

# RADIANCE CWDM SYSTEM



*Installation & User Guide*

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# ***Radiance Coarse Wavelength Division Multiplexing (CWDM) System***

## **Chassis:**

R4000-02 \_\_\_\_\_ 2-slot 1U rack-mount chassis for CWDM/OADM modules

## **CWDM Multiplexer/Demultiplexer Modules:**

- R416-A4-A \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion, 1550, 1570, 1590, 1610 nm
- R416-A4-B \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion, 1470, 1490, 1510, 1530 nm
- R416-A4-C \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion, 1390, 1410, 1430, 1450 nm
- R416-A4-D \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion, 1310, 1330, 1350, 1370 nm
- R416-B4 \_\_\_\_\_ 8-channel CWDM mux/demux module, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm
- R416-A4-AE \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion; 1550, 1570, 1590, 1610 nm; extended temperature range
- R416-A4-BE \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion; 1470, 1490, 1510, 1530 nm; extended temperature range
- R416-A4-CE \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion; 1390, 1410, 1430, 1450 nm; extended temperature range
- R416-A4-DE \_\_\_\_\_ 4-channel CWDM mux/demux module w/expansion; 1310, 1330, 1350, 1370 nm; extended temperature range

## **Optical Add/Drop Multiplexing (OADM) Drop/Pass Modules:**

- R426-D4-31 \_\_\_\_\_ 1-channel OADM drop/pass module, 1310 nm
- R426-D4-33 \_\_\_\_\_ 1-channel OADM drop/pass module, 1330 nm
- R426-D4-35 \_\_\_\_\_ 1-channel OADM drop/pass module, 1350 nm
- R426-D4-37 \_\_\_\_\_ 1-channel OADM drop/pass module, 1370 nm
- R426-D4-39 \_\_\_\_\_ 1-channel OADM drop/pass module, 1390 nm
- R426-D4-41 \_\_\_\_\_ 1-channel OADM drop/pass module, 1410 nm
- R426-D4-43 \_\_\_\_\_ 1-channel OADM drop/pass module, 1430 nm
- R426-D4-45 \_\_\_\_\_ 1-channel OADM drop/pass module, 1450 nm
- R426-D4-47 \_\_\_\_\_ 1-channel OADM drop/pass module, 1470 nm
- R426-D4-49 \_\_\_\_\_ 1-channel OADM drop/pass module, 1490 nm
- R426-D4-51 \_\_\_\_\_ 1-channel OADM drop/pass module, 1510 nm
- R426-D4-53 \_\_\_\_\_ 1-channel OADM drop/pass module, 1530 nm
- R426-D4-55 \_\_\_\_\_ 1-channel OADM drop/pass module, 1550 nm
- R426-D4-57 \_\_\_\_\_ 1-channel OADM drop/pass module, 1570 nm
- R426-D4-59 \_\_\_\_\_ 1-channel OADM drop/pass module, 1590 nm
- R426-D4-61 \_\_\_\_\_ 1-channel OADM drop/pass module, 1610 nm

**OADM Drop/Pass Modules (continued):**

R426-D4-47E \_\_\_ 1-channel OADM drop/pass module, 1470 nm, extended temp  
R426-D4-49E \_\_\_ 1-channel OADM drop/pass module, 1490 nm, extended temp  
R426-D4-51E \_\_\_ 1-channel OADM drop/pass module, 1510 nm, extended temp  
R426-D4-53E \_\_\_ 1-channel OADM drop/pass module, 1530 nm, extended temp  
R426-D4-55E \_\_\_ 1-channel OADM drop/pass module, 1550 nm, extended temp  
R426-D4-57E \_\_\_ 1-channel OADM drop/pass module, 1570 nm, extended temp  
R426-D4-59E \_\_\_ 1-channel OADM drop/pass module, 1590 nm, extended temp  
R426-D4-61E \_\_\_ 1-channel OADM drop/pass module, 1610 nm, extended temp

**OADM Drop/Insert Modules:**

R436-J4-31 \_\_\_ 1-channel OADM drop/insert module, 1310 nm  
R436-J4-33 \_\_\_ 1-channel OADM drop/insert module, 1330 nm  
R436-J4-35 \_\_\_ 1-channel OADM drop/insert module, 1350 nm  
R436-J4-37 \_\_\_ 1-channel OADM drop/insert module, 1370 nm  
R436-J4-39 \_\_\_ 1-channel OADM drop/insert module, 1390 nm  
R436-J4-41 \_\_\_ 1-channel OADM drop/insert module, 1410 nm  
R436-J4-43 \_\_\_ 1-channel OADM drop/insert module, 1430 nm  
R436-J4-45 \_\_\_ 1-channel OADM drop/insert module, 1450 nm  
R436-J4-47 \_\_\_ 1-channel OADM drop/insert module, 1470 nm  
R436-J4-49 \_\_\_ 1-channel OADM drop/insert module, 1490 nm  
R436-J4-51 \_\_\_ 1-channel OADM drop/insert module, 1510 nm  
R436-J4-53 \_\_\_ 1-channel OADM drop/insert module, 1530 nm  
R436-J4-55 \_\_\_ 1-channel OADM drop/insert module, 1550 nm  
R436-J4-57 \_\_\_ 1-channel OADM drop/insert module, 1570 nm  
R436-J4-59 \_\_\_ 1-channel OADM drop/insert module, 1590 nm  
R436-J4-61 \_\_\_ 1-channel OADM drop/insert module, 1610 nm  
R436-J4-47E \_\_\_ 1-channel OADM drop/insert module, 1470 nm, extended temp  
R436-J4-49E \_\_\_ 1-channel OADM drop/insert module, 1490 nm, extended temp  
R436-J4-51E \_\_\_ 1-channel OADM drop/insert module, 1510 nm, extended temp  
R436-J4-53E \_\_\_ 1-channel OADM drop/insert module, 1530 nm, extended temp  
R436-J4-55E \_\_\_ 1-channel OADM drop/insert module, 1550 nm, extended temp  
R436-J4-57E \_\_\_ 1-channel OADM drop/insert module, 1570 nm, extended temp  
R436-J4-59E \_\_\_ 1-channel OADM drop/insert module, 1590 nm, extended temp  
R436-J4-61E \_\_\_ 1-channel OADM drop/insert module, 1610 nm, extended temp

**Accessories:**

R1000-RM \_\_\_\_\_ 21-inch rackmounting hardware  
4000-CA \_\_\_\_\_ four 1-meter LC-to-SC singlemode fiber cables

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# Overview

The Radiance Coarse Wavelength Division Multiplexing (CWDM) System is a passive, optical solution for increasing the flexibility and capacity of existing fiber lines in high-speed networks. By adding more channels onto available fibers, the Radiance CWDM System enables greater versatility for data communications in ring, point-to-point, and multipoint topologies for both enterprise and metro applications.

