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IQ-3400

Polarization Dependent/Optical Loss Meter

Instruction Manual

October 1998
P/N: MAN-109-I .2ACE

Second Edition

CE

If the equipment described herein bears the CE *symbol, the said equipment complies with the European Community Directive and Standards found in the Declaration of Conformity.*

If the equipment described herein bears an **FCC** *statement, the said equipment complies with the relevant Federal Communications Commission standards.*

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CONTENTS

Certification Information vi

1 INTRODUCTION 1-1

1.1 IQ-200 Optical Test System Product Line 1-1
1.2 Unpacking and Inspection 1-2
1.3 Safety Conventions 1-3
1.4 Transportation and Storage 1-3
1.5 Getting Help 1-4

2 PRODUCT OVERVIEW 2-1

2.1 Front Panel Description 2-2
2.2 Module Setup 2-4
2.3 Optical Connections 2-5
2.4 Module Removal 2-5

3 GENERAL DESCRIPTION 3-1

3.1 Title Bar and Menu Bar 3-2
3.2 Function Buttons 3-3
3.3 Function Sheet 3-4
3.4 Status Bar 3-7
3.5 Monitor Window 3-7

4 GENERAL OPERATION 4-1

4.1 Launching the Application 4-1
4.2 General Setup 4-1
4.3 Acquisition Setup 4-5
4.4 Starting and Stopping the Acquisition 4-8
4.5 Exiting the Application Software 4-8

5 TESTING WITH THE IQ-3400 PDL/OL METER 5-1

5.1 DUT Calibration 5-2
5.2 DUT Testing 5-3
5.3 DUT Results 5-5
5.4 Coupler Calibration 5-6
5.5 Coupler Testing 5-7

6 ORL TESTING WITH THE IQ-3400 PDL/OL METER 6-1

6.1 ORL Application General Description 6-1
6.2 ORL Calibration 6-5

6.3 ORL Testing 6-9

7 GRAPHICAL DISPLAY MODE 7-1

7.1 Graphical Display Mode Menu Bar 7-2
7.2 Function Buttons 7-3
7.3 Display Tabs and Display Area 7-3
7.4 Channel Selection 7-4
7.5 Zoom Control 7-6
7.6 Markers 7-6
7.7 Alarms 7-8
7.8 Display 7-9

8 MAINTENANCE AND TROUBLESHOOTING 8-1

8.1 Maintenance 8-1
8.2 Calibration 8-2
8.3 Troubleshooting 8-2

9 TECHNICAL SPECIFICATIONS 9-1

10 WARRANTY 10-1

10.1 General Information 10-1
10.2 Liability 10-2
10.3 Exclusions 10-2
10.4 Certification 10-2
10.5 Service and Repairs 10-2

GLOSSARY GLOSSARY-1

INDEX INDEX-1

FIGURES

Figure 2-1 Module Nameplate 2-1
Figure 2-2 Front Panel of the IQ-3400 PDL/OL Meter 2-2
Figure 2-3 IQ-3400 Block Diagram 2-3
Figure 2-4 Removing an IQ Module 2-6
Figure 3-1 PDL/OL Meter Main Window 3-1
Figure 3-2 CPL Results Page 3-5
Figure 3-3 DUT Results Page 3-6
Figure 3-4 Monitor Window for ORL Measurement 3-8
Figure 4-1 Wavelength Setup Window 4-2
Figure 4-2 Scan Setup Window 4-3
Figure 4-3 Settings Sheet 4-4
Figure 4-4 Acquisition Setup Window 4-6
Figure 5-1 DUT Test Mode Calibration Setup 5-2
Figure 5-2 Calibration Results 5-3
Figure 5-3 DUT Test Mode Acquisition Setup 5-4
Figure 5-4 DUT Test Results 5-5
Figure 5-5 CPL Test Mode Calibration Setup 5-6
Figure 5-6 Coupler Test Mode Setup 5-7
Figure 5-7 Coupler Test Mode Results Page 5-8
Figure 6-1 ORL Main Window 6-1
Figure 6-2 Reference Box 6-6
Figure 6-3 Reference Calibration—Zero Measurement 6-7
Figure 6-4 ORL Calibration Setup 6-8
Figure 6-5 ORL Test Mode Setup 6-9
Figure 6-6 Terminating the Test Jumper—ORL Measurement 6-10
Figure 6-7 Display when Making ORL Measurements 6-11
Figure 7-1 Graphical Display Mode Window 7-1
Figure 7-2 Curve in Display Area (Graph) 7-4
Figure 7-3 Channel Results in Display Area (Table) 7-4
Figure 7-4 Channel Selection Page 7-5
Figure 7-5 Zooms Control Page 7-6
Figure 7-6 Magnifying Glass 7-6
Figure 7-7 Markers Page 7-7
Figure 7-8 Display Area 7-7
Figure 7-9 Alarms Page 7-8
Figure 7-10 Display Page 7-9

CERTIFICATION INFORMATION

F.C.C. INFORMATION TO USER

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

WARNING

Changes or modifications not expressly approved by EXFO Electro-Optical Engineering could void the user's authority to operate the unit.

INDEPENDENT LABORATORY TESTING

This unit has undergone extensive CE certification testing both internally, at EXFO, and externally, at an independent, qualified laboratory. All pre-qualification tests were performed at EXFO while all final tests were performed at UltraTech Engineering Labs Inc., a renowned test laboratory from Mississauga, Canada. This guarantees the unerring objectivity and authoritative compliance of all test results.

CE INFORMATION TO USER

This unit has been tested and found to comply with the limits for a Class A digital device. Please see the Declaration of Conformity.

1 INTRODUCTION

EXFO E. O. Engineering Inc. (EXFO) is pleased to introduce the IQ-3400 Polarization Dependent/Optical Loss Meter module as part of the IQ-200 Optical Test System product line.

