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# FC Detector Interface Adapter

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# RX3 SERIES
# MULTICHANNEL BACKREFLECTION METER

## User's Manual

JDS Uniphase

**10129979 Rev. 001 • June 2005**

## Instrumentation Support

Regular support hours of operation are 8:00 AM - 5:00 PM ET, Monday through Friday, excluding Canadian holidays.

### Emergency Technical Support

For emergency assistance, technical support is available 7 days a week, 24 hours a day. Dial one of the telephone numbers below and follow the voice prompts to page a specialist.

### North America

Toll Free: 800 406-9559
Toll Free Fax: 800 898-8537
Tel: 613 843-3000 Ext. 4999
Fax: 613 843-3333
E-mail: support@jdsu.com

### Outside North America

Toll Free: +800 4069-5599
Toll Free Fax: +800 7777-5378

### China

Toll Free: +10 800 140 5599

### Toll Free Access Codes by Country

| Country* | Code |
|---|---|
| Australia | 0011 |
| Europe | 00 |
| Hong Kong | 001(phone), 002(fax) |
| Israel | 014 |
| Japan | 001 KDD, 0041 ITJ, 0061 IDC |
| Malaysia | 00 |
| New Zealand | 00 |
| Singapore | 001 |
| South Korea | 001 Korea Telecom, 002 Dacom |
| Sweden | 009 Telia, 007 Tele2 |
| Taiwan | 00 |

*For all other countries, dial the access code for North America.

Please refer to the JDSU Terms and Conditions of Sale for warranty coverage information.

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# Safety Information

## Safety Instructions

The following safety instructions must be observed whenever the unit is operated, serviced, or repaired. Failure to comply with any of these instructions or with any precaution or warning contained in the user's manual is in direct violation of the standards of design, manufacture, and intended use of the unit. JDS Uniphase assumes no liability for the customer's failure to comply with any of these safety requirements.

### Safety Symbols

The following symbols and messages can be marked on the unit (Table 1). Observe all safety instructions that are associated with a symbol.

**Table 1: Safety Symbols**

| Symbol | Description |
|---|---|
|  | Laser safety. See the user's manual for instructions on handling and operating the unit safely. |
|  | See the user's manual for instructions on handling and operating the unit safely. |
|  | Electrostatic discharge (ESD). See the user's manual for instructions on handling and operating the unit safely. |
|  | Frame or chassis terminal for electrical grounding within the unit. |
|  | Protective conductor terminal for electrical grounding to the earth. |
| **WARNING** | **The procedure can result in serious injury or loss of life if not carried out in proper compliance with all safety instructions. Ensure that all conditions necessary for safe handling and operation are met before proceeding.** |
| **CAUTION** | The procedure can result in serious damage to or destruction of the unit if not carried out in compliance with all instructions for proper use. Ensure that all conditions necessary for safe handling and operation are met before proceeding. |

### Laser Classification

Laser specifications defining the laser class and the maximum possible wavelength range and power output of lasers used in this product, as submitted to the FDA, are outlined in Table 2. For the exact specification of the lasers described in this manual, please refer to the Specifications section.

**Table 2: Laser Class and Parameter Limits**

| Parameter | Specification |
|---|---|
| Wavelength | 850 –1650 nm |
| Class | 1* |
| Output power | 0.32 mW (max) |

* Per standard IEC 60825-1 and FDA standard 21CFR1040.10 except deviation per Laser Notice No. 50 July 2001.

### Before Initializing and Operating the Unit

☑ Inspect the unit for any signs of damage, and read the user's manual thoroughly.

☑ Install the unit as specified in the **Getting Started** section.

☑ Ensure that the unit and any devices or cords connected to it are properly grounded.

### Operating the Unit

**Warning**

To avoid the risk of injury or death, always observe the following precautions before initializing the unit:

If using a voltage-reducing autotransformer to power the unit, ensure that the common terminal connects to the earthed pole of the power source.

Use only the type of power cord supplied with the unit.

Connect the power cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord that is not equipped with this feature.

Willfully interrupting the protective earth connection is prohibited.

Never look into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible, and direct exposure can severely injure the human eye. For more information, see the user's manual of the laser source in use.

Turning off the power to the device does not always block the externally supplied radiation to the connector at the output of the unit.

Do not use the unit outdoors.

To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.

Do not operate the unit when its covers or panels have been removed.

Do not interrupt the protective earth grounding. Any such action can lead to a potential shock hazard that can result in serious personal injury.

Do not operate the unit if an interruption to the protective grounding is suspected. In this case, ensure that the unit remains inoperative.

| | |
|---|---|
| | Use only the type of fuse specified by the manufacturer as appropriate for this unit. Do not use repaired fuses, and avoid any situations that can short-circuit the fuse.<br><br>Unless absolutely necessary, do not attempt to adjust or perform any maintenance or repair procedure when the unit is opened and connected to a power source.<br><br>Repairs are to be carried out only by a qualified professional.<br><br>Do not attempt any adjustment, maintenance, or repair procedure to the unit's internal mechanism if immediate first aid is not accessible.<br><br>Disconnect the power cord from the unit before adding or removing any components.<br><br>Operating the unit in the presence of flammable gases or fumes is extremely hazardous.<br><br>Do not perform any operating or maintenance procedure that is not described in the user's manual.<br><br>Some of the unit's capacitors can be charged even when the unit is not connected to the power source. |

## Safety Features and Compliance

The RX3 Series Multichannel Backreflection Meter complies to CE requirements plus UL3101-1 and CAN/CSA-C22.2 No.1010.1 with respect to laser sources. It is classified per Table 2 as a Class 1 instrument. The following safety features are incorporated into the design of the unit

There is an LED on the front panel indicating when the laser/LED source is on.

### Laser Safety Labeling

The RX3 Series Backreflection Meter is classified per Table 2. As required by the FDA standard 21CFR1040.10, an identification label (Figure 1) is placed on the top of the unit showing name of manufacturer, address, and month and year of manufacture.

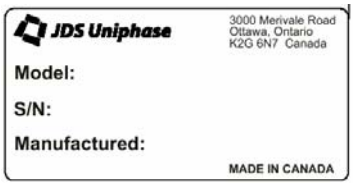


**Figure 1: Identification Label**

A note, as shown in Figure 2, indicating compliance to FDA requirements is silk-screened on the rear panel of the instrument.

“THIS DEVICE COMPLIES WITH 21CFR1040.10 EXCEPT DEVIATIONS PER LASER NOTICE N0. 50, JULY 2001”

**Figure 2: FDA Compliance Text**

A triangular laser safety label, as shown in Figure 3, is located adjacent to output connectors on the front panel.

**Figure 3: Laser Safety Label**

A warning label is located on the front of the instrument, as shown in Figure 4, indicating the IEC Class of laser and applicable standard:


**Figure 4: Laser Warning Label**

JDS Uniphase

## EC DECLARATION OF CONFORMITY

**Manufacturer's Name:** JDS Uniphase Corporation

**Manufacturer's Address:** 3000 Merivale Road,
Ottawa, Ontario
CANADA K2G 6N7
Phone: +(1)-613-843-3000 Fax: +(1)-613-843-3333

Declares that the products:

**Product Name:** Multichannel Backreflection Meter
**Model Name:** **RX3 Series**
**Product Options:** This declaration covers all options of the above products.

Conform to the following Product specifications:

**Safety:**

IEC 1010-1:1990+A2:1992
EN 61010-1:1993+A2:1995
CAN/CSA-C22.2 No. 1010.1-92(R1999)
UL No.3101-1:1993
IEC 60825-1:2001
21CFR 1040.10

**EMC:**

EN61326-1:1997+A1:1998
EN55022:1998
EN55024:1998

**Supplementary Information:**
The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carry the CE-marking accordingly.

Ottawa, Ontario, CANADA November 27, 2003

Bill Birkas
Product Quality Engineering

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# General Information and Specifications

## General Information

This user's manual for the RX3 Series Multichannel Backreflection Meter contains complete operating instructions. The Multiple Connector Test System (MCTS) software is bundled with the meter; for information on using the software, see the *Multiple Connector Test System Software User's Manual* (document SD000318). The inspection report and a description of any customer-requested information are found in the Customized Features and Test Data section.

The JDS Uniphase Multichannel Backreflection Meter performs a wide range of of single-mode (SM) and multimode (MM) return loss (RL) and loss measurement functions, ranging from single component testing to automated multifiber testing. The primary functions of high sensitivity RL measurements and power measurements can be augmented by adding multiple output ports and multiple internal light sources. The meter is available with 1, 4, 8, 12, 16, 20, or 24 output ports. A multidisplay mode lets the viewer see multiple test results at a glance. (see Figure 5).

**Figure 5: RX3 Series Multimode Multichannel Backreflection Meter**

The meter is used from single fiber and ribbon fiber connector measurements. The use of hybrid jumpers allows a quick change of the connector type without limiting the RL range. The meter is also available with 2 or 3 internal sources for measurements at 850, 1310, 1480, 1490, 1550, 1625, or 1650 nm.

The 2-mm InGaAs detector is particularly useful for high sensitivity single fiber applications. The 5-mm Ge detector is an economical solution for measurements of the ribbon fiber connectors, and can accurately measure connectors with up to 8 MM and 12 SM fibers. The large surface 10-nn InGaAs detector is ideal for measurements of larger fiber count ribbon connectors, and can be used with wavelengths extending in the L- band. One FC detector adaptor is supplied with the unit, and other adaptors (such as MTP/MPO or MU for ribbon fiber connector types) are also available.