Metrobility's CWDM System increases fiber capacity by placing widely spaced, separate wavelengths—between 1310 and 1610 nm—from multiple ports onto a singlemode fiber pair on the network. Using the expansion port included on some modules, the CWDM System can be configured to deliver up to 16 different channels, each carrying 1 Gbps of bandwidth.

All CWDM System components are passive and require no power supplies. They include the two-slot R4000 chassis and a set of mux/demux, drop/pass, and drop/insert modules with color-coded port connectors. Any two modules may be installed in the R4000 chassis. The 1U high R4000 can be installed anywhere from the central office to the customer premise.

The CWDM mux/demux takes 4 or 8 different wavelength channels and combines (multiplexes) them onto one common fiber cable for transmission to the network. It also separates (demultiplexes) the channels it receives from the network and sends each channel to a different device. Multiple modules may be chained through the expansion port on the four-channel modules. This increases flexibility and enables growth for evolving networks.

Optical Add/Drop Multiplexing (OADM) drop/pass and drop/insert modules provide the ability to terminate (drop) one CWDM channel from the network fiber, while allowing all other channels to continue (pass) to other nodes. Similarly, the drop/insert module removes an individual channel from the network fiber, however, it also provides the ability to add (insert) that same channel back onto the network fiber. The drop/insert module supports two paths (east and west) for dropping and adding, so that network viability is maintained in a ring topology, even if a break occurs in the ring.

All CWDM/OADM modules interface with Metrobility products that support CWDM transceivers.

Through Metrobility's NetBeacon® management software, you can enter hardware and configuration information about the R4000 chassis and its modules. This information is stored in a database which can be viewed and

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modified in a user-friendly format. The chassis and modules appear as an inventory device with matching colored ports.

## ***Product Features***

The Radiance CWDM System provides the following key features:

- ITU G.694.2 CWDM wavelength grid with 20 nm spacing.
- Support for up to 16 different channels, each carrying 1 Gbps of bandwidth.
- Expansion port on all 4-channel mux/demux modules.
- Color-coded port labels for easy identification.
- SC connectors.
- Transparency to data frame sizes, accommodating multiple protocols.
- Bidirectional capability on all channels using dual fiber.
- Optional 21-inch rackmounting hardware available.
- Support from Metrobility's NetBeacon management element software as an inventory device.
- Extended operating temperature range (-40° to 80°C) available on some modules.

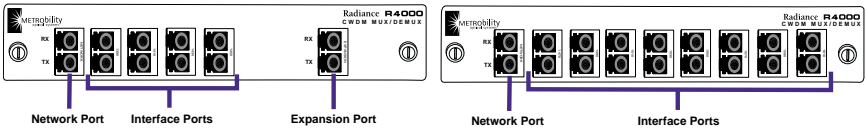
# System Description

This section describes the components of the Radiance CWDM System.

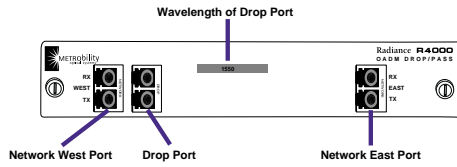
## CWDM Components

The Radiance CWDM System is comprised of three basic components.

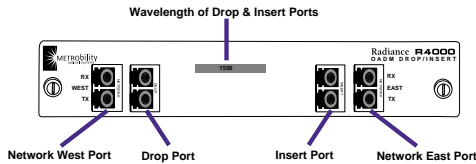
- The multiplexer/demultiplexer (mux/demux) combines four or eight different channels onto a common network fiber. Data received from the network fiber is separated back into the individual channels and returned to the local ports.



- The drop/pass module removes one channel from the eastbound network fiber and delivers it to a local port. The remaining channels are passed straight through to other nodes on the network.



- The drop/insert module terminates one channel from the network fiber in one direction and delivers it to a local port. It also allows a second local port to add the same channel back onto the network fiber in the opposite direction.



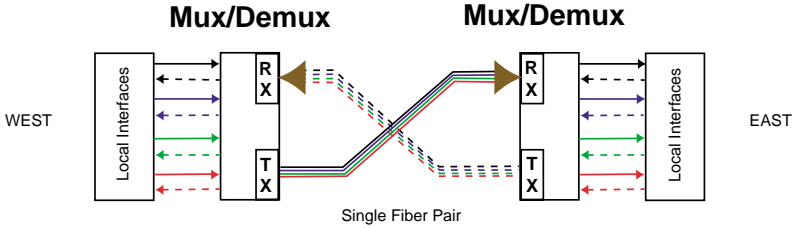
The following examples use four channels, however, the principles are applicable to all. The only exception is the expansion feature, which only applies to the four-channel mux/demux. A dual fiber configuration is assumed.

CWDM applications are described in terms of an east-west connection. Different colors represent individual channels. Westbound traffic is represented by dashed lines; eastbound traffic is shown with solid lines.