EXFO's commitment to superior design in all its fiber-optic instrumentation is respected throughout the industry and is based on the following four goals:

- reliable and accurate performance
- simple operation
- extensive features
- dedicated interest in customer needs

The IQ-3400 PDL/OL Meter module will provide many years of reliable operation. To benefit fully from the many features offered by the IQ-3400 PDL/OL Meter module, it is important to read the following instructions thoroughly.

1.1 IQ-200 Optical Test System Product Line

The IQ-200 Optical Test System product line is a modular optical test system designed for laboratory applications. Thanks to the Windows™ compatible IQ Software, the IQ-200 Optical Test System combines power, performance, and flexibility with a user-friendly interface. The main components of the system are the IQ-203 Mainframe, which can house three modules, and the IQ-206 Expansion Unit, which can house six modules. It is also possible to control one or several IQ-206 Expansion Units with an IQ-206 PC Expansion Card.

For more information on the IQ-200 Optical Test System and the IQ Software, please refer to the *IQ-200 Optical Test System Instruction Manual*.

1.2 Unpacking and Inspection

The IQ-3400 PDL/OL Meter module is delivered with the following standard items:

- IQ-3400 Polarization Dependent/Optical Loss Meter Instruction Manual
- reference jumper
- two FC-UPC FOA
- backup floppy disk
- accessory kit
- Certificate of Quality
- Declaration of Conformity
- warranty validation card

The IQ-3400 PDL/OL Meter module has been thoroughly inspected before shipment. If any damage has occurred during transportation or if any item is missing, please notify EXFO immediately. Retain the original packing material in case you need to return the IQ-3400 PDL/OL Meter module.

1.3 Safety Conventions

The following conventions are used throughout the manual and should be understood before operating the unit:

WARNING	Refers to a potential *personal* hazard. It requires a procedure which, if not correctly followed, may result in bodily harm or injury. Do not proceed beyond a **WARNING** unless the required conditions are fully understood and met.
CAUTION	Refers to a potential *product* hazard. It requires a procedure which, if not correctly followed, may result in component damage. Do not proceed beyond a **CAUTION** unless the required conditions are fully understood and met.
IMPORTANT	Refers to any information regarding the operation of the product which should not be overlooked.

1.4 Transportation and Storage

Maintain a temperature range within specifications when transporting or storing the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in the original packing material when shipping.
- Store unit at room temperature in a clean and dry area. Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shock and vibration.

1.5 Getting Help

If any difficulty is encountered while operating the unit, please call EXFO at one of the offices listed below. The Customer Service Group is available from 7:30 a.m. to 8:00 p.m. eastern time, Monday to Friday.

Corporate Headquarters
465 Godin Avenue
Vanier QC
G1M 3G7
Canada

1-800-663-3936 (USA and Canada)
Tel.: (418) 683-0211
Fax: (418) 683-2170
support@exfo.com
www.exfo.com

EXFO Europe
Centre d'Affaires-Les Metz
100, rue Albert Calmette
78353 Jouy-en-Josas, France

Tel.: 33-1-34.63.00.20
Fax: 33-1-34.65.90.93

2 PRODUCT OVERVIEW

The IQ-3400 is designed for laboratory and manufacturing measurement applications using the IQ-203 Mainframe or an IQ-206 Expansion Unit.

The IQ-3400 supports both local and remote control. Local control is via the Windows compatible software preinstalled on the IQ-203 or installed on a host PC when using the IQ-206 and PC expansion card.

Remote control of the IQ-3400 is accomplished either through a GPIB Interface or via a Windows Dynamic Data Exchange (DDE) communication channel. Please refer to the *IQ-200 GPIB and Application Development Guide* for detailed information about remote control of the IQ components.

The product nameplate is located on a side panel near the rear of the module.

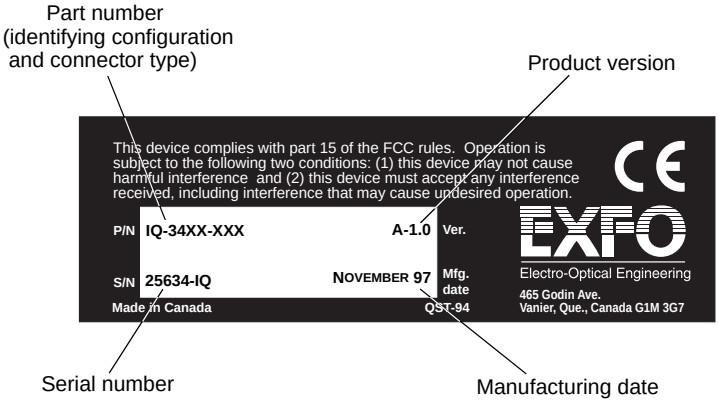


Figure 2-1 Module Nameplate

***Note**: The information found on the nameplate will differ according to the module configuration.*

2.1 Front Panel Description

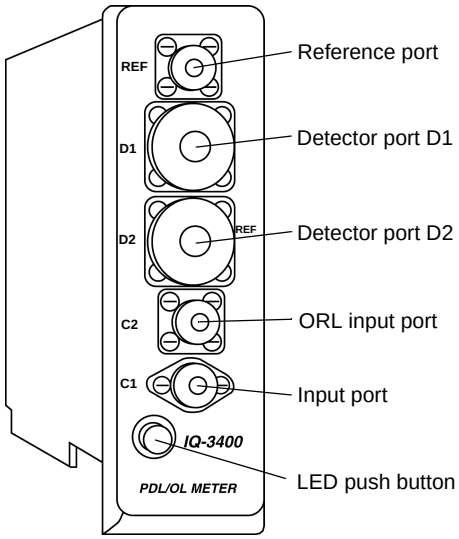


Figure 2-2 Front Panel of the IQ-3400 PDL/OL Meter

2.1.1 Optical Ports

There are two detector ports located on the front panel of the module.