The meter is supplied with one calibrated hybrid jumper for calibration purposes and one hybrid test jumper for measurement purposes. Both jumpers are equipped with an FC/APC connector on one end (for the output port of the meter) and an FC/PC connector on the other end. Uncalibrated hybrid jumpers for measurements with other connector types are also available.

.

## Backreflection Measurements

Reflections in optical systems can come from a number of sources. Primary sources include the fiber (Rayleigh backscatter) and Fresnel reflections that occur at the planar junction of two materials having different refractive indices, for example, connector and fiber endfaces, splices, bulk optic interfaces, and detector surfaces.

Typically, only Fresnel reflections are significant because transmitters are relatively insensitive to distributed reflections such as Rayleigh backscatter. Backreflection caused by Rayleigh backscatter varies with the length and type of fiber, and is only significant when measuring components with backreflections below -40 dB or with very long pigtails (multimode), or -80 dB (single-mode). However, Rayleigh backscatter can be a large contributor of backreflection in installed systems; therefore, proper fiber termination techniques must be applied to separate the backreflection of the test component from the Rayleigh backscatter of the fiber.

An internal switch and coupler enable the RX3 meter to measure the internal light source signal ($P_{in}$), the signal offset with no light ($P_{dark}$), and the total signal level from internal and external backreflections ($P_{br}$).

The meter first calculates the total backreflection from internal and external sources ($BR_{tot}$) using the following equation, where CAL and USERCAL are the factory- and user-set calibration factors, respectively:

$$BR_{tot} = 10 \log (P_{br} - P_{dark})/(P_{in} - P_{dark}) + CAL + USERCAL \qquad [dB]$$

When the RX3 meter is calibrated at the factory, USERCAL is set to 0 dB.

The backreflection from external sources (BR) is then calculated using the following equation, where $BR_0$ is the stored value of the total backreflection up to the device under test (DUT), and OFFS is the offset used to compensate for losses between the meter and the DUT:

$$BR = 10 \log (10^{BR_{tot}/10} - 10^{BR_0/10}) + OFFS \qquad [dB]$$

The measurement cycle takes approximately one second to complete. The meter then displays the value of BR. The preset value of OFFS is set at twice the average insertion loss of the connection between the RX3 meter and a measurement jumper.

The exact values of $BR_0$ and OFFS can be measured after a measurement jumper is connected to the meter.

## Loss and Power Measurements

The RX3 meter is equipped with a front-panel InGaAs or Ge detector for loss measurements and both relative and absolute power measurements. Because the meter is capable of storing the dark signal from the detector, high-accuracy power measurements as low as -80 dBm (single-mode)/-60 dBm (multimode) can be obtained.

## Output Port

The output ports of the RX3 meter are equipped with ultra-low backreflection FC/APC connectors.

**Caution**

To prevent damage to the output port connectors, always use the measurement jumper for all measurements, even when measuring components with a FC/APC connector.

***Internal Light Sources***

The RX3 meter can be equipped with two internal laser sources. These are thermoelectrically cooled for added stability and can be run in both Modulated Laser mode and CW LED mode.

Modulated Laser mode is used for backreflection and power measurements. CW LED mode is used for power measurements only. In CW LED mode, the laser is run below threshold to provide a very low coherence length source that is mostly unpolarized.

**Hybrid Jumpers**

The RX3 meter is supplied with one hybrid measurement jumper and one hybrid calibrated jumper. The measurement jumper has an FC/APC connector at the input end and an FC/PC connector at the output end. The user can select other hybrid measurement jumpers with with other connector types on the output end to provide an end compatible with the input connector of the DUT. The calibrated jumper has an FC/APC connector at the input end and an FC/PC connector at the output end.

The FC/APC connectors on both types of hybrid jumpers are connected to the output port of the meter.

Use the measurement jumper for measurement purposes only; use the calibrated jumper for calibration purposes only.

**Coherence Length**

Reflected light from multiple reflections can change the backreflection measured by the meter. This variation shows up as noise or drift in the signal. The internal light source is designed to have low coherence length (usually less than 10 cm) in Modulated Laser mode. Thus, interference effects typically are seen only between very closely spaced components, such as non-contacting connectors.

**Key Features**

SM and MM available
Measurements at 850, 1310, 1480, 1490, 1550, 1625, or 1650 nm
Integrated switch included in the calibration
Multidisplay mode

**Applications**

SM fiber connectors and component testing
Ribbon fiber measurements
MM fiber connector testing

## Standard Accessories

AC power cord
Laser sources (as specified at time of order)
2, 3, or 10 mm InGaAs detector, or 5 mm Ge detector (as specified at time of order)
FC/PC-FC/APC hybrid measurement jumper
FC/PC-FC/APC hybrid calibrated jumper
FC-type detector adapter
Detector cap
User’s manual
MCTS software and user’s manual
Certificate of Compliance (NIST Traceability Report available on request)

## Optional Accessories

Variety of detector adapters
Measurement jumpers with various user-selected connectors

## Specifications

The following optical specifications describe the warranted characteristics of the instrument (Table 3). Supplementary specifications describe the typical non-warranted performance of the instrument (**Error! Reference source not found.**).

**Table 3: Optical Specifications**

| Parameter | Single-Mode (SM) | Multimode (MM) |
|---|---|---|
| Operating wavelength | 1310, 1480, 1550, 1625, 1650 ±10 nm | 850, 1310, 1550 ±10 nm |
| Outputs | 1, 4, 8, 12, 16, 20, or 24 | |
| Detector type | 2 mm In GaAs, 5 mm Ge[8], 10 mm InGaAs, 3 mm InGaAs, 5 mm Ge[8], 10 mm InGaAs | |
| Power range[1] | 3 to -80 dBm, 3 to – 40 dBm, -5 to -40 dBm, 3 to -60 dBm, 3 to -40 dBm, 5 to -40 dBm | |
| Relative power accuracy[5, 9] | ±0.15 dB[6] | ±0.15 dB[7] |
| Relative power accuracy (5 dB range) [5, 9] | ±0.05 dB[6] | ±0.15 dB[7] |
| Backreflection range [1,2,9] | 0 to -75 dB | 0 to -40 dB |
| Relative backreflection accuracy [3, 9] | ±0.4 dB[4] | ±0.7 dB |
| Relative backreflection accuracy (5 dB range) [3, 9] | ±0.3 dB[4] | ±0.7 dB |
| Absolute power accuracy | ±0.25 dBm typical at -10 dBm | |
| Backreflection resolution | 0.1 dB | |
| Power resolution | 0.01 dB | |
| Input voltage | 100 to 240 V AC, 50 to 60 Hz | |
| Operating temperature | 0 to 40 °C | |
| Storage temperature | -40 to 70 °C | |
| Dimensions (W x H x D)<br>single output<br>multiple output | <br>36 x 15 x 31 cm<br>48 x 15 x 31 cm | |
| Weight<br>single output<br>multiple output | <br>10 kg<br>12 kg | |

1. Depending on the measurement setup, measurements with lower levels are possible at reduced accuracy.
2. Reduced backreflection accuracy in the last 10 dB of range based on termination effectiveness. Depending on the measurement setup, measurements with lower levels are possible at reduced accuracy.
3. Following user-calibration procedure at recommended interval.
4. For a typical application, add ±0.4 dB for readings between -60 and -67 dB. Add ±0.8 dB for readings between -67 dB and -72 dB. Add ±1.5 dB for readings between -72 and -75 dB.
5. Immediately after performing a dark measurement.
6. Add ±0.1 dB between 0 and 3 dBm and in the last 10 dB of the range.
7. Add ±0.1 dB between 0 and 3 dBm and in the last 5 dB of the range.

8. 5 mm Ge detector can accurately measure ribbon fiber connectors with up to 8 multimode or 12 single-mode fibers.
9. Measured at ambient temperature ± 3°C.

# Getting Started

The RX3 Series Multimode Multichannel Backreflection Meter consists of the meter, power cord, detector adapter, measurement jumper, calibrated jumper, and test software.

## Before Initializing and Operating the Unit

☑ Inspect the unit for any signs of damage.

☑ Read the user's manual thoroughly, and become familiar with all safety symbols and instructions to ensure that the unit is operated and maintained safely.

## Initial Inspection

**Warning**

To avoid electrical shock, do not initialize or operate the unit if it bears any sign of damage to any portion of its exterior surface, such as the outer cover or panels.

Check that the unit and contents are complete:

1. Wear an anti-static wrist strap, and work in an electrostatic discharge (ESD) controlled area.

2. Inspect the shipping container for any indication of excessive shock to the contents, and inspect the contents to ensure that the shipment is complete.

3. Inspect the unit for structural damage that can have occurred during shipping.

4. Connect the unit to a power source, using the AC power cord provided.

5. Set the power switch to **I** (on), and observe the power-up sequence: The prompt to restore last settings or initialize is displayed. The software version is also displayed. Internal measurements of $P_{in}$ and $P_{dark}$ are made at both wavelengths. See the **Powering Up the Meter** section.

6. Keep the packaging.

Immediately inform JDS Uniphase and, if necessary, the carrier if the contents of the shipment are incomplete, if the unit or any of its components are damaged or defective, or if the unit does not pass the initial inspection.