## Mux/Demux

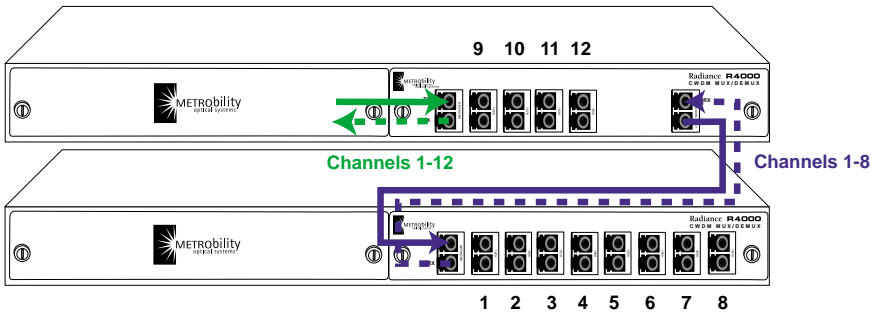
The mux/demux provides four interface ports, each mapped to a different wavelength. The mux/demux combines the channels and transmits them on a single outbound (TX) fiber. Simultaneously, the mux/demux receives the same four channels from a single inbound (RX) fiber, separates them into individual wavelengths, and delivers each to the appropriate local interface. This process quadruples the capacity of the existing network fiber cable.



## Expansion Port

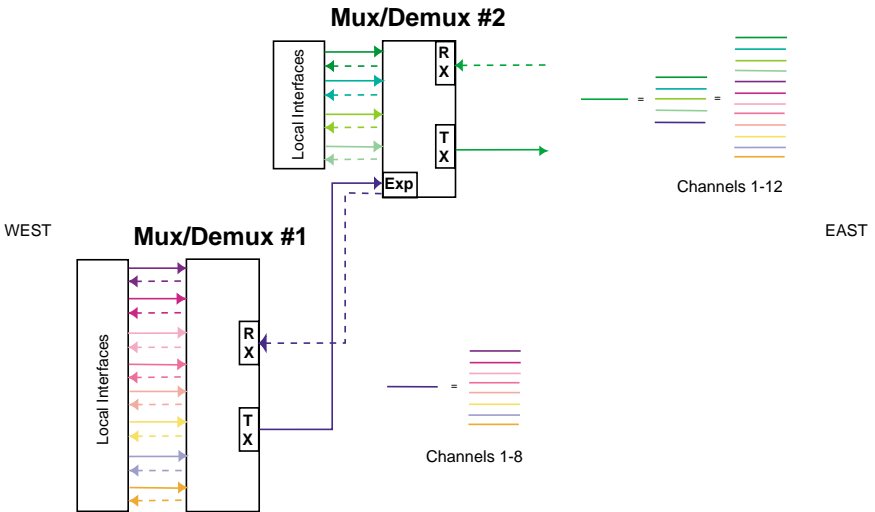
The four-channel mux/demux can be configured to support additional channels through the expansion port. By cascading the modules in series, you can increase the total number of available network channels, up to 16. The channels connecting to the expansion port must differ from those on the mux/demux to which they are being cascaded.

In the following illustration, a four-channel module is connected to an eight-channel module to transport 12 separate channels, each with a different wavelength.





The next diagram illustrates how the channels for the example above are cascaded through the expansion port. Mux/Demux #1 is transporting 8 different channels, and Mux/Demux #2 is transporting 12 channels on its network fiber.

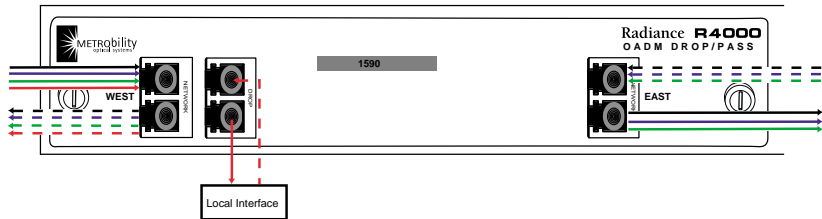


The Radiance CWDM System supports four 4-channel mux/demux modules and one 8-channel mux/demux. The interface ports on the mux/demux connect to any Metrobility product that supports CWDM transceivers. The network port on the mux/demux connects to another mux/demux for a point-point application, or to a drop/insert or drop/pass module for other applications.

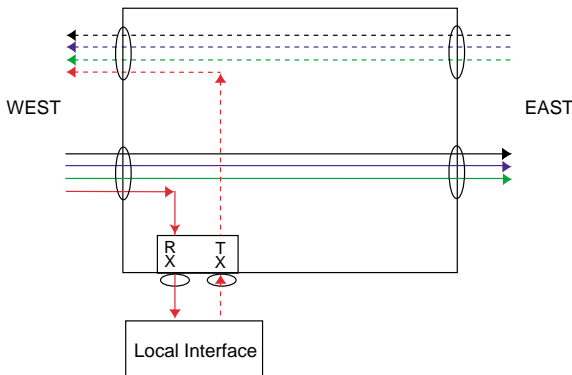
## Drop/Pass Module

The drop/pass module removes one wavelength-specific channel from the eastbound fiber and allows the remaining channels to pass straight through to other nodes along the network. When the drop/pass module drops the channel from the network, it sends the data to a local interface. The local interface sends the same channel back to the drop/pass module for transmission in the westbound direction, thus completing the point-to-point connection between the local interface and another device located in the west. That other device may be a mux/demux, drop/pass, or drop/insert module.

There are 16 drop/pass modules, each set to drop one of the 16 wavelength-specific channels supported by the Radiance CWDM System. Dropped channels interface with any Metrobility product that supports CWDM transceivers.



### Drop and Pass



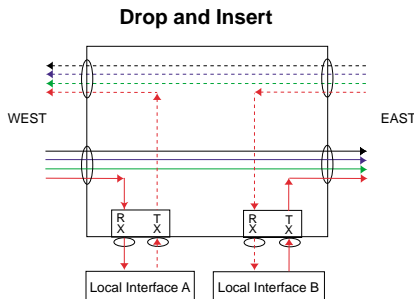
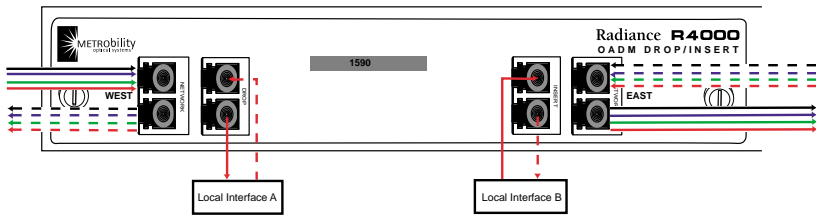
## Drop/Insert Module

The drop/insert module provides two local interface ports. One port removes a wavelength-specific channel from the network fiber in one direction, and the other port adds that same channel back onto the fiber in the opposite direction. Because the drop/insert module supports two separate pathways going in opposite directions, network viability in a ring topology is ensured even if there is a break in the network.

