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* Refer to the **Command Line Interface Reference Guide**, **NetBeacon Element Management Software Installation & User Guide** or **WebBeacon Management Software Installation & User Guide** for software management information.

Voltage and Temperature Monitors

The access line card includes four environmental sensors that provide real-time monitoring of the board's temperature and each of its three voltage supplies (1.8, 3.3, and 5.0 volts). To inform the network administrator of a potential problem, a trap can be enabled through software to send an alarm if the reading goes above or below the recommended limits. The accuracy of the temperature sensor is ±3° C. The accuracy of the voltage sensors is ±2%.

Topology Solutions
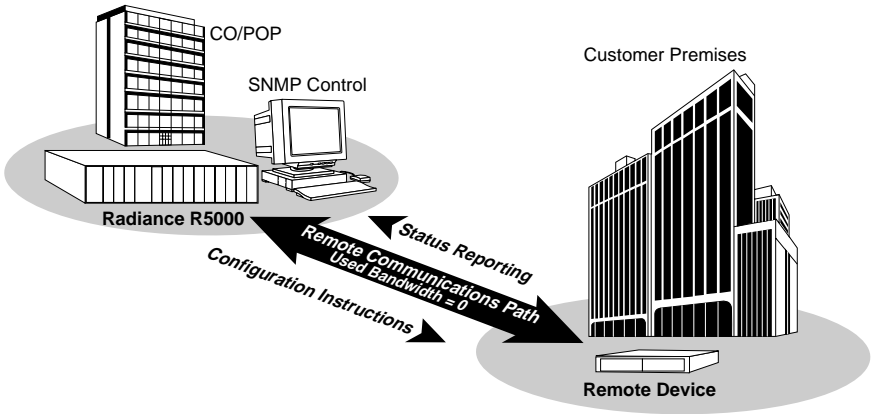
Technical Specifications
Data Rate
Data Rate _____ 100Mbps half duplex, 200Mbps full duplex
Bit Delay _____ 66 bits (fiber to copper)
_____ 51 bits (copper to fiber)

Network Connections

Singlemode F/O Interface (R231-14, R231-16)
Connector _____ ST or SC
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -29 dBm minimum
Output Power _____ -15 dBm to -8 dBm
Supported Link Length _____ up to 20 km full duplex
Cable Type _____ 9/125 μm F/O

Singlemode F/O Interface — long haul distance support (R231-17)
Connector _____ SC
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -34 dBm minimum
Output Power _____ -5 dBm to 0 dBm
Supported Link Length _____ up to 40 km full duplex
Cable Type _____ 9/125 μm SM F/O

Singlemode F/O Interface — extended long haul distance support (R231-1J)
Connector _____ SC
Wavelength _____ 1550 nm
RX Input Sensitivity _____ -34 dBm minimum
Output Power _____ -5 dBm to 0 dBm
Supported Link Length _____ up to 100 km full duplex
Cable Type _____ 9/125 μm SM F/O

Singlemode BWDM F/O Interface (R231-1X, R231-1Y)
Connector _____ SC
Supported Link Length _____ up to 20 km full duplex
Cable Type _____ 9/125 μm F/O
RX Input Sensitivity _____ -32 dBm minimum
Output Power _____ -15 dBm to -8 dBm (9/125 μm)
(R231-1X)
    TX Wavelength _____ 1550 nm
    RX Wavelength _____ 1310 nm
(R231-1Y)
    TX Wavelength _____ 1310 nm
    RX Wavelength _____ 1550 nm

Singlemode CWDM F/O Interface (R231-47, -49, -51, -53, -55, -57, -59, -61)

Connector _____ SC
Wavelength _____ (see tables below)
RX Input Sensitivity _____ -34 dBm minimum
Output Power _____ -5 to 0 dBm
Supported Link Length _____ up to 80 km full duplex
Cable Type _____ 9/125 μm F/O

Model Number	Wavelength		Model Number	Wavelength
R231-47	1470 nm		R231-55	1550 nm
R231-49	1490 nm		R231-57	1570 nm
R231-51	1510 nm		R231-59	1590 nm
R231-53	1530 nm		R231-61	1610 nm