## Operating Environment

In order for the unit to meet the warranted specifications, the operating environment must meet the following conditions for temperature, humidity, and ventilation.

### Temperature

The unit can be operated in the temperature range of 0 to 40 °C.

### Humidity

The unit can be operated in environments with up to 95% humidity (0 to 40 °C). Do not expose it to any environmental conditions or changes to environmental conditions that can cause condensation to form inside the unit.

### Ventilation

The unit contains a built-in cooling fan. Do not install it in any location where the ventilation is blocked. For optimum performance, the unit must be operated from a location that provides at least 75 mm (3 inches) of clearance at the rear and at least 25 mm (1 inch) of clearance at the bottom. Blocking the air circulation around the unit can cause the unit to overheat, compromising its reliability.

**Warning**

Do not use the unit outdoors.

To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.

## Cleaning Connectors

**Caution**

Connecting damaged or dirty fibers to the unit can damage the connectors on the unit.

Never force an optical connector. Some connectors have a ceramic ferrule that can easily be broken.

Tighten the connector lock screws by hand. Do not use a screwdriver.

Optical cable ends need to be cleaned before using them with the unit.

The following items are required for cleaning:

Filtered compressed air or dusting gas (for example, Tech Spray Envi-Ro-Tech Duster 1671 gas, available from http://www.techspray.com/1671.htm)
Lint-free pipe cleaners (for example, from 3M[1]) or lint-free swab
Lint-free towels (for example, 10 x 10 cm or 4 x 4 in HydroSorb III wipers, available from http://www.focenter.com/acctech/hydrosobr_wipers.htm)
Optical grade isopropyl alcohol or optical grade 200° ethanol (do not use rubbing alcohol, which contains 30% water)

To clean the connectors:

1. Blow the sleeve with filtered compressed air (Figure 6).

[1] 3M is a trademark of 3M.

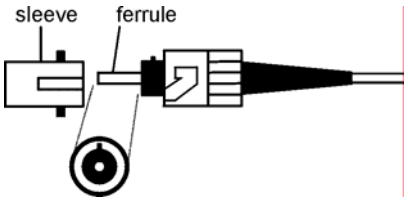


**Figure 6: Connector Cleaning (connector type can vary)**

2. Apply optical grade isopropyl alcohol or optical grade ethanol (do not use rubbing alcohol) to a small area of a lint-free towel and rub the end of the ferrule over the wet area.

3. Wipe the ferrule on a dry area of the lint-free towel.

4. Using the dusting gas or compressed air, blow the end of the ferrule.

5. Apply the alcohol or ethanol to a lint-free pipe cleaner or swab and wipe off the remaining parts of the connector.

6. With the other end of the pipe cleaner or swab, dry the areas cleaned.

7. Using the dusting gas or compressed air, blow the areas cleaned.

## Powering Up the Meter

To power up the meter:

1. Connect the meter to a power source, using the AC power cord provided.

2. Set the power switch to **I** (on), and observe the power-up sequence. The prompt to restore last settings or initialize the meter is displayed. The software version is displayed also. Internal measurements of $P_{in}$ and $P_{dark}$ are made at both wavelengths

3. Select the Restore Last Settings or Initialize option (using the soft key to the right of the option).

When you select the Restore Last Settings option, the meter retains the operating mode, source and output setting, and all stored parameters that were active when the meter was last powered off. The value of the operating mode, and the source and channel setting are displayed.

When you select the Initialize option, the meter is set to the operating state shown in Table 4.

**Table 4: Initialized Operating State**

| Feature | Function |
|---|---|
| Output | Channel 1 |
| Source | 1.3 laser |
| Measurement mode | Backreflection |
| Averaging function | Off |
| Data logging | Off |
| Multidisplay mode | Off |
| $BR_0$ | Factory-set value |
| Setup | Via loss (factory-set value) |
| Operating keys | All keys that could be disabled are enabled |

Any changes made to the BR or Power calibration are retained. Once initialized, the meter displays the backreflection on channel 1 at 1310 nm.

The Initialize option can be locked out so that the last settings used are automatically restored when the meter is powered on (see the **Customizing the Meter** section).

## Terminating a Fiber

Termination is a technique used to block all backreflections beyond a certain point in a network of components. In all measurement testing, two terminations must be made:

The first (for measuring $BR_0$) is made before the DUT, for example, on the meter side
The second (for measuring $br_{tot}$) is made after the DUT

To minimize the errors associated with Rayleigh backscattering in the fiber, make both termination points as close as possible to the DUT. The backreflection of all components and connections between these two points is included in the equation for calculating the backreflection value (BR) of the DUT.

High-attenuation bends in the fiber (for example, bends with a relatively small radius) remove all backreflection and can be made anywhere along the length of the cable. When measuring backreflection levels below -60 dB, in order to offset the small amount of reflection caused by the high-attenuation bends, make low-attenuation bends (for example, bends with a relatively large radius) just before the high-attenuation bends.

To terminate a fiber (single-mode fibers only):

1. Using the size of rod specified in the Inspection Report (see the **Customized Features and Test Data** section), wind the cable around the rod until the reading displayed on the meter no longer changes (approximately six turns). To minimize any memory of the bends in the cable jacket, do not pull on the cable while winding, and occasionally wind the cable in the opposite direction.

The diameter of the rod must be suitable for the type of fiber connected to the output port jumper and for the wavelength in use.

Termination can also be performed by using index-matching gel or terminating connectors. These methods are recommended only when measuring fairly high backreflection levels because they do not remove all the backreflection from the fiber end and they cannot be applied sufficiently close to a DUT with long jumpers.

To terminate using index-matching gel:

1. Apply index-matching gel directly to the fiber end, or connect the terminating connectors to the jumper of the DUT.

## Using Menu Functions

To use the menu:

1. Press the MENU key to access the first menu level (Menu mode).

2. From the first menu level, use the soft keys to access the next menu levels (see Figure 7 as an example).

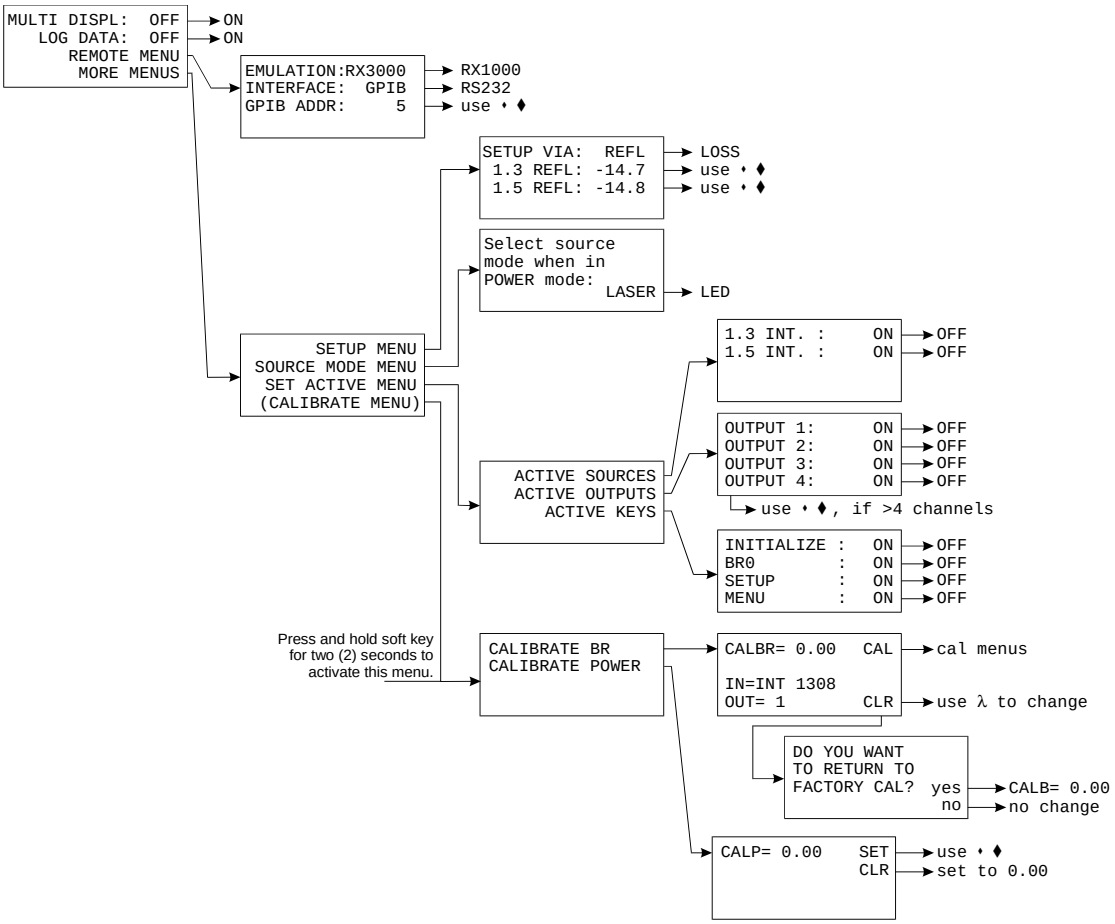


**Figure 7: Accessing Menu Levels**

3. To step back one menu level (for example, to return to the previous menu level), press the MENU key.

4. To exit Menu mode, press the BR or POWER key.

# Operating and Maintenance Instructions

## Front Panel

The front panel shown in Figure 8 is for the RX3074-5G meter. Not all RX3 Series meters are exactly as shown.