On the west side, the drop/insert module removes a wavelength-specific channel from the eastbound fiber and sends it to Local Interface A. To complete the westbound connection, the drop/insert module receives the same channel from Local Interface A and inserts it onto the westbound fiber.

The same happens on the east side, except in the opposite direction. The drop/insert module removes the channel from the westbound fiber and sends it to Local Interface B. To complete the eastbound connection, the drop/insert module receives the same channel from Local Interface B and inserts it onto the eastbound fiber.

The drop and insert completes the point-to-point connections between the two local interfaces and two other devices located in the east and west. The other devices may be a mux/demux, drop/pass, or drop/insert module.



# Installation Guide

Follow the steps outlined in this section to install and start using the Radiance CWDM System.

## 1 **Unpack the System**

Check that the following components have been included:

- R4000 chassis with pre-installed CWDM/OADM module(s)
- 19-inch rackmounting hardware (2 brackets, 8 screws)
- CD-ROM

The following items are available separately:

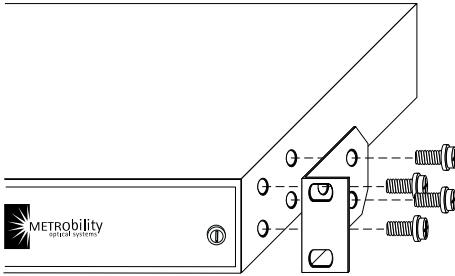
- NetBeacon software
- CWDM mux/demux module
- OADM drop/pass module
- OADM drop/insert module
- 21-inch rackmounting hardware

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

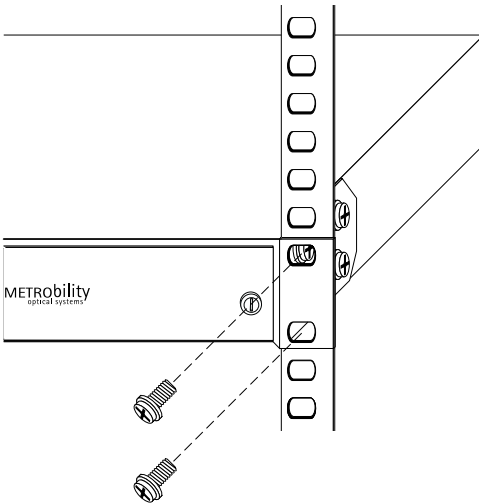
## 2 Mount the Chassis

The R4000 is intended for use in an office or industrial environment with the chassis installed in a standard equipment rack.

Use the 6-32 self-tapping screws included with the R4000 to secure the mounting brackets to the side panel.



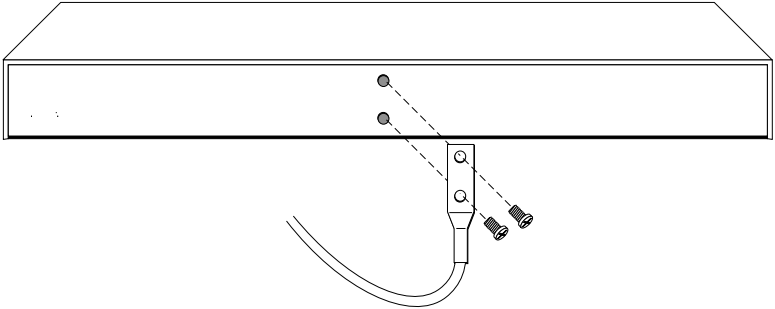
You will need four (4) additional screws (not included with the R4000) to mount the chassis into the rack.



Make sure that the mounting of the R4000 does not create a hazardous condition due to an unbalanced load. Consider the overall loading before installing any equipment onto the rack. Reliable grounding must be maintained in the rack system. The R4000 is intended to be connected to earth ground.

### 3 **Attach the Grounding Lug**

On the back panel, the R4000 provides two vertical grounding points where a grounding lug may be installed. Use a Panduit® copper, standard barrel, two-hole lug (part number LCD8-10A-L) or its equivalent. Use two 10-32 screws to fasten the lug to the chassis. Use a No. 8 AWG copper wire to connect the lug to the grounding point at your site.

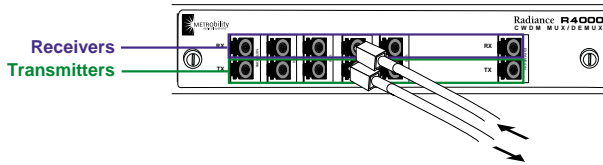


### 4 **Connect to the Network**

To connect to the network, simply insert singlemode cables from your system equipment to the appropriate SC connectors on the CWDM mux/demux module or OADM module. The modules' color codes are described below.

Color	Wavelength
brown	1610 nm
red	1590 nm
orange	1570 nm
yellow	1550 nm
green	1530 nm
ice blue	1510 nm
majestic purple	1490 nm
40% black	1470 nm

Color	Wavelength
light violet	1450 nm
chalk	1430 nm
sand	1410 nm
mint green	1390 nm
moon green	1370 nm
turquoise	1350 nm
powder blue	1330 nm
red-brown	1310 nm



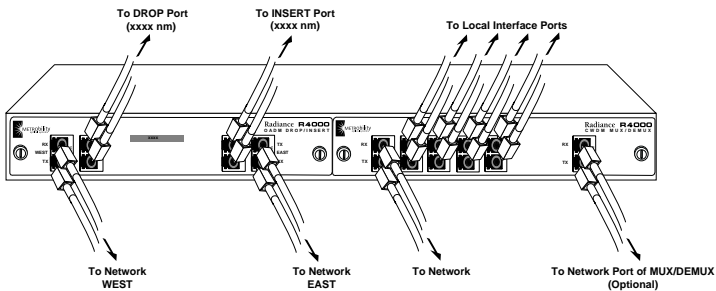
Port receivers (RX) are located above their corresponding transmitters (TX). For proper connectivity, make sure that the module's receiver connects to the transmitter on the system device, and that the receiver on the system device connects to the Radiance module's transmitter.