- D1
- D2

When making PDL measurements on single output components, detector D2 must be used. When making ORL measurements on single output components, use detector D1. When making loss measurements on double output components, both detectors are used.

There are three optical ports located on the front panel of the module:

- C1
- C2
- REF

C1 is an input APC connector to which the DUT is connected. C2 and C3 are UPC connectors. C2 is the source input. REF is connected to the D1 detector on single output components to provide the reference measurement.

For detailed information on optical connections for specific tests, see Section 5, *Testing with the IQ-3400 PDL/OL Meter*, and Section 6, *ORL Testing with the IQ-3400 PDL/OL Meter*.

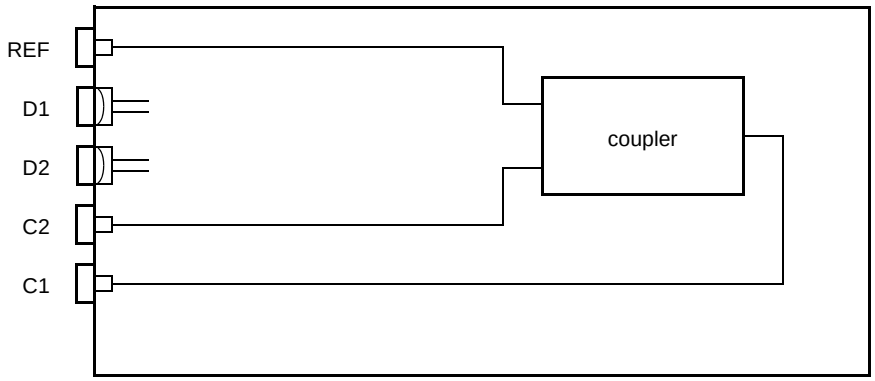


Figure 2-3 IQ-3400 Block Diagram

IMPORTANT

It is very important to keep optical ports clean. The protective caps should always be installed when the module is not being used.

2.1.2 LED Push Button

The LED push button on the front panel has three functions:

- When the IQ-203 is powered on, the LED will illuminate.
- Pressing the LED push button opens the main window.
- Pressing the LED push button when the main window is active opens the monitor window.

***Note**: The monitor window is a compact window displaying basic data and is fully explained in Section 3.5, Monitor Window.*

2.2 Module Setup

CAUTION

Never insert or remove any module when the IQ-203 mainframe unit or the IQ-206 Expansion Unit are powered on. This will result in immediate, irreparable damage to the module and the IQ-203/IQ-206.

To insert the module

1. Power off the IQ-203/IQ-206.
2. Insert the IQ module into any available slot. The IQ-203/IQ-206 will automatically recognize the selected slot.

IMPORTANT

Be sure to insert the module all the way to the back of the IQ-203/IQ-206 to ensure that the backplane connectors are properly mated. The module is correctly inserted when the module front panel is flush with the IQ-203/IQ-206 front panel.

2.3 Optical Connections

IMPORTANT

Always clean fiber end prior to insertion into the port as explained below.

The fiber-optic cable end should be cleaned at all times to ensure optimum performance and avoid erroneous readings.

To clean the fiber end

1. Gently wipe the end with a lint-free swab dipped in isopropyl alcohol.
2. Dry using clean compressed air.

To connect the fiber-optic cable to the port

1. Ensure the connector is dry.
2. Align the connector and port to avoid the fiber end touching the outside of the port or rubbing against other surfaces.
3. Do not overtighten.

2.4 Module Removal

CAUTION

Never insert or remove any module while the IQ-203/IQ-206 is powered on. This will result in immediate, irreparable damage to the module and the IQ-203/IQ-206.

Depending on the locking system with which the module is designed, there are two ways to remove an IQ module from the IQ-203 Mainframe/IQ-206 Expansion Unit.

1. With the IQ-203 Mainframe/IQ-206 Expansion Unit powered off, place fingers under the front panel of the module and firmly pull module outward.

2. Put one of the supplied protective covers over the empty slot to prevent dust from entering the module housing.

Or

1. As shown in Figure 2-4, with the IQ-203 Mainframe/IQ-206 Expansion Unit powered off, push up the locking mechanism under the front panel of the module.

2. Pull out the module.

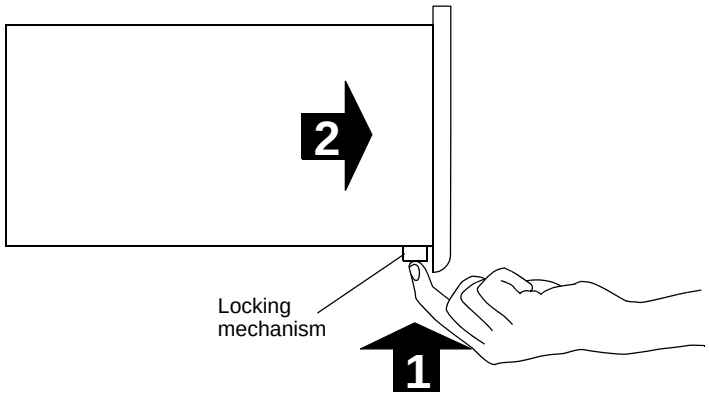


Figure 2-4 Removing an IQ Module

3. Put one of the supplied protective covers over the empty slot to prevent dust from entering the module housing.

3 GENERAL DESCRIPTION

The main window can be broken down into four sections:

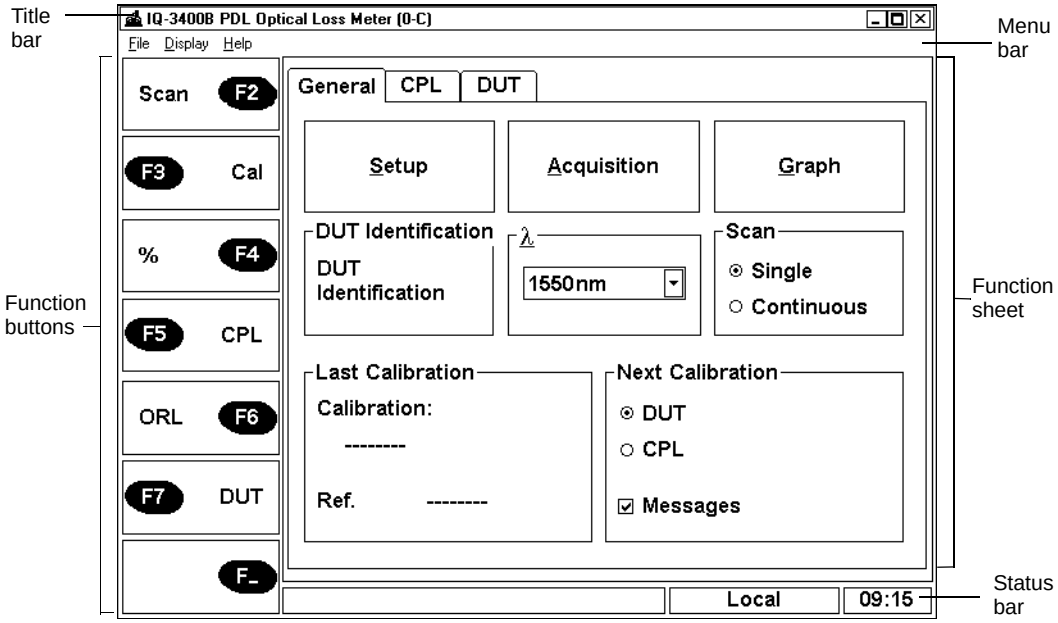


Figure 3-1 PDL/OL Meter Main Window

- title bar and menu bar
- function buttons
- function sheet
- status bar

3.1 Title Bar and Menu Bar

The title bar and menu bar are located at the top of the main window. The title bar indicates the active application. The menu bar, described in Table 3-1, contains three drop-down menus.

Menu	Item	Function
File	Open Config...	Opens a previously saved configuration.
	Save Config...	Saves the current configuration.
	Exit	Closes the application.
Display	Monitor	Opens the monitor window, which displays basic loss meter data (refer to Section 3.5, *Monitor Window* for details).
Help	Online Manual...	Displays the contents of this manual.
	About	Opens a window that provides the following information: • module type and serial number • software version • technical assistance telephone numbers • available IQ-203 system memory (includes RAM and virtual memory) • remaining hard disk drive storage space

Table 3-1 Main Window Drop-Down Menus

3.2 Function Buttons

Function buttons are located on the left side of the main window.

Button	Function
Scan F2	Starts the acquisition scan according to specified setup. The **Scan** button is enabled only when an acquisition mode (CPL or DUT) is selected. This button reads **Stop** when scanning is in progress. Keyboard shortcut: F2
F3 Cal	Opens the **Calibration** sheet that corresponds to the device being tested (CPL or DUT) and performs a reference measurement and calibration. The **Cal** button is enabled only when the **General** page is active. Keyboard shortcut: F3
% F4	Toggles display units between dB and %. Keyboard shortcut: F4
F5 CPL	Activates Coupler PDL/OL acquisition mode. Keyboard shortcut: F5
ORL F6	Switches to ORL window and gives access to ORL measurement functions. When ORL mode is active, this button displays **PDL** to give access back to PDL mode. Keyboard shortcut: F6
F7 DUT	Activates DUT PDL/OL acquisition mode. Keyboard shorcut: F7
F_	Transfers control to the IQ-203 front panel function keys (refer to the *IQ-200 Optical Test System Intruction Manual*).

Table 3-2 Function Buttons

***Note**: The function buttons are also available in monitor window mode. Place the cursor in the monitor window and press the right mouse button.*

3.3 Function Sheet

The function sheet, located at the bottom of the screen, contains three pages: **General**, **CPL**, and **DUT**.

3.3.1 General Page

Choosing any of the buttons in the **General** page (see Figure 3-1, on page 3-1) opens a window allowing the user to define and customize various operating parameters. Table 3-3 describes the function of each button.

Button	Description
Setup	Opens the *Setup* window allowing the user to select various on screen measurement parameters. See Section 4.2, *General Setup*, for details.
Acquisition	Opens the *Acquisition Setup* window. See Section 4.3, *Acquisition Setup*, for details.
Graph	Activates graphical display mode where acquisition data can be seen as a continuous trace. For more information about Graph mode, see Section 7, *Graphical Display Mode*.

Table 3-3 Parameter Definition Buttons

Three other groups are available: **DUT identification**, λ, and **Scan**. The information appearing in the **DUT Identification** group is the information entered in the **Settings** page, see Section 4.2.3, *General Settings*. The λ drop-down list contains the list of wavelengths entered in the **Wavelength** page, see Section 4.2.1, *Wavelength Setting*. The **Scan** group allows the user to select a single scan or continuous scanning.

The last two groups available are **Last Calibration** and **Next Calibration**. The first group gives the last calibration results. The latter allows the user to decide the type of calibration to make (DUT or CPL) and whether warning messages should appear during the calibration process.

3.3.2 CPL Page

To select the **CPL** page, click the corresponding tab or the **CPL** function button. CPL stands for coupler. This page displays coupler analysis results.