Multimode F/O Interface (R231-13, R231-15)

Connector _____ ST or SC
Wavelength _____ 1310 nm
RX Input Sensitivity _____ -31 dBm minimum
Output Power _____ -23.5 dBm to -14 dBm (50/125 μm)
_____ -20 dBm to -14 dBm (62.5/125 μm)
Supported Link Length _____ up to 2 km full duplex
Cable Type _____ 50/125 or 62.5/125 μm F/O

Twisted-Pair Interface

Connector _____ Shielded RJ-45, 8-pin jack
Impedance_____ 100 Ohms nominal
Signal Level Output (differential) _____.95 to 1.05 V
Signal Level Input _____ 350 mV minimum
Supported Link Length _____ 100 m
Cable Type _____ Category 5 UTP
(For NEBS Level III and EN55024:1998 compliance, use only
Category 5 STP cables.)

Power

Input _____5 V @1.0 A, 5 W average

Environmental

Operating Temperature _____ 0° to 55° C
Storage Temperature _____ -30° to 70° C
Operating Humidity _____ 5% to 95% non-condensing
Weight _____ 5 oz (0.14 kg)

Product Safety, EMC and Compliance Statements

This equipment complies with the following requirements:

- UL
- CSA
- EN60950 (safety CE)
- FCC Part 15, Class A
- EN55022 Class A (emissions CE)
- EN55024: 1998 (immunity)
- DOC Class A (emissions)
- Class 1 Laser Product
- NEBS Level 3
- CB

This product shall be handled, stored and disposed of in accordance with all governing and applicable safety and environmental regulatory agency requirements.

The following *FCC* and *Industry Canada* compliance information is applicable to North American customers only.

USA FCC Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution: Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canadian Radio Frequency Interference Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

Warranty and Servicing

Three-Year Warranty for the Radiance Access Line Card

Metrobility Optical Systems, Inc. warrants that every Radiance access line card will be free from defects in material and workmanship for a period of THREE YEARS from the date of Metrobility shipment. This warranty covers the original user only and is not transferable. Should the unit fail at any time during this warranty period, Metrobility will, at its sole discretion, replace, repair, or refund the purchase price of the product. This warranty is limited to defects in workmanship and materials and does not cover damage from accident, acts of God, neglect, contamination, misuse or abnormal conditions of operation or handling, including overvoltage failures caused by use outside of the product's specified rating, or normal wear and tear of mechanical components.

To establish original ownership and provide date of purchase, complete and return the registration card or register the product online at www.metrobility.com. If product was not purchased directly from Metrobility, please provide source, invoice number and date of purchase.

To return a defective product for warranty coverage, contact Metrobility Customer Service for a return materials authorization (RMA) number. Send the defective product postage and insurance prepaid to the address provided to you by the Metrobility Technical Support Representative. Failure to properly protect the product during shipping may void this warranty. The Metrobility RMA number must be clearly on the outside of the carton to ensure its acceptance.

Metrobility will pay return transportation for product repaired or replaced in-warranty. Before making any repair not covered by the warranty, Metrobility will estimate cost and obtain authorization, then invoice for repair and return transportation. Metrobility reserves the right to charge for all testing and shipping costs incurred, if test results determine that the unit is without defect.

This warranty constitutes the buyer's sole remedy. No other warranties, such as fitness for a particular purpose, are expressed or implied. Under no circumstances will Metrobility be liable for any damages incurred by the use of this product including, but not limited to, lost profits, lost savings, and incidental or consequential damages arising from the use of, or inability to use, this product. Authorized resellers are not authorized to extend any other warranty on Metrobility's behalf.

Product Manuals

The most recent version of this manual is available online at
http://www.metrobility.com/support/manuals.htm

Product Registration

To register your product, go to
http://www.metrobility.com/support/registration.asp
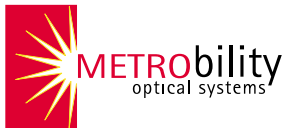
25 Manchester Street, Merrimack, NH 03054 USA
tel: 1.603.880.1833 • fax: 1.603.594.2887
www.metrobility.com