There are three types of ports on the CWDM/OADM modules.

*Interface Port* Each interface port connects to a local device on a specific channel. **The port's channel wavelength must match that of the connected device.**

*Network Port* The modules provide one or two network ports through which multiple channels are carried bidirectionally on a fiber pair. This is the network backbone.

*Expansion Port* Only available on the four-channel mux/demuxes, this port is used to increase the number of available channels carried on the network cable.



## Connecting to the Local Interfaces

The interface ports on the CWDM/OADM modules connect to a local device such as a Radiance R5000 chassis with R153 GigE line cards. The interface ports' wavelengths are labeled on the front panel. CWDM/OADM modules interface with any Metrobility product that supports CWDM transceivers. **Make sure the wavelength on the module is identical to that of the connected port.** On the OADM modules, channels are dropped from eastbound traffic and inserted onto the westbound traffic. Refer to [Drop/Pass Module](#) and [Drop/Insert Module](#) for more information.

## Connecting to the Network

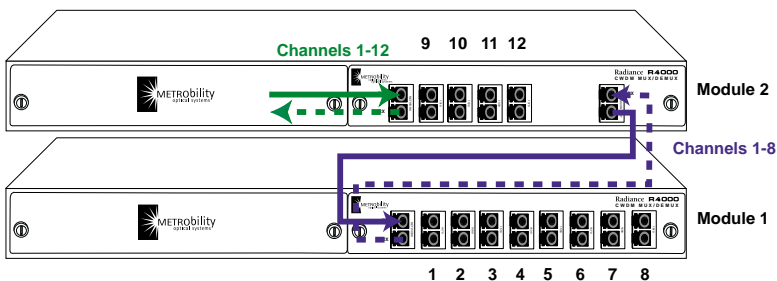
Use the Network Port for backbone connectivity. The mux/demux modules have one network port, which alternatively may be connected to an expansion port (see below).

The OADM modules provide two network ports for connectivity to the east and west. Connect the singlemode fiber from the west backbone to the module's WEST Network Port, and connect the singlemode cable from the east backbone to the module's EAST Network Port.

When making network connections, Metrobility recommends low water peak ITU G.652.C-compliant singlemode fiber, such as Corning® SMF-28e™, which ensures low attenuation at the water peak (1383 nm).

## Adding Channels Through the Expansion Port

By cascading through the expansion port, the four-channel mux/demux modules can be configured to support up to 16 different channels over the network. An example of how to configure two modules is shown below.



After connecting to the local interfaces (channels 1-8), connect the Network Port transmitter (TX) on Module 1 to the Expansion Port receiver (RX) on Module 2. This connection is shown as a dashed blue line in the diagram above. Connect Module 1's Network Port receiver to the Expansion Port's transmitter (solid blue line).

In the illustration, the connection of the two modules via the expansion port results in the transport of 12 wavelengths (channels 1-12) to the network backbone. This is shown in green.

Refer to [Expansion Port](#) for more information.



# User Guide

This section contains more detailed information about using the Radiance CWDM System.

## Calculating the Transmission Power Budget

When designing an optical link, one of the factors to consider is the transmission power budget. The power budget is required for determining the maximum distance a link can support. The transmission power budget is the difference between the optical transmitter output power and the receiver sensitivity:

$$\text{Power Budget} = \text{TX Power} - \text{RX Sensitivity} \quad [\text{EQ. 1}]$$

**Example 1:** A -2 dBm optical transmitter and a -25 dBm receiver provide a total transmission power budget of 23 dBm.

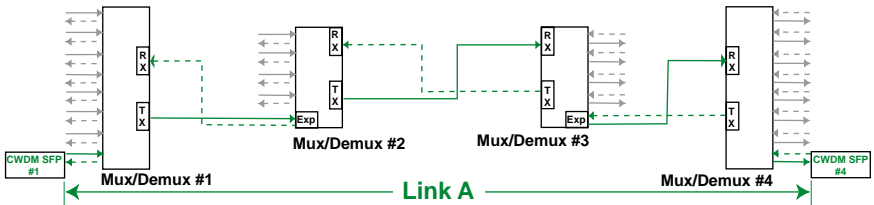
$$\begin{aligned} \text{Power Budget} &= \text{TX Power} - \text{RX Sensitivity} \\ &= -2 \text{ dBm} - (-25 \text{ dBm}) \\ &= 23 \text{ dBm} \end{aligned}$$

In a CWDM system, every point where a channel is dropped, added, or passed results in a loss of signal strength. When calculating the power budget for a CWDM link, all losses must be added together and then subtracted from Equation 1 above:

$$\text{Power Budget} = \text{TX Power} - \text{RX Sensitivity} - \text{Losses} \quad [\text{EQ. 2}]$$

Refer to [Technical Specifications](#) for the expected loss values for the CWDM/OADM modules. A link is defined as the connection between the point where a signal begins and the point where it ends. Because the CWDM/OADM modules do not regenerate signals, the link distances are calculated from CWDM SFP to SFP. In the CWDM power budget equation, the TX Power and RX Sensitivity are the specifications for the CWDM transceivers being used.

**Example 2:** Calculate the power budget for Link A in the diagram below. Link A is the distance from CWDM SFP #1 to CWDM SFP #4.