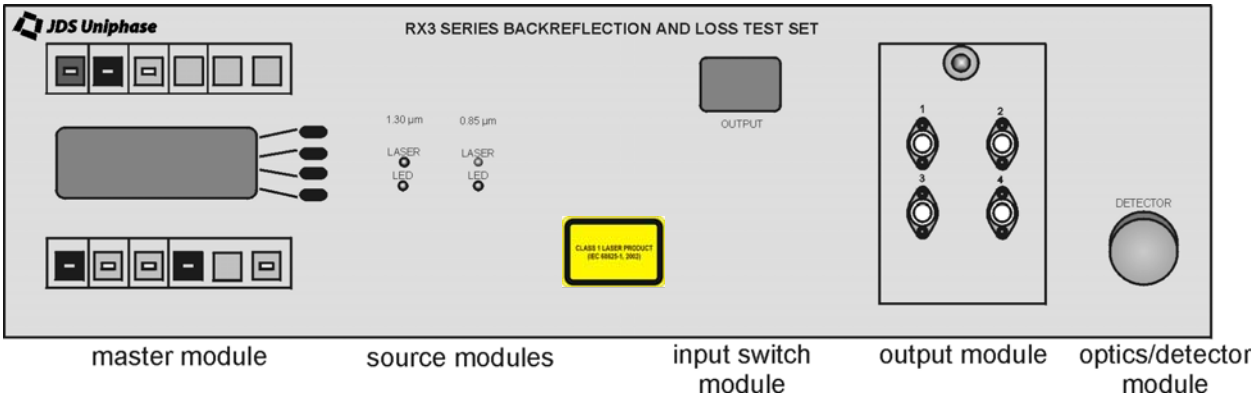


**Figure 8: Front Panel of RX3 Series Multichannel Backreflection Meter**

### Master Module

The Master Module panel is shown in Figure 9.

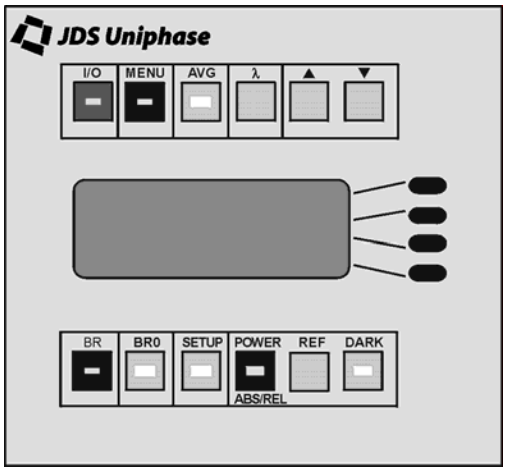


**Figure 9: Master Module Panel**

### Input Switch Module

The input switch module displays the selected output port.

### Output Module

The output module provides a push-button release for a hinged door to provide access to the FC/APC output connectors.

### Optics/Detector Module

The optics/detector module contains the power meter.

### Operating Keys and Status LEDs

The operating keys and LEDs are described in Table 5.

**Table 5: Operating Keys and Status LEDs**

| Key/LED | Description |
|---|---|
| I/O | Powers the meter on (**I**) or off (**O**). The key lamp lights to indicate that the meter is powered on. |
| MENU | Toggles Menu mode on and off. When deeper menu levels are selected, press the MENU key to step back one level at a time. |
| AVG | Toggles the measurement averaging function on and off. The key lamp lights to indicate that the averaging function is on. |
| | Selects one of the two laser sources. |
| / | Select the output channel and adjust the calibration factor. |
| BR | Sets the meter to Backreflection Measurement mode. Press the BR key to toggle between the backreflection and return loss display. This key can also be used to exit Menu mode. |
| $BR_0$ | Measures the backreflection value and stores it as $BR_0$. The key lamp lights to indicate that the function is on. To restore the factory-set $BR_0$ value, press the $BR_0$ key again. The key lamp turns off. |
| SETUP | Sets the power meter to zero and measures connector loss for measurements using the measurement jumper. The key lamp lights to indicate that the Setup function is on. Backreflection measurements use a standard loss of 0.15 dB. |
| POWER | Sets the meter to Optical Power Measurement mode and toggles between absolute power and relative power display. This key can also be used to exit Menu mode. |
| REF | Sets the reference power for relative power measurements. |
| DARK | Measures the dark signal level of the power meter. |
| ⬭ | Selects items from the menu level displayed or special functions that are activated. |
| LASER | Lights when the internal light source is in Modulated Laser mode. |
| LED | Lights when the internal light source is in CW LED mode. |

## Rear Panel

The back of the meter is shown in Figure 10 and the rear-panel features are described in Table 6.

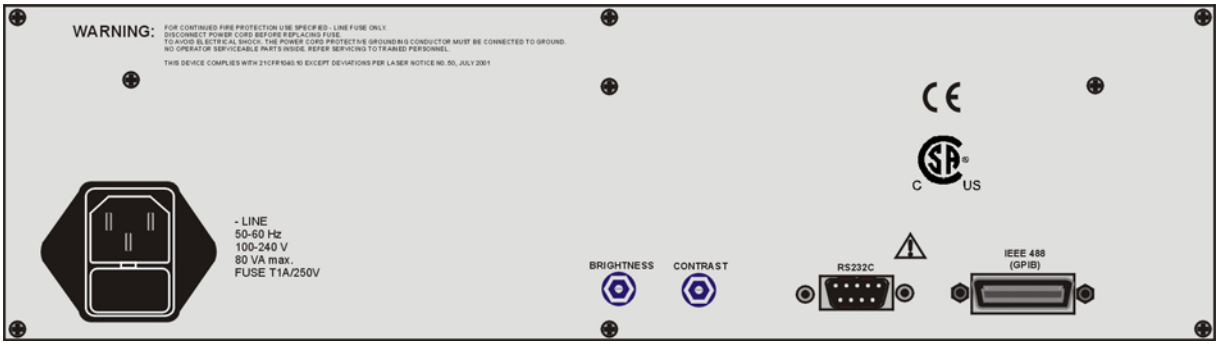


**Figure 10: Rear Panel of Multimode RX3 Meter**

**Table 6: Rear-Panel Features**

| Feature | Description |
|---|---|
| BRIGHTNESS | Controls the brightness of the front-panel display. |
| CONTRAST | Controls the contrast of the front-panel display. |
| RS232C | RS232C serial interface port. |
| IEEE 488 (GPIB) | GPIB (IEEE 488.1) interface port. |

## Preparing the Meter for Backreflection Measurements

To prepare the meter for backreflection measurements:

1. Ensure that the meter is powered off.

2. Set the power switch to **I** (on), and select the Restore Last Settings or Initialize option using the soft key to the right of the option.

3. Press the BR key to set the meter to Backreflection mode. The mode is indicated on the display.

4. Clean the output port on the front of the meter and the FC/APC connector (green boot) of the measurement jumper, and connect this end of the jumper to the output port. The output connector of the measurement jumper is user-selected and must be compatible with the input connector of the DUT.

5. Press the or key to select the required output port.

6. Press the key to select the required wavelength.

7. Attach the appropriate detector adapter to the detector on the front of the meter.

8. Clean and connect the output connector of the measurement jumper to the detector adapter on the front of the meter.

9. Press the SETUP key. The offset value (equal to twice the measured loss) is briefly displayed. The key lamp lights to indicate that the meter is using the measured offset value to calculate the backreflection.

10. To have the meter perform the setup for both wavelengths, press and hold the SETUP key for two seconds.

11. Repeat steps 5 to 10 for the next required output port.

12. Disconnect the output connector from the detector adapter.

13. Terminate the measurement jumper just before the output connector, and hold the termination point steady (Figure 11).

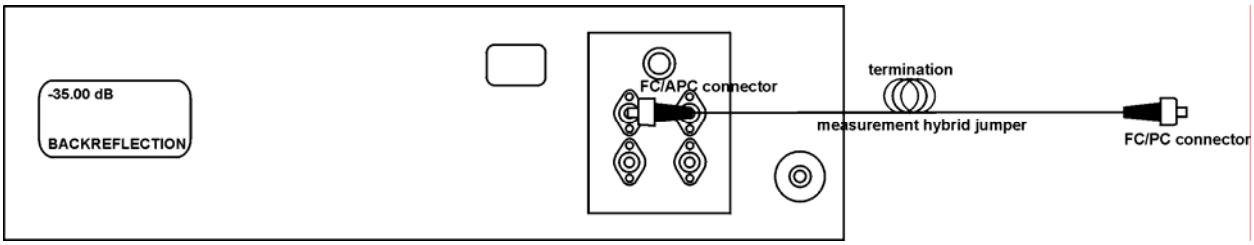


**Figure 11: Terminating the Measurement Jumper**

14. Press the $BR_0$ key. The key lamp lights to indicate that the backreflection of the measurement jumper has been stored. The $BR_0$ value will be used in the calculation of the DUT backreflection at the selected wavelength.