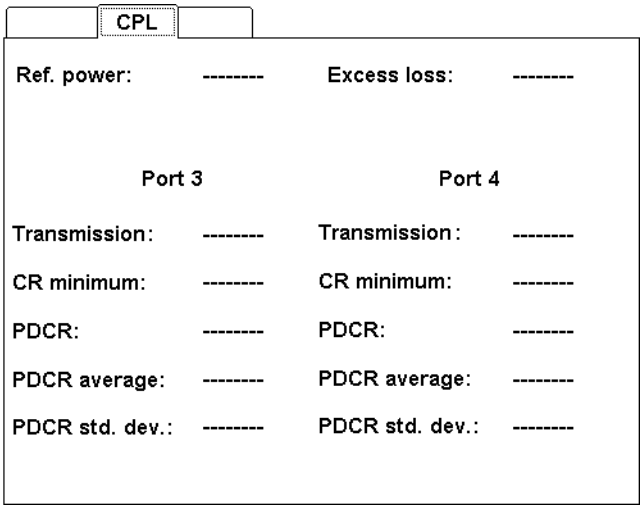


Figure 3-2 CPL Results Page

For information about this page and instructions on how to set up a coupler analysis, see Section 5, *Testing with the IQ-3400 PDL/OL Meter*.

3.3.3 DUT Page

IMPORTANT

DUT stands for device under test and is used in this document to differentiate a device with one output from a device with two outputs.

To select the **DUT** page, click the corresponding tab or the **DUT** function button. The DUT page shows results for other devices.

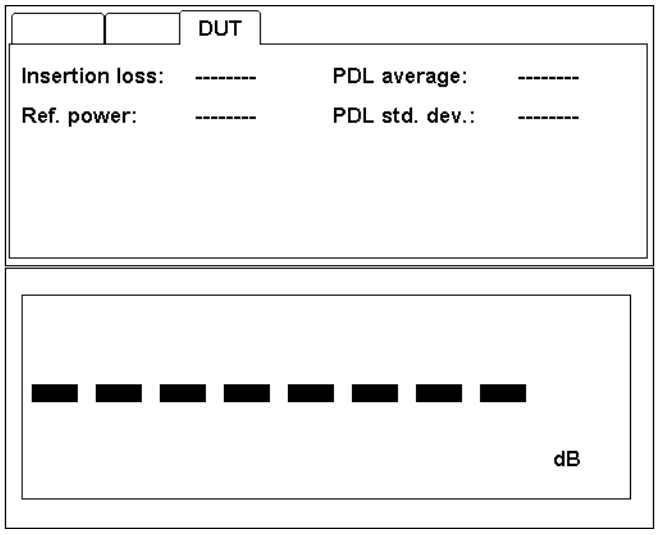


Figure 3-3 DUT Results Page

For information about this page and instructions on how to set up a DUT analysis, see Section 5, *Testing with the IQ-3400 PDL/OL Meter*.

3.4 Status Bar

The status bar displays the current module status:

- **Waiting for start time** - Data acquisition will begin after a specified time.
- **Acquiring** - Data acquisition is in progress.
- **Processing...** - The IQ-203 is processing the latest commands.

On the status bar, you also find the inscription **Local**, **Remote**, or **Lockout**, which indicates if the IQ-3400 PDL/OL module is controlled locally or through a GPIB link. Table 3-4 explains the meaning of these inscriptions. For more information on how to control the different IQ modules through a GPIB link, refer to the *GPIB and Application Development Guide*. Finally, the status bar displays the time.

Indication	Meaning
Local	The unit is controlled locally.
Remote	The unit is controlled through a GPIB link but local commands can still be used.
Lockout	The unit is exclusively controlled through a GPIB link.

Table 3-4 Module Control Status

3.5 Monitor Window

The monitor window displays basic loss meter data. Using the monitor window in conjunction with other IQ monitor windows will allow the user to create an integrated data display screen (for further information, refer to *IQ-200 Optical Test System Instruction Manual*). The size and position of the monitor window can be adjusted.

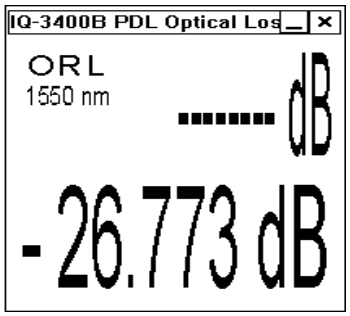


Figure 3-4 Monitor Window for ORL Measurement

***Note**: The information displayed in the monitor window varies according to the measurement mode that is currently active.*

3.5.1 Opening the Monitor Window

There are three ways to open the monitor window:

- In the main window, choose **Monitor** from the *Display* menu.
- In the main window, click on the bar icon in the upper right corner of the main window.
- Push the LED push button on the front panel of the switch module.

3.5.2 Closing the Monitor Window

There are two ways to close the monitor window and return to the main window:

- Double-click anywhere in the monitor window.
- Push the LED push button on the front panel of the module.

***Note**: The function buttons can be accessed while in monitor window mode by positioning the cursor inside the monitor window and clicking the right mouse button. The function button keypad will appear to the left of the monitor window.*

4 GENERAL OPERATION

This section describes the steps prior to acquisition and how to start and stop an acquisition.

4.1 Launching the Application

There are two ways to load the application software:

- Press the LED push button on the front panel.
- Double-click on the IQ-3400 icon in the *IQ-200 Optical Test System* main window.

Once the IQ-3400 application software is loaded, the IQ-3400 main window opens, see Figure 3-1. The main window contains all the necessary commands to control the PDL/OL Meter.

4.2 General Setup

Acquisitions can be viewed on screen only, or viewed on screen and saved in a file. The **Setup** button configures on screen only acquisitions, while the **Acquisition** button, see Section 4.3, *Acquisition Setup*, configures acquisitions that will be saved to files.

The **Setup** button, on the **General** page, opens the *Setup* window. The *Setup* window contains three different pages: **Wavelength, Scan**, and **Settings**, where the different acquisition parameters can be adjusted. At the bottom of the window, there are three buttons: **Null**, **OK**, and **Cancel**. **Null** allows the user to eliminate the electronic offsets. This action is recommended before each testing session. **OK** must be selected to validate the information and setup entered in the different pages and close the window. **Cancel** exits the window without making any changes.