Power Budget = TX Power - RX Sensitivity - Losses

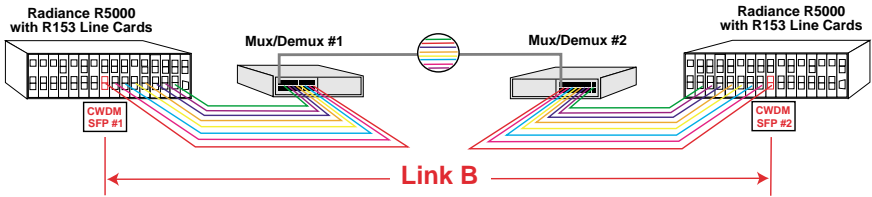
TX Power = 2 dBm

RX Sensitivity = -25 dB

Losses = (8-channel Mux/Demux #1 loss) + (4-channel Mux/Demux #2 loss) +  
(4-channel Mux/Demux #3 loss) + (8-channel Mux/Demux #4 loss)  
= 2.5 dBm + 2.0 dBm + 2.0 dBm + 2.5 dBm  
= 9.0 dBm

Power Budget = TX Power - RX Sensitivity - Losses  
= 2 dBm - (-25 dBm) - 9.0 dBm  
= 18 dBm

**Example 3:** Calculate the power budget for Link B in the following diagram.  
Link B is the distance from CWDM SFP #1 to CWDM SFP #2



Power Budget = TX Power - RX Sensitivity - Losses

TX Power = 2 dBm

RX Sensitivity = -25 dBm

Losses = (8-channel Mux/Demux #1 loss) + (8-channel Mux/Demux #2 loss)  
= 2.5 dBm + 2.5 dBm  
= 5.0 dBm

Power Budget = TX Power - RX Sensitivity - Losses  
= 2 dBm - (-25 dBm) - 5.0 dBm  
= 22 dBm

### ***Calculating the Maximum Link Distance***

After you have determined the power budget for a fiber link, you can use that value to calculate the maximum distance the link will support.

$$\text{Distance} = \frac{\text{Power Budget} - \text{Buffer}}{\text{Fiber Attenuation}} \quad [\text{EQ. 3}]$$

Typically, a buffer of 2 dBm is subtracted from the power budget to account for other factors that may affect the loss of transmission power. These factors include fiber aging, temperature, humidity, poor splices, etc.

Fiber attenuation is the loss of signal strength as it travels through the fiber. The attenuation varies with the wavelength. Refer to the specifications of the fiber cable you are using, to obtain the fiber attenuation value. Typical values are 0.2 to 0.35 dBm/km.

**Example 4:** Calculate the maximum link distance for Link A from Example 2. Using a worst case value of 0.35 for the fiber attenuation, the distance is:

$$\text{Distance} = \frac{18 \text{ dBm} - 2 \text{ dBm}}{0.35 \text{ dBm/km}} = 46 \text{ km}$$

**Example 5:** Calculate the maximum link distance for Link B from Example 3. Using a worst case value of 0.35 for the fiber attenuation, the distance is:

$$\text{Distance} = \frac{22 \text{ dBm} - 2 \text{ dBm}}{0.35 \text{ dBm/km}} = 57 \text{ km}$$

## Software Support

Metrobility's NetBeacon software (version 3.5 and above) supports the Radiance R4000 chassis and CWDM/OADM modules. After you enter the system and configuration information through a special dialog box, NetBeacon automatically archives the information in its server database. The NetBeacon Server maintains a general inventory of all R4000 chassis entered by all NetBeacon Clients. The inventory is accessible by any NetBeacon Client.

Through NetBeacon, you can record the following information about the Radiance CWDM System into a database:

- A coded identifier, which is used in place of an IP address.
- Device name, device contact, location, and description.
- Part number for the first module (or an indication that the first slot is empty).
- Name for the first module.
- Part number for the second module (or an indication that the second slot is empty).
- Name for the second module.

As a NetBeacon Client, you can do the following tasks:

- Display the list of R4000 chassis in the general inventory, click on an item in the list, and add it to the list of devices managed under your current user profile.
- Add a new R4000 chassis to the general inventory, or edit an existing one, through a dialog box.
- Delete an R4000 chassis being managed under your current user profile.

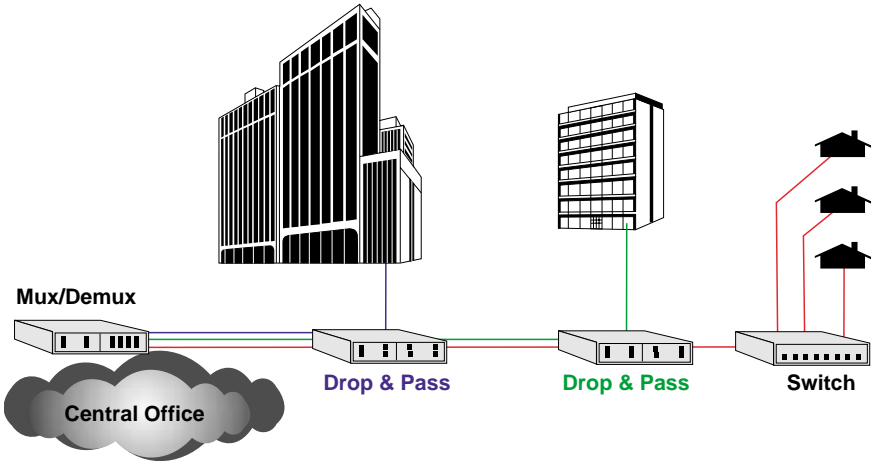
***NOTE:** You cannot delete chassis you added to the general inventory. This can only be done through the NetBeacon Server.*

R4000 chassis appear in the NetBeacon "Devices List" along with other chassis. Clicking on an R4000 in the Devices List provides an image of the chassis and a subset of the contents of the "Information" tabbed panel.

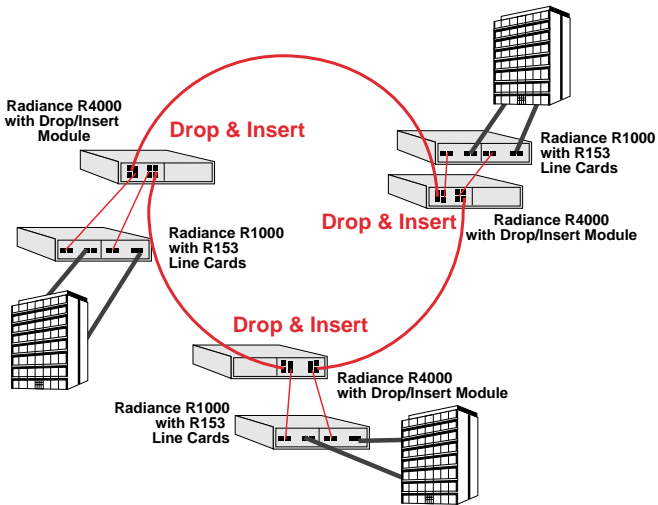
# Topology Solutions

Colored lines are used to represent different CWDM channels in all topology examples.