15. To have the RX3 meter perform the $BR_0$ measurement for both wavelengths, hold down the $BR_0$ key for two seconds.

16. Remove the termination. The meter is now ready for backreflection measurements to be made.

## Measuring Backreflection

To measure backreflection from a DUT after setting up the meter (see the Preparing the Meter for Backreflection Measurements section):

1. Clean the output connector of the measurement jumper and the input connector of the DUT, and then connect the two connectors.

2. Press the or key to select the required output port.

3. Press the key to select the wavelength at which the measurement is to be made.

4. Terminate the measurement hybrid jumper immediately after the DUT, and hold the termination point steady. The meter displays the backreflection between the two termination

points that is caused by the fiber, all connections and the DUT, for example, the area within the dashed line in Figure 12.

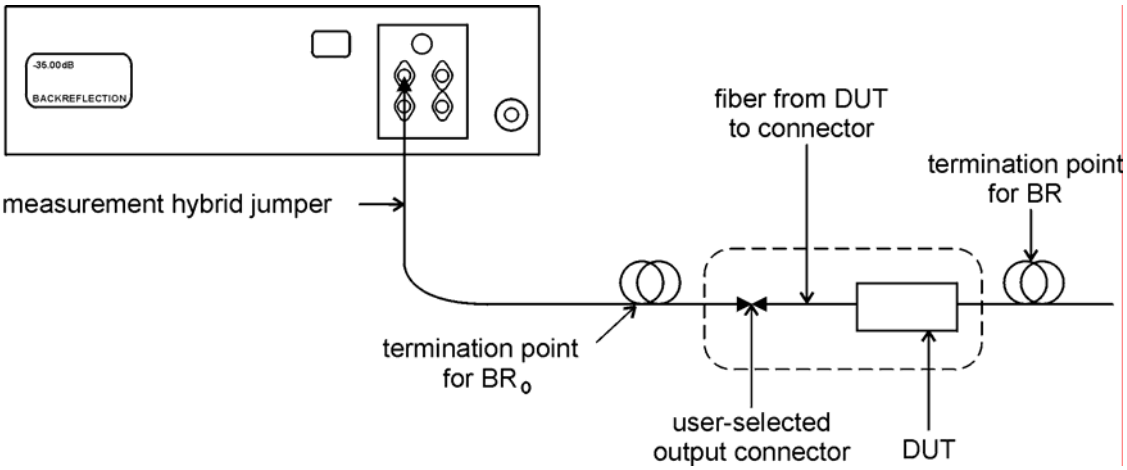


**Figure 12: Measuring Backreflection**

6. If necessary, terminate the fiber for $BR_0$ again, just before the DUT, to eliminate the backreflection caused by the fiber and all connections before the DUT.

7. Press the $BR_0$ key. The key lamp lights to indicate that the $BR_0$ function is on.

8. Release the termination. The meter now displays the backreflection of the DUT only.

9. To make a measurement at a second wavelength, repeat steps 2 to 8.

The small amount of reflections that $BR_0$ represents can be polarization sensitive, and multiple reflections can cause interference effects that make the reflections very sensitive to temperature. To ensure accurate backreflection measurements below -25 dB, perform the $BR_0$ measurement frequently or before each measurement.

## Backreflection Accuracy and Range

The absolute accuracy of backreflection measurements made with the RX3 meter depends on the level of backreflection to be measured.

The backreflection measurement is restricted by the $BR_0$ level. The meter can measure backreflection levels 15 dB below $BR_0$, to a maximum of -40 dB (for multimode). For example, if $BR_0$ is -20 dB, the maximum backreflection range is -35 dB.

An asterisk (*) is displayed near the range limit (last 5 dB of range). The asterisk emphasizes that the setup and measurement procedures described in this manual must be followed carefully to ensure accurate results.

Absolute accuracy specifications depend on the accuracy of the meter calibration; a calibration check needs to be performed periodically (see the **Calibrating the Meter** section).

## Setting Up the Meter for Loss and Power Measurements

To prepare the meter for loss and power measurements:

1. Ensure that the meter is powered off.

2. Set the power switch to **I** (on), and select the Restore Last Settings or Initialize option.

3. Press the  or  key to select the required output port.

4. Clean the output port on the front of the meter and the FC/APC connector (green boot) of the measurement jumper. Connect this end of the jumper to the output port. Ensure that you are using the measurement jumper and not the calibration jumper (which is labeled).

5. Press the  key to select the required wavelength.

6. Attach the appropriate detector adapter to the detector on the front of the meter.

7. Connect the output connector of the measurement jumper to the detector adapter. This end of the jumper is user-selected and must be compatible with the input connector of the DUT.

8. Press the POWER key to set the meter to Relative Power mode. When the meter is in Relative Power mode, measurements are displayed in dB and the mode is indicated (Figure 13).

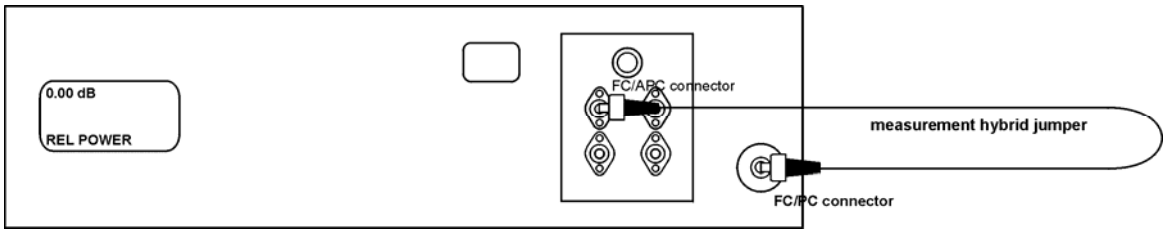


**Figure 13: Setting Up for Loss and Power Measurements**

9. Press the REF key. The display reads 0.00 dB, and the loss of the measurement jumper is subtracted from the DUT loss or power measurements to be made.

10. Repeat steps 3 to 9 for the next required output port.

11. Ensure that the detector is covered; for example, the detector cap is on or the output connector is connected to the detector. This dark measurement current is subtracted from future power measurements.

12. Press the DARK key. The key lamp lights to indicate that the user-stored value of DARK (the dark signal from extraneous sources) is used to calculate the DUT loss or power.

    If the detector is not sufficiently covered, the message “Too Much Light” is displayed.

    If the DARK value is not stored before a measurement is made, the last value stored is used.

If the SETUP key is pressed when the meter is set to either Backreflection or Power mode, the meter measures the loss of connectors and calculates the offset to be used in the backreflection measurements. The meter also zeros the reference power (for example, REF). Therefore, once the setup for a jumper has been performed in either mode, the meter is ready to display the backreflection or loss of the DUT attached to that jumper.

## Measuring Absolute Power

In Absolute Power mode, measurements are displayed in dBm. To make an absolute power measurement of a DUT after performing the setup described in the **Setting Up the Meter for Loss and Power Measurements** section:

1. Press the POWER key to set the meter to Absolute Power mode, indicated on the screen as ABS.

2. Press the  or  key to select the required output port.

3. Press the  key to select the wavelength at which the measurement is to be made.

4. Clean and connect the output connector of the DUT to the detector on the front of the meter. The detector must be equipped with the appropriate detector adapter. The RX3 meter displays the DUT absolute power output.

5. If a measurement is to be made at a second wavelength, repeat steps 4 and 5, and then read the DUT absolute power.

## Measuring Relative Power

Relative power is expressed as the negative value of the insertion loss, for example -31 dB for insertion loss 31 dB. Relative power is displayed by the loss meter in dB.

To make a relative power measurement of a DUT after performing the setup steps in the **Setting Up the Meter for Loss and Power Measurements** section):

1. Press the POWER key to set the meter to Relative Power mode. When the meter is in Relative Power mode, measurements are displayed in dB and the mode is indicated.

2. Press the  or  key to select the required output port.

3. Press the  key to select the wavelength at which the measurement is to be made.

4. Clean the output connector of the measurement jumper and the input connector of the DUT, and then connect the two connectors.

5. Connect the input connector of the DUT to the output of the measurement jumper.

6. Connect the output connector of the DUT to the detector on the front of the RX3 meter. The meter displays the loss due to the DUT (Figure 14).

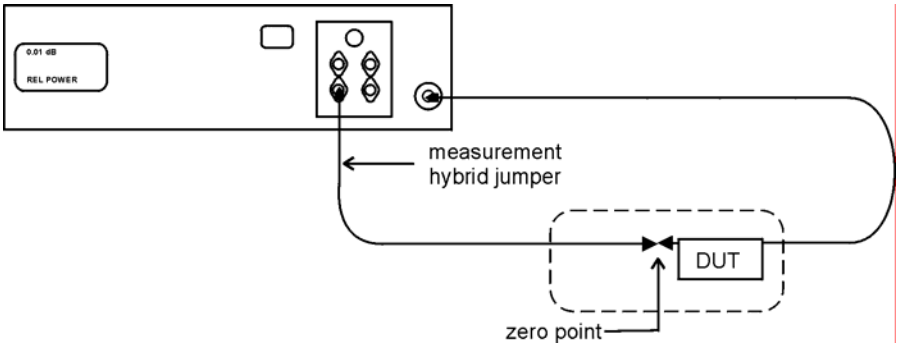


**Figure 14: Measuring Relative Power**

7. Press the  key to measure and display the loss at another wavelength.

## Power Accuracy

The absolute accuracy of power measurements made with the meter depends on the power level to be measured.

To ensure accurate power measurements, store the dark signal frequently or at least before each measurement.