Note: **Null** *is only available when the* **Settings** *page is active.*

4.2.1 Wavelength Setting

The choice of the test wavelength is made from this page.

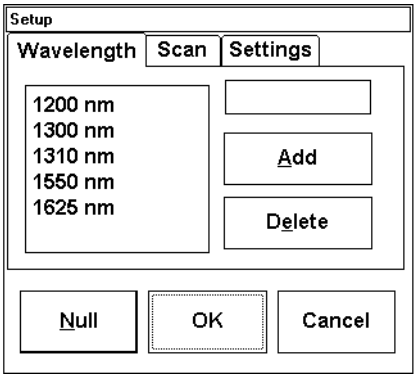


Figure 4-1 Wavelength Setup Window

The selected wavelengths appear in the list box and are chosen as follows:

1. Select the **Wavelength** tab.

2. Type the desired wavelength in the edit box.

The wavelength range covered by the IQ-3400 PDL/OL Meter module goes from 1200 nm to 1625 nm inclusively.

3. Click **Add** to transfer the value to the list.

To erase values from the list

1. Select the value to be deleted.

2. Click **Delete**.

4.2.2 Scan Settings

The **Scan** page allows the user to adjust acquisition times and number, as well as the display mode. These settings are especially useful for long term DUT reliability testing or for environmental (temperature, moisture, pressure) variation testing.

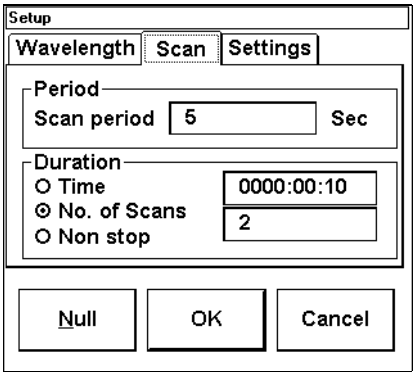


Figure 4-2 Scan Setup Window

The **Scan Period** setting is closely related to the acquisition resolution and repeatability, see Section 4.2.3, *General Settings*. The minimum value is 2 seconds and the maximum value is 9999 seconds. See Table 4-1, on page 4-5, for a relationship between the period and the resolution.

Acquisitions can be set to last a specific time, stop when a specific number of scans has been made, or stop only when the **Stop** button is selected. To make an acquisition last a specific time

1. Select the **Time** radio button in the **Duration** group.

2. Type the desired time value in the edit box next to the **Time** radio button. The maximum time value allowed is 999:59:59.

To make an acquisition stop after a specific number of scans has been made

1. Select the **No. of Scans** radio button in the **Duration** group.

2. Type the desired number of scans in the edit box to the right of the **No. of Scans** radio button. The minimum value is 2 and the maximum is 9999.

To make continuous scans until the Stop button is selected, click the **Non stop** radio button.

The acquisitions made from the main window using these settings are kept in volatile memory until the user decides to save the data. When closing the application, if the acquisition data has not been saved, a window will appear, asking to save the unsaved data.

4.2.3 General Settings

In the **Settings** page, the user can select the display units, resolution, and minimum power threshold, as well as enter an identification name for the DUT.

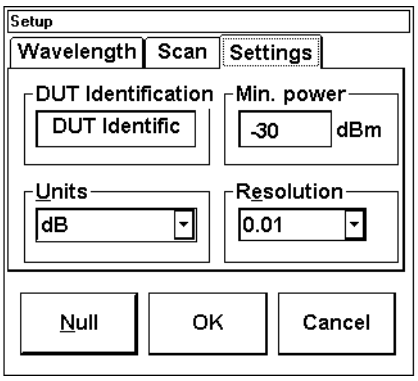


Figure 4-3 Settings Sheet

The serial number of the DUT is a recommended ID value. The user is strongly recommended to specify a name, since this information will be assigned to the corresponding data file if a file name is not specified.

The minimum power threshold, a value between -60 and 8, lets the user specify the minimum input source power allowed for testing. Whenever the power level is lower than the value specified, a window will appear indicating that the input power is too low. This does not affect the measurements as long as the input power on both detectors is not less than -65 dBm.

The display units can be selected from the **Units** drop-down list. You may choose to work in dB or percentage.

The resolution is the number of significant decimal digits. A scanning period is associated with the available resolutions. However, for better accuracy, you may choose a higher period for the selected resolution. See Section 4.2.2, *Scan Settings*, for complementary information.

Resolution (dB or %)	Period (sec)
0.01	2
0.001	5

Table 4-1 Available Resolution and Corresponding Scanning Period

4.3 Acquisition Setup

The **Acquisition** button, on the **General** page, opens the *Acquisition Setup* window. The *Acquisition Setup* window allows the user to adjust acquisition mode, start delay, duration and number of acquisitions, and the name of the data file. These settings are used when doing multiple acquisitions in auto save mode. Auto save mode automatically names and saves the acquisitions in a sequential order, beginning with the name indicated in the **Data File** group box.