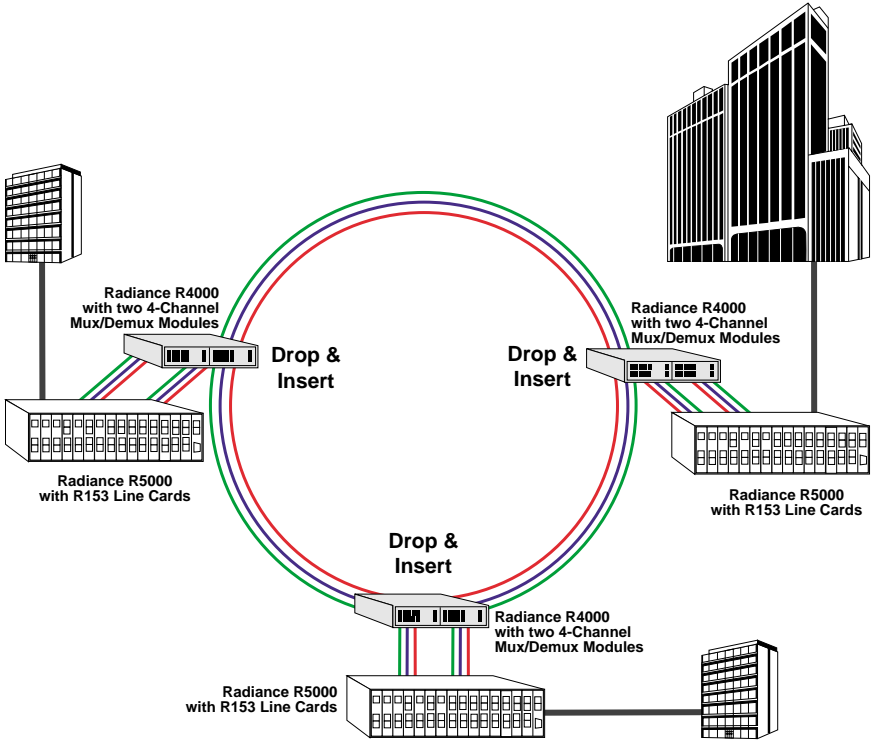
## MULTIPOINT TOPOLOGY



## RING TOPOLOGY

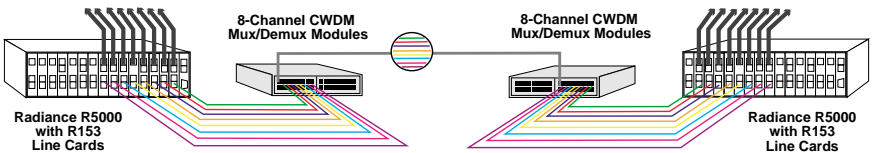


## RING TOPOLOGY

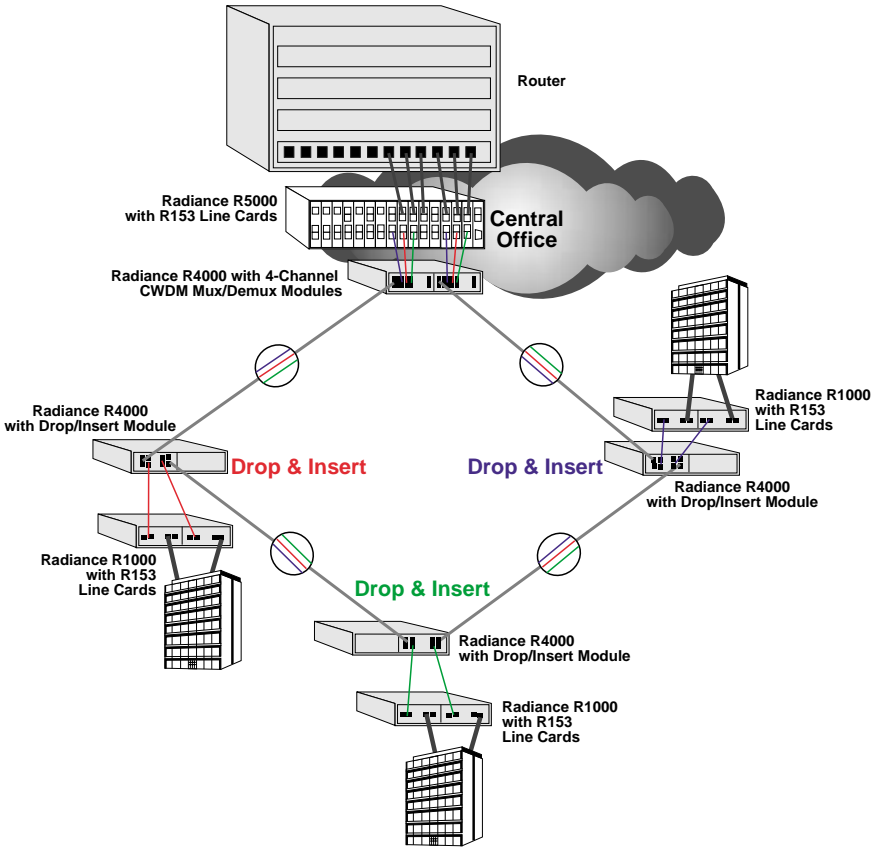


The network connections in the following examples are shown in gray with the magnification circles displaying the channels carried on the network fiber. Connections to the end user are shown in dark gray.

## POINT TO POINT TOPOLOGY



## REDUNDANCY AND PROTECTION TOPOLOGY



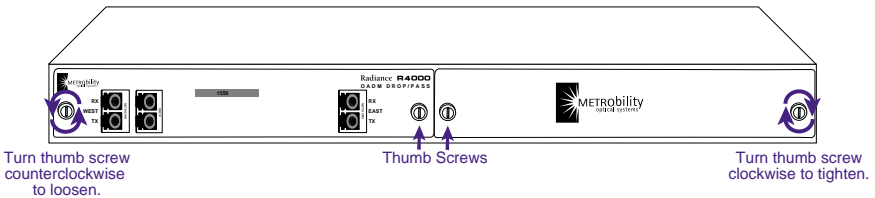
## Replacing a Module

This section describes how to replace a module in the R4000 chassis.