The value of the dark signal can change with temperature fluctuations.

## Customizing the Meter

### LED Mode for Power Measurements

LED mode reduces the interference effects of multiple reflections during loss measurements. Although the same laser diode is used, if the laser power is reduced by 25 dB, it becomes an LED with a broader bandwidth and, therefore, less spatial coherence.

To set LED mode:

1. Press the MENU key.

2. Press the soft key labeled MORE MENUS.

3. Press the soft key labeled SOURCE MODE MENU.

4. Press the soft key labeled LASER to change the key label to LED.

To reset the meter to operate in Laser mode for loss measurements:

1. Set the power switch to **O** (off).

2. Turn the power switch to **I** (on).

3. Select the Initialize option during power-up; or repeat the preceding procedure, selecting LASER rather than LED in step 4.

### Multidisplay Mode

The meter features a multidisplay function to facilitate data viewing during multiple-port testing or during measurements that involve ribbon fiber. This function enables the meter to make and display backreflection or loss measurements in groups of four.

To set multidisplay mode:

1. Press the MENU key.

2. Press the soft key labeled MULTI DISPLAY to change the status option from OFF to ON.

3. Press the MENU key.

4. Press the  or  key to change the channel in increments of four.

Measurements for the four output ports made with the $BR_0$, SETUP, and REF functions are made sequentially, with only a small time delay between each port. Therefore, when terminating the jumpers for $BR_0$ measurements, all four jumpers must be terminated at the same time. When terminating for SETUP and REF measurements, the light from all four jumpers must reach the detector at the same time (this is possible only through the use of ribbon fiber).

To reset the meter to single-channel display mode:

1. Set the power switch to **O** (off).

2. Turn the power switch to **I** (on).

3. Select the initialize option during power-up; or repeat the preceding procedure, selecting OFF rather than ON in step 2.

### Data Logging

The data logging function enables the user to download information from the meter to either a computer or a printer.

To set data logging:

1. Press the MENU key.

2. Press the soft key labeled LOG DATA to set the status option to ON. When the data logging function is on, the bottom soft key is labeled LOG.

3. Press the MENU key.

4. Press the soft key labeled LOG to transmit the most recent measurement via the GPIB or the RS232 serial port. The measurement is transmitted as ASCII text in the same format as it is displayed but with a two-letter prefix, for example, BR (backreflection), AP (absolute power), or RP (relative power).

If the data logging function is used with a computer, the computer must be either continuously waiting for data or serial polling the GPIB interface to test whether the meter is trying to send data.

To deactivate the data logging function:

1. Set the power switch to **O** (off).

2. Turn the power switch to **I** (on).

3. Select the Initialize option during power-up; or repeat the preceding procedure, selecting OFF rather than ON in step 2.

**Setup Using a Reference Reflector**

In ordinary use, the Setup function enables the front-panel detector to measure the connector loss of the measurement jumper. The Setup function adds an offset to the backreflection readings to compensate for this loss.

For a device with a known backreflection, the function of the SETUP key can be changed:

1. Press the MENU key.

2. Press the soft key labeled MORE MENUS.

3. Press the soft key labeled SETUP MENU.

4. Press the soft key labeled SETUP VIA: LOSS to set the status option to REFLECTION.

5. Press the soft key corresponding to the required wavelength.

6. Press the or key to adjust the reference reflection.

7. Press the POWER or BR key to exit Menu mode.

8. Attach the reference reflector to the output of the jumper.

9. Press the SETUP key. The meter measures the backreflection of the reference reflector. The meter assumes that the difference between the reading and the value stored in step 6 is caused by loss, and adjusts the offset to compensate for that loss in future measurements.

10. To have the meter perform the setup for both wavelengths, hold down the SETUP key for more than two seconds.

    If the key lamp is already lit, pressing the SETUP key turns off the key lamp and restores the standard offset of 0.3 dB.

To reset the meter to SETUP VIA: LOSS:

1. Set the power switch to **O** (off).

2. Turn the power switch to **I** (on).

3. Select the Initialize option during power-up; or repeat the preceding procedure, selecting LOSS rather than REFLECTION in step 4.

### Disabling Functions

When the RX3 meter is initialized at power-up, all sources, outputs, and keys are active. The user can disable sources, outputs, and keys to prevent their accidental or erroneous use.

To disable functions:

1. Press the MENU key.

2. Press the soft key labeled MORE MENUS.

3. Press the soft key labeled SET ACTIVE MENU.

4. Select the functions to be disabled from the SOURCES, OUTPUTS, or KEYS selections as described in Table 7.

**Table 7: Functions Capable of Being Disabled**

| Prompt | Option |
|---|---|
| SOURCES | To set the 1.3 laser or the 0.85 laser to OFF. The disabled source cannot be selected for backreflection or loss measurements. |
| OUTPUTS | To set any of the outputs to OFF. The / keys are not able to access the disabled outputs. |
| KEYS | |
| $BR_0$ | To set the $BR_0$ function to OFF. The last $BR_0$ value used (factory-set or user-stored) remains in effect. |
| SETUP | To set the SETUP function to OFF. The last offset value used (factory-set or user-stored) remains in effect. |
| INITIALIZE | To set the INITIALIZE function to OFF. The settings in effect at the time that the meter is powered off are restored. |
| MENU | To set the MENU function to OFF. The MENU key must be held down for two seconds before its functions can be accessed. |

## Messages and Symbols

The messages and symbols that can be displayed by the RX3 meter are described in Table 8.

**Table 8: Display Messages and Symbols**

| Display | Description |
|---|---|
| RX3-00 VX.XX | Displayed momentarily during the power-up sequence, indicating the software version (X.XX). |
| BACKREFLECTION | Backreflection mode |
| ABS POWER | Absolute Power mode |
| REL POWER | Relative Power mode |
| * | Displayed (flashes) when the BR value is within the last 5 dB of range |
| < | P or BR is lower than the minimum value. |
| > | P is greater than the maximum value. |
| -XX.X dB<br>BRo STORED | Displayed momentarily when the BR value (-XX.X dB) is being stored as $BR_0$. |
| MEASURING | Displayed momentarily when measuring DARK or when the SETUP key is pressed. |
| TOO MUCH LIGHT | Displayed momentarily when the DARK value is too high. |
| INPUT LOW | Displayed momentarily when the laser power is too low. |
| INPUT HIGH | Displayed momentarily when the laser power is too high. |
| BATTERY LOW! | Indicates that the RAM battery chip is low and, consequently, the stored values used to restore last settings can be faulty. |
| WARNING!<br>BRo HIGHER<br>THAN NORMAL | Displayed momentarily when the BR value being stored as $BR_0$ is between -22 dB and -47 dB. |
| BRo TOO HIGH<br>CHECK<br>TERMINATION | Displayed momentarily when the BR value being stored as $BR_0$ is greater than -22 dB. |
| OVERRANGE!<br>CONNECT HYBRID<br>TO DETECTOR | Displayed momentarily when SETUP is pressed and the front-panel detector does not receive enough light. |
| -X.X dB<br>OFFS STORED<br>VIA LOSS | Displayed momentarily when SETUP VIA: LOSS is completed successfully in Backreflection mode, and the offset (X.X dB) is stored. |
| -X.X dB<br>OFFS STORED<br>VIA BACKREF | Displayed momentarily when SETUP VIA: REFLECTION is completed successfully in Backreflection mode, and the offset (XX.X dB) is stored. |

| Display | Description |
|---|---|
| TRANSMITTING | Displayed when the LOG key is pressed. |
| | (table continued) |
| TIME OUT ERROR! | Displayed momentarily when the meter is unable to send out data through the GPIB or the RS232 port. |
| LOG | Indicates that the data logging option has been enabled. |
| RESTORE<br>LAST SETTINGS➔<br>INITIALIZE ➔ | Displayed during power-up, enabling the user either to restore the last settings used or to initialize the meter. |
| OFFS STORED | Displayed momentarily when the Setup function was successfully completed in Absolute or Relative Power mode. |

## Troubleshooting

If any problem described in this section persists, contact JDS Uniphase or your local representative.

All backreflection measurement is affected by the loss before the DUT and by reflections before and after the DUT.

### ❑ Loss Before the DUT

When a DUT is connected to the meter, the loss from the connectors affects the backreflection reading. Because the light is exiting from the meter and then returning, it goes through the connectors twice; consequently, the loss effect is doubled. If the loss is close to 0.15 dB, its effect is compensated automatically by the meter. If the loss differs substantially from 0.15 dB, follow the setup procedures described in the **Setting Up the Meter for Loss and Power Measurements** section.

### ❑ Reflections Before the DUT

When a device is connected to the RX3 meter, the reflections from the connectors affect the backreflection readings. The front panel FC/APC connection should have $BR_0$ no higher than -25 dB in order to provide backreflection to -40 dB. To ensure that the meter automatically compensates for these backreflections, follow the instructions in the **Setting Up the Meter for Loss and** Power Measurements section, and ensure that the backreflections do not change from the time of the setup.

### ❑ Reflections After the DUT

When making a backreflection measurement, the fiber after the DUT must be terminated to eliminate reflections from the end of the fiber. For best accuracy when making very low backreflection measurements, terminate near the DUT to eliminate reflections from the fiber itself.