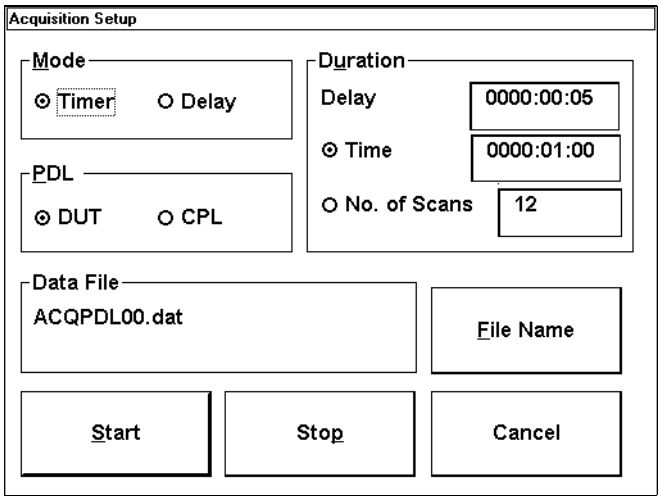


Figure 4-4 Acquisition Setup Window

4.3.1 Acquisition Mode and Duration

To set a trigger time

1. Check the **Delay** radio button.

2. In the **Delay** edit box, type the desired trigger time value.

The duration can be set according to a specific time or a specific number of scans. To make an acquisition last a specific time

1. Select the **Timer** radio button.

2. In the **Duration** group, select the **Time** radio button.

3. In the edit box next to the **Time** radio button, type the desired duration for the acquisition.

For example, you can make an acquisition of twelve scans, each of which lasts ten seconds. The scan period is set in the **Scan** page (see Section 4.2.2). Using this setup, a complete acquisition will take 120 seconds (two minutes) from the moment you select **Start**. If you set a delay value of five minutes, the total acquisition will take seven minutes from the moment you select **Start**.

To make an acquisition stop after a specific number of scans

1. Select the **Timer** radio button.

2. In the **Duration** group, select the **No. of Scans** radio button.

3. In the edit box next to the **No. of Scans** radio button, type the desired number of acquisitions.

For example, you can make a four-minute acquisition composed of ten-second scans. The scan period is set in the **Scan** page (see Section 4.2.2). Using this setup, a complete acquisition will be composed of 24 scans. If you set a delay value of five minutes, the total acquisition will take nine minutes from the moment you select **Start**.

4.3.2 Auto Save Feature

The acquisition files are automatically saved in the file specified in the **Data File** group. If the name contains a number at the end, this number will automatically increase by one every time an acquisition is made. You can type any name, provided there is a number at the end. The file in Figure 4-4 has two digits at the end. This will allow 100 acquisitions (from 00 to 99) that will share the same base name (ACQPDL*.dat). To specify the file path

1. Click **File Name**.

2. Select the desired directory where acquisition files shall be saved.

3. Click **OK**.

4. In the **Data File** group, type the name and number of the first acquisition file.

4.4 Starting and Stopping the Acquisition

Once the setup is made, you may start an acquisition by clicking **Scan** on the main window. This button becomes **Stop** when the acquisition is in progress. To stop the acquisition, click **Stop**.

If you are in the *Acquisition Setup* window, click **Start** to begin the acquisition. To stop the acquisition, click **Stop**.

4.5 Exiting the Application Software

Closing any application software that is not in use is a good way to free system memory. The application software can be closed from the main window or the monitor window.

There are four ways to exit the application software from the main window:

- Click the **x** in the top right corner of the main window.
- Choose **Exit** from the *File* menu.
- Click the application icon in the top left corner of the main window and select **Close**.
- Type Alt+F4.

To exit the application software from the monitor window, click the **x** in the top right corner of the monitor window.

5 TESTING WITH THE IQ-3400 PDL/OL METER

DUT test mode allows for complete PDL/PDG characterization of optical components including insertion loss and reference power. Average PDL/PDG and PDL/PDG standard deviation are provided for a complete DUT analysis.

CPL (coupler) test mode allows for complete characterization of optical couplers through the following measurements: coupling ratio, polarization dependent coupling ratio, excess loss, reference power, and insertion loss. This setup permits easy one-connection testing of 1×2 and 2×2 couplers.

ORL characterization of optical components is made possible through ORL test mode. The IQ-3400 is ideal for component reflectance measurements in manufacturing.

Before starting

1. Be sure to properly insert the IQ-3400 PDL/OL meter, IQ-5100 Polarization Controller, and a source into their slots.

2. Launch the application.

3. Check that the selected wavelength corresponds to the source wavelength.

4. Do a nulling by clicking **Null** in the *Setup* window.

5. Configure acquisition parameters from

   - the *Setup* window (see Section 4.2, *General Setup*) or
   - the *Acquisition Setup* window, if you wish to save the results to a data file (see Section 4.3, *Acquisition Setup*).

6. Calibrate the unit according to the test you wish to perform.

5.1 DUT Calibration

Figure 5-1 depicts the connections to make when calibrating the unit for DUT testing.

1. In the **General** page, select **DUT** in the **Next Calibration** group.
2. Connect the source output to the IQ-5100 Polarization Controller input port.
3. Connect the IQ-5100 Polarization Controller output port to the IQ-3400 PDL/OL Meter C1 connector.
4. Connect a jumper between connector C2 and detector D1.
5. Connect a jumper between the reference port and detector D2.

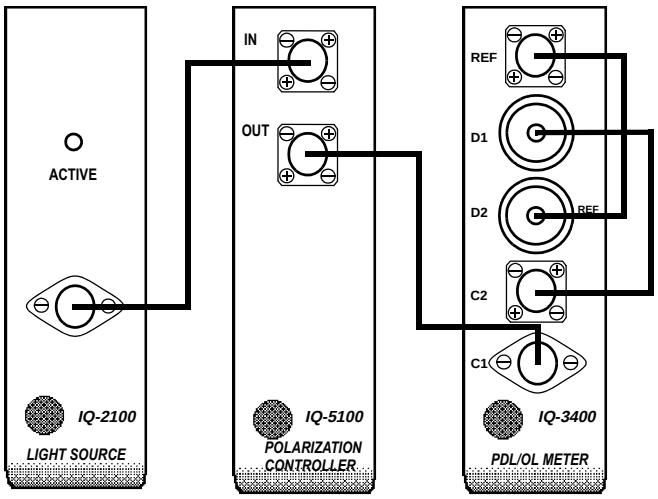


Figure 5-1 DUT Test Mode Calibration Setup

6. Make sure that the source is powered on and that the IQ-5100 is in random scanning mode.

7. In the main window, click **Cal**. Results will appear in the **Last Calibration** group.

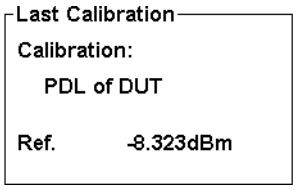


Figure 5-2 Calibration Results

5.2 DUT Testing

After calibration, you may begin testing in DUT mode. Figure 5-3 shows how connections should be made.