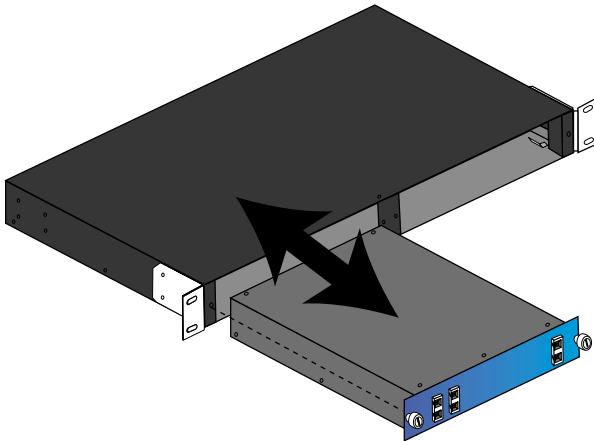
1. If there are any fiber optic cables installed, disconnect them from the module.

**WARNING:** Avoid looking into the laser beam coming from the cable.

2. Turn the two thumb screws counterclockwise several times to loosen the module from the chassis.



3. Gently pull to remove the module out of the slot.



4. Insert the new module into the slot. Do not force it into the chassis unnecessarily. It should slide in easily and evenly.
5. Push the module until the front panel is flush and even with the chassis.
6. Turn the two thumb screws clockwise until snug. The module is now properly installed and ready for connection to the network.



## Technical Specifications

### Environmental

Operating Temperature \_\_\_\_\_ 0° to 50° C  
Extended Operating Temperature<sup>†</sup> \_\_\_\_\_ -40° to 80° C  
Operating Humidity \_\_\_\_\_ 5% to 95% non-condensing

### Physical

Physical Case \_\_\_\_\_ Fully enclosed metal construction

#### Dimensions

Chassis \_\_\_\_\_ 10.0" L x 17.0" W x 1.72" H  
\_\_\_\_\_ 25.4 cm x 43.2 cm x 4.4 cm  
CWDM Module \_\_\_\_\_ 9.812" L x 7.375" W x 1.61" H  
\_\_\_\_\_ 24.92 cm x 18.73 cm x 4.1 cm

#### Weight

Chassis \_\_\_\_\_ 2.85 lb (1.29 kg)  
CWDM Module \_\_\_\_\_ 1.75 lb (0.79 kg)  
Blank Panel \_\_\_\_\_ 0.26 lb (0.11 kg)

### Network Connections

#### CWDM Module Fiber Optic Interfaces

Connector \_\_\_\_\_ SC  
Cable Type \_\_\_\_\_ 9/125  $\mu$ m singlemode\*  
Insertion Loss \_\_\_\_\_ 1.0 dBm (OADM)  
\_\_\_\_\_ 2.0 dBm (4-channel Mux/Demux)  
\_\_\_\_\_ 2.5 dBm (8-channel Mux/Demux)  
Wavelengths \_\_\_\_\_ 1310 nm, 1330 nm, 1350 nm, 1370 nm,  
\_\_\_\_\_ 1390 nm, 1410 nm, 1430 nm, 1450 nm,  
\_\_\_\_\_ 1470 nm, 1490 nm, 1510 nm, 1530 nm,  
\_\_\_\_\_ 1550 nm, 1570 nm, 1590 nm, 1610 nm

#### CWDM Transceivers for Radiance Gigabit Line Cards

Connector \_\_\_\_\_ LC  
Cable Type \_\_\_\_\_ 9/125  $\mu$ m singlemode\*  
RX Input Sensitivity \_\_\_\_\_ -26 dBm to -24 dBm  
Output Power \_\_\_\_\_ 0 dBm to 5 dBm; 2 dBm (typical)  
Typical Link Budget \_\_\_\_\_ 28 dB  
Supported Link Length \_\_\_\_\_ 80 km  
Wavelength \_\_\_\_\_ (see tables on next page)

<sup>†</sup> Only applicable to the models ending in "E."

\* ITU G.652.C-compliant fiber recommended.

<b>Model Number</b>	<b>Wavelength</b>
O411-80-31	1310 nm
O411-80-33	1330 nm
O411-80-35	1350 nm
O411-80-37	1370 nm
O411-80-39	1390 nm
O411-80-41	1410 nm
O411-80-43	1430 nm
O411-80-45	1450 nm

<b>Model Number</b>	<b>Wavelength</b>
O411-80-47	1470 nm
O411-80-49	1490 nm
O411-80-51	1510 nm
O411-80-53	1530 nm
O411-80-55	1550 nm
O411-80-57	1570 nm
O411-80-59	1590 nm
O411-80-61	1610 nm

## **Abbreviations**

ACT	Activity
CWDM	Coarse Wavelength Division Multiplexing
dB	Decibels
dBm	Decibels relative to 1 mW of power (0 dBm equals 1 mW)
Demux	Demultiplexer
Gbps	Gigabits per second
GigE	Gigabit Ethernet
ITU	International Telegraphic Union
km	Kilometer
Mbps	Megabits per second
Mux	Multiplexer
nm	Nanometer
OADM	Optical Add/Drop Multiplexing
RX	Receive
SFP	Small Form-Factor Pluggable optical transceiver
SNMP	Simple Network Management Protocol
TX	Transmit

## **Product Safety and Compliance Statements**

This equipment complies with the following requirement:

NEBS Level 1 Certification

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

## ***Warranty and Servicing***

### **Three-Year Warranty for the Radiance CWDM System**

Metrobility Optical Systems, Inc. warrants that every Radiance CWDM System (R4000 chassis and modules) 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](http://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.

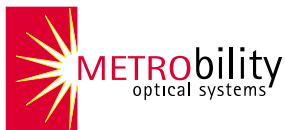
## **Notes**

### **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](http://www.metrobility.com)