### ❑ Front-Panel Connectors

Follow the maintenance procedure described in the **Maintaining the Meter** section to ensure that the internal pigtail connectors are clean and properly connected to the hinged door of the output module.

### ❑ Connector Loss and Backreflection

Ensure that the loss and backreflection levels of all the connectors are low and stable.

### ❑ Long Cables

Terminate long cables near the DUTs or connectors being tested to eliminate backreflections from the fiber.

### ❑ Laser Stability

If the message INPUT HIGH or INPUT LOW is displayed, lower the hinged door of the output module, connect one of the internal FC/APC connector to the detector, and press the POWER key. The reading is expected to be both steady and higher than -10 dBm. If the reading is as expected, but an error message persists, perform the appropriate procedure recommended in Table 9.

### ❑ Calibration

If the backreflection or power calibration was not performed properly, set CALBR to 0 dB and CALP to 0 dB (see the **Calibrating the Meter** section) to restore the factory-set calibration. This should provide reasonably accurate backreflection and power measurements.

### ❑ Other

A variety of other possible display messages and symbols are described in Table 9.

**Table 9: Other Messages and Symbols**

| Display | Problem | Solution |
|---|---|---|
| * | The backreflection or power measurement is approaching the range limit of the RX3 meter. | Follow the setup and measurement techniques described in the **Preparing the Meter for Backreflection** Measurements and **Setting Up the Meter for Loss and Power Measurements** sections. |
| < | BR range is very limited. | Follow the setup and measurement techniques described in the **Preparing the Meter for Backreflection** Measurements and **Setting Up the Meter for Loss and Power Measurements** sections. |
| TOO MUCH LIGHT | DARK value is too high. | Attach the detector cap to the detector, and press the DARK key. |
| INPUT LOW | Laser power is too low. | Check the measurement setup for an external source that can have entered the output. |
| INPUT HIGH | Laser power is too high. | Check the measurement setup for an external source that can have entered the output. |

(table continued)

| Display | Problem | Solution |
|---|---|---|
| WARNING!<br>BRo HIGHER<br>THAN NORMAL | Ignore the message. | Ignore the message. |
| BRo TOO HIGH<br>CHECK TERMINATION | Ignore the message. | Ignore the message. |
| OVERRANGE!<br>CONNECT HYBRID TO<br>DETECTOR | The detector is not getting enough light during setup. | Connect the jumper to the detector adapter. |
| TIME OUT ERROR! | The RX3 meter is unable to transmit data through the GPIB or the RS232C ports. | Ensure that the GPIB or the RS232 cables are properly connected to the RX3 meter and to the computer. |

## Calibrating the Meter

Annual calibration of the meter by JDS Uniphase is recommended.

In addition, to ensure the accuracy of backreflection, loss, and power measurements, the calibration of the meter needs to be checked periodically and adjusted, if required. Use only the calibrated hybrid jumper for all calibration procedures.

### Backreflection Calibration Adjustment

The meter has a factory-set backreflection calibration value (USERCAL) that compensates for the typical loss resulting from a connection to the front-panel FC/APC connector. This value appears in the Inspection Report (see the **Customized Features and Test Data** section).

To perform a backreflection calibration adjustment:

1. Press the BR key to set the meter to Backreflection mode. The mode is indicated on the display.

2. Clean and connect the FC/APC connector (green hood) of the calibrated jumper to the output port of the meter.

3. Press the  or  key to select the required output port.

4. Press the  key to select the wavelength at which the calibration check is to be performed (Choose either wavelength first, and then check the other as described in this procedure).

5. Attach the detector adapter to the detector on the front of the meter.

6. Clean and connect the output connector of the calibrated jumper to the detector adapter.

7. Press the SETUP key.

8. Disconnect the output connector of the calibrated jumper.

The value displayed on the RX3 meter must match the reference value that appears in the inspection report and on the label of the calibrated jumper.

If these values do not match, ensure that the FC/APC connector is properly connected to the meter, and clean all the connectors. If the values still do not match to within ±0.3 dB, adjust the backreflection calibration:

1. Press the MENU key to access Menu mode.

2. Press the soft key labeled MORE MENUS.

3. Press and hold the unlabeled (fourth) soft key until the calibration menu is displayed.

4. Press the soft key labeled CALIBRATE BR. The menu selections CAL and CLR are displayed.

5. To enter a new calibration setting, select CAL. To restore the original factory settings, select CLR. To exit the calibration menu without modifying any settings, press the MENU key.

If CAL is selected, the meter displays a series of prompts for each step remaining in the calibration procedure:

1. Press the  or  key to adjust the values displayed on the meter until these match the value marked on the calibrated jumper.

2. Press the soft key labeled DONE.

3. Connect each of the outputs to the external detector in sequence, and press the soft key labeled DONE after each output is connected. For the first channel only, connect the jumper between the output and the detector.

Each time the meter makes a measurement, the top soft key is labeled MEAS. To make the measurement again (and ensure that the value has not changed), clean and reconnect the last connection made, and press the MEAS key. If the values differ significantly, repeat this procedure until the values match.

1. Disconnect the calibrated jumper from the detector, and clean the connector end.

Any residue on the connector end can affects its reflection in air. Clean the connector end thoroughly with a lint-free tissue and alcohol, and rub the connector end against a clean lint-free tissue laid on a flat surface. The measurement must be repeated using the MEAS function to ensure its accuracy and stability. See the **Cleaning Connectors** section.

**Power Calibration Adjustment**

To perform a power calibration adjustment:

1. Press the POWER key to set the meter to Absolute Power mode, which is indicated on the screen as ABS.

2. Clean and connect the FC/APC connector (green boot) of the calibrated jumper to an output port of the meter.

3. Press the or key to select the required output port.

4. Press the key to select the wavelength at which the calibration check is to be performed (choose either wavelength, as you will check both).

5. Measure the power from the output of the calibrated jumper, using a highly accurate, calibrated power meter. The calibration of the power meter must be set exactly for the wavelength being used. This setting appears in upper, right corner of the meter display. Note the number on the power meter.

6. Attach the FC detector adapter to the detector on the meter.

7. Connect the output connector of the calibrated jumper to the detector adapter. The value displayed on the meter must match the value measured by the power meter to within ±0.25 dBm.

If the values do not match, adjust the value of USERCAL:

1. Press the MENU key to access Menu mode.

2. Press the soft key labeled MORE MENUS.

3. Press and hold the unlabeled (fourth) soft key until the calibration menu is displayed.

4. Press the soft key labeled CALIBRATE POWER. The calibration factor is displayed.

5. To adjust the calibration factor, press the or key to scroll to the required setting. This calibration factor is used by the meter.

6. If desired, press the CLR key to clear the calibration factor (set to 0.00). CLR sets the calibration factor to the original factory setting.

## Maintaining the Meter

### Cleaning the Connector Ends

Clean all connector ends with a lint-free tissue and alcohol before every mating. See the **Cleaning Connectors** section. The internal connectors can be accessed using the hinged door of the output module:

1. Press the push-button fastener on the output door, and lower the output module door.

2. Remove the connectors from the mating sleeves in the door.

3. Clean the connector endfaces and mounting sleeves, using a cotton swab dampened with methanol or isopropyl alcohol.

4. Reinstall the connectors on the door.

5. Raise the output module door, and press the push-button fastener to secure it. To avoid damaging the input and output port fibers, make one or two large loops in the fibers when raising the door.

# Programming Guide

The following programming instructions for the RX3 meter are intended for users who are familiar with remote interfaces and how to send or receive messages over a device.

A detailed description of the GPIB interface is in *ANSI/IEEE Std. 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation* published by the Institute of Electrical and Electronics Engineers.

There are two external interfaces for remote control of the RX3 meter: a GPIB parallel interface and an RS232 serial interface. Via either interface, the meter can be controlled by a computer and can transmit the measured values of backreflection, absolute power, and relative power to external devices, such as a printer. A measurement is transmitted as ASCII text in the same format as it is displayed on the meter, but preceded by a two-letter code—BR (backreflection), AP (absolute power), or RP (relative power).

Both interfaces can be set to emulate the interface command set of JDS Uniphase RX1000 Series Backreflection and Loss Test Sets. In RX1000 emulation mode, the measurements displayed by the RX3 meter include the prefixes BR+, PR=, and L= to identify backreflection, power, and loss measurements, respectively.

The RX1000 displayed loss is the negative value corresponding to the value of the displayed relative power.

## GPIB Interface

### GPIB Interface Pin Assignment and Functions

The required GPIB pin assignment is shown in Figure 15 and the functions are listed in Table 10.

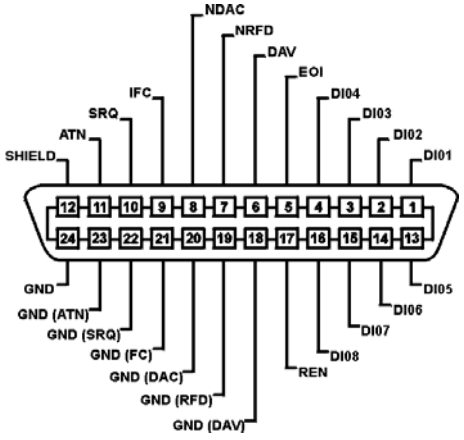


**Figure 15: GPIB Pin Assignment**

**Table 10: GPIB Functions**

| Mnemonic | Function Name |
|---|---|
| SH1 | Source handshake, complete capability. |
| AH1 | Acceptor handshake, complete capability. |
| T6 | Basic talker, serial poll, unaddressed if MLA. |
| L4 | Basic listener, unaddressed if MTA. |
| SR0 | No service request capability. |
| RL2 | Remote/local, complete capability. |
| PP0 | Parallel poll, no capability. |
| DC0 | Device clear, no capability. |
| DT0 | Device trigger, no capability. |
| C0 | Controller, no capability. |
| E1 | Electrical interface, open collector drivers. |

### Setting the GPIB Interface Address

To set the GPIB address:

1. Press the MENU key.
2. Press the soft key labeled REMOTE MENU.
3. Press the soft key labeled EMULATION: RX3 emulation, or press the key again to select RX1000 emulation.
4. Press the soft key labeled INTERFACE: to set the interface to GPIB. The GPIB address is displayed.
5. Press the or key to set the interface to the required address.
6. Press the BR or POWER key to exit Menu mode.

### GPIB Standard Commands

The GPIB standard commands are listed in Table 11.

**Table 11: GPIB Standard Commands**

| Command | Operation |
|---|---|
| REMOTE ENABLE | Lockout keypad. |
| RETURN TO LOCAL | Enable keypad. |
| INTERFACE CLEAR | Resets the interface to the default setting. |
| ENTER | Read measurement. |
| OUTPUT | Write a device-dependent command. |
| SPOLL | Serial poll. |

### Status Codes of the Serial Poll Register

The status codes of the serial poll register are listed in Table 12.

**Table 12: Status Codes of the Serial Poll Register**

| Code | Meaning |
|---|---|
| 0 | RX3 meter is ready to receive commands. |
| 1 | RX3 meter is busy executing commands. |
| 3 | RX3 meter is trying to send commands. |

### GPIB Device-Dependent Commands

The GPIB device-dependent commands are listed in Table 13.

**Table 13: GPIB Device-Dependent Commands**

| Command | Operation |
|---|---|
| A01E | Select LED source for Power mode. |
| A02E | Select laser source for Power mode. |
| A03E | Turn averaging function on. |
| A04E | Turn averaging function off. |
| A05E | Switch to Relative Power mode. |
| A06E | Switch Absolute Power mode. |
| A07E | Switch source[1]. |
| A08E | Switch to Backreflection mode. |

(table continued)

| Command | Operation |
|---|---|
| A09E | Measure dark signal[2]. |
| A11E TO A30E | Set output channel (command = channel number +10). |
| A41E | Select 1.3 source if available. |
| A42E | Select 1.5 source if available . |
| A45E | Set relative power reference. |
| A46E | Perform Setup measurements. |
| A47E | Measure $BR_0$[3]. |
| A50E | Set $BR_0$ to 99.9 dB[3]. |
| A51E | Initialize meter[4]. |

[1] Same as key.
[2] Valid in Power mode only.
[3] Valid in BR mode only.
[4] Same as initialize.

## RS232 Interface

### RS232 Pin Assignment and Functions

The RS232 pin assignment is shown in Figure 16 and the interface functions are listed in Table 14.

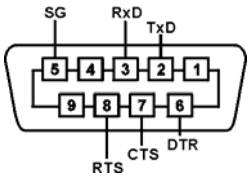


**Figure 16: RS232 Pin Assignment**

**Table 14: RS 232 Functions**

| Name | Symbol | Pin Number | Signal Direction |
|---|---|---|---|
| Transmitted data | TxD | 2 | |
| Received data | RxD | 3 | |
| Request to send | RTS | 8 | |
| Clear to send | CTS | 7 | |
| Data carrier detect | DCD | 4 | |
| Data terminal ready | DTR | 6 | |
| Signal ground | SG | 5 | |

### Setting the RS232 Serial Interface

To set the RS232 interface:

1. Press the MENU key.
2. Press the soft key labeled REMOTE MENU.
3. Press the soft key labeled EMULATION: RX3.
4. Press the soft key labeled INTERFACE: RS232. The GPIB address is displayed.
5. Press the or key to set the interface to the required address.
6. Press the BR or POWER key to exit Menu mode.

The RS232 serial interface is configured as Data Terminal Equipment (DTE) and operates at 1200 baud. The communication protocol is set to ASCII character code with eight bits per character, two stop bits, and no parity bits.

To connect the RX3 meter to the serial port of a DTE (computer), use a straight-through cable.

On power-up, the RTS and DTR signals on the interface connector become positive, indicating that the RS232 interface is ready to communicate. The interface controller then waits for the CTS line to become positive before the measurements are transmitted. For the RX3 meter to receive commands, the DCD line must become positive.

To initiate each measurement and transmission, the command G must be sent to the RX3 meter. In addition, other commands can be sent via the RS232 interface to control the meter.

### RS232 Device-Dependent Commands

The RS232 interface device-dependent commands are listed in Table 15.

**Table 15: RS232 Device-Dependent Commands**

| Command | Operation |
|---|---|
| A00E | Lockout key pad. |
| A01E | Select LED source for Power mode. |
| A02E | Select laser for Power mode. |
| A03E | Turn averaging function on. |
| A04E | Turn averaging function off. |
| A05E | Switch to Relative Power mode. |
| A06E | Switch Absolute Power mode. |
| A07E | Switch source[1]. |

| Command | Operation |
|---|---|

(table continued)

| | |
|---|---|
| A08E | Switch to Backreflection mode. |
| A09E | Measure dark signal[2]. |
| A11E TO A30E | Set output channel (command = channel number 10). |
| A41E | Select 1.3 source if available. |
| A42E | Select 0.85 source if available. |
| A45E | Set relative power reference. |
| A46E | Perform SETUP measurements. |
| A47E | Measure $BR_0$[3]. |
| A50E | Set $BR_0$ to 99.9 dB[3]. |
| A51E | Initialize meter[4]. |
| A99E | Enable keypad. |

[1] Same as key.
[2] Valid in Power mode only.
[3] Valid in BR mode only.
[4] Same as initialize.

When the keypad is locked out, the computer controls the meter and the only key that functions on the meter is the I/O (on/off) key.

## Programming Examples

### GPIB Interface Programming Example

The following sample program, written in MS-DOS[2] Qbasic, controls the RX3 meter. It can be used with an IOTECH GP4**A interface board.

All GPIB messages must end with the terminating sequence <CR> <LF>.

```
10    OPEN "\DEV\IEEEOUT" FOR OUTPUT AS #1
20    OPEN "\DEV\IEEEIN" FOR INPUT AS #2
30    PRINT #1, "TERM CR LF"                ' set terminating characters
                                            ' (IOTECH)
40    PRINT #1, "CLEAR 05"                  ' interface clear
50    PRINT #1, "REMOTE 05"                 ' lockout keypad
60    PRINT #1, "OUTPUT 05; A08E"           ' backreflection mode
70    PRINT #1, ENTER 05                    ' read measurement
80    INPUT #2, READING$
90    PRINT READING$                        ' display measurement
100   PRINT #1, "LOCAL 05"                  ' enable keypad
```

[2] MS-DOS is a trademark of Microsoft Corporation.

```
110    END
```

**RS232 Interface Programming Example**

The following sample program, written in MS-DOS Qbasic, controls the RX3 meter.

All RS232 messages must end with the terminating sequence <CR>.

```
10     OPEN "COM1 : 1200, N, 8, 2" AS #1
20     PRINT #1, "A00E"                        ' lockout keypad
30     PRINT #1, "A08E"                        ' backreflection mode
40     PRINT #1, "G"                           ' read measurement
50     INPUT #1, READING$
60     PRINT READING$                          ' display measurement
70     PRINT #1, "A99E"                        ' enable key pad
80     CLOSE #1
70     END
```

## Customized Features and Test Data

# Service

## Storing and Shipping

To maintain optimum operating reliability, do not store the unit in locations where the temperature falls below -40 °C or rises above 70 °C. Avoid any environmental condition that can result in internal condensation. Ensure that these temperature and humidity requirements can also be met whenever the unit is shipped.

## Claims and Repackaging

Immediately inform JDS Uniphase and, if necessary, the carrier, if

The contents of the shipment are incomplete
The unit or any of its components are damaged or defective
The unit does not pass the initial inspection

In the event of carrier responsibility, JDS Uniphase will allow for the repair or replacement of the unit while a claim against the carrier is being processed.

### Returning Shipments to JDS Uniphase

JDS Uniphase only accepts returns for which an approved Return Material Authorization (RMA) has been issued by JDS Uniphase sales personnel. This number must be obtained prior to shipping any material to JDS Uniphase. The owner's name and address, the model number and full serial number of the unit, the RMA number, and an itemized statement of claimed defects must be included with the return material.

Ship return material in the original shipping container and packing material. If these are not available, packaging guidelines are as follows:

1. Cover the front panel with a strip of foam.

2. Wrap the unit in anti-static packaging.

3. Pack the unit in a reliable shipping container.

4. Use enough shock-absorbing material (10 to 15 cm or 4 to 6 in on all sides) to cushion the unit and prevent it from moving inside the container. Pink poly anti-static foam is the recommended material.

5. Seal the shipping container securely.

6. Clearly mark FRAGILE on its surface.

7. Always provide the model and serial number of the unit and the RMA number on any accompanying documentation.

Please contact the RMA department, using the contact information at the beginning of this document, to provide an RMA number and a shipping address.