1. Connect the source to the IQ-5100 Polarization Controller input port.
2. Connect the IQ-5100 Polarization Controller output port to connector C1.
3. Connect C2 to DUT input port
4. Connect DUT output port to detector D1.
5. Connect the reference port to detector D2.

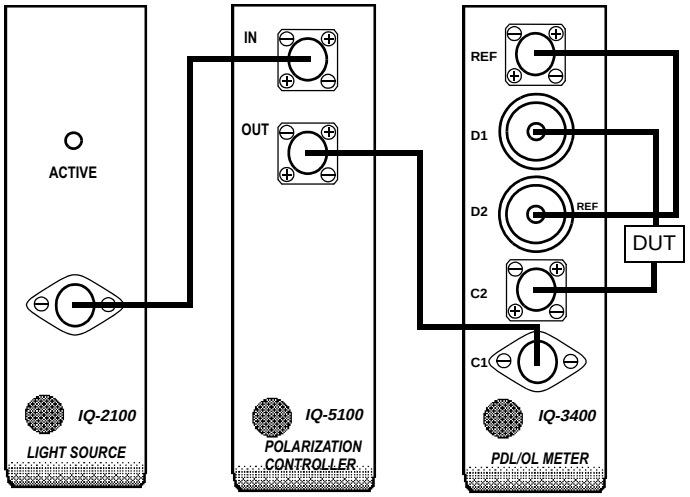


Figure 5-3 DUT Test Mode Acquisition Setup

6. Select random scanning mode in the IQ-5100 Polarization Controller main window by clicking the **Scan** function button.

***Note**: If **Scan** does not appear in the main window, the module is already in manual scanning mode.*

7. On the IQ-3400 PDL/OL Meter main window, click the **Scan** function button.

   This acquisition gives precise polarization dependent measurements and insertion loss values.

5.3 DUT Results

DUT results appear in the DUT page, shown in Figure 5-4.

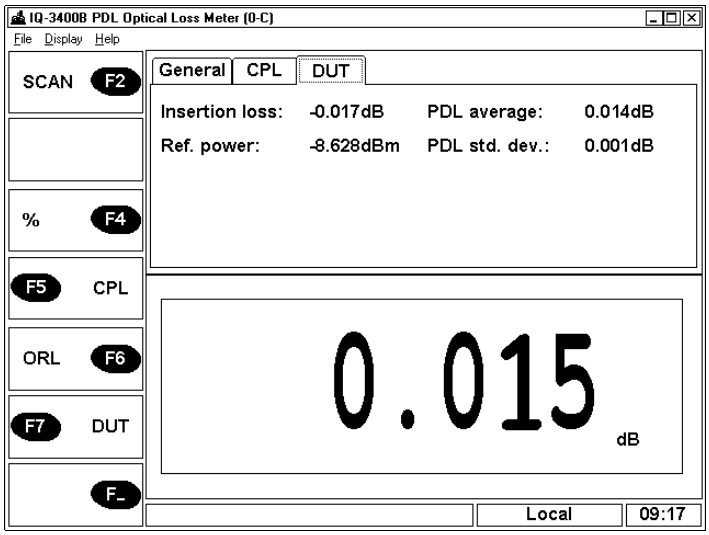


Figure 5-4 DUT Test Results

Insertion loss

Indicates the ratio of input power to output power, in dB units (for a given output port), for an optical component such as a connector, splice, or coupler. For a multiport device, the insertion loss includes the splitting ratio and excess loss.

Ref. Power

Calibration value obtained by following instructions in Section 5.1, *DUT Calibration*.

PDL Average

Average polarization dependent loss value calculated from all acquisitions made during the actual testing session.

PDL std. dev.

Polarization dependent loss standard deviation.

5.4 Coupler Calibration

Figure 5-5 shows how connections should be made to calibrate the unit in CPL test mode.

1. In the main window, select **CPL** in the **Next Calibration** group.
2. Connect the source to the IQ-5100 Polarization Controller input port.
3. Connect the polarization controller output port to detector D2.

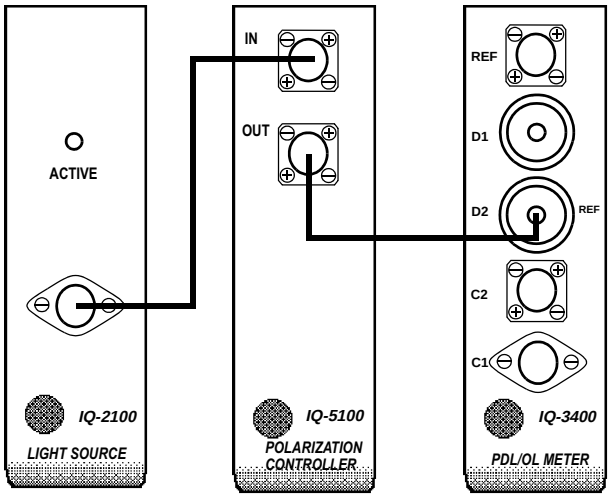


Figure 5-5 CPL Test Mode Calibration Setup

4. In the main window, click **Cal**. Results will appear in the **Last Calibration** group.

5.5 Coupler Testing

1. Connect the source to the IQ-5100 Polarization Controller input port.

2. Connect the polarization controller output port to the input port of the coupler.

3. Connect the output ports of the coupler to detectors D1 and D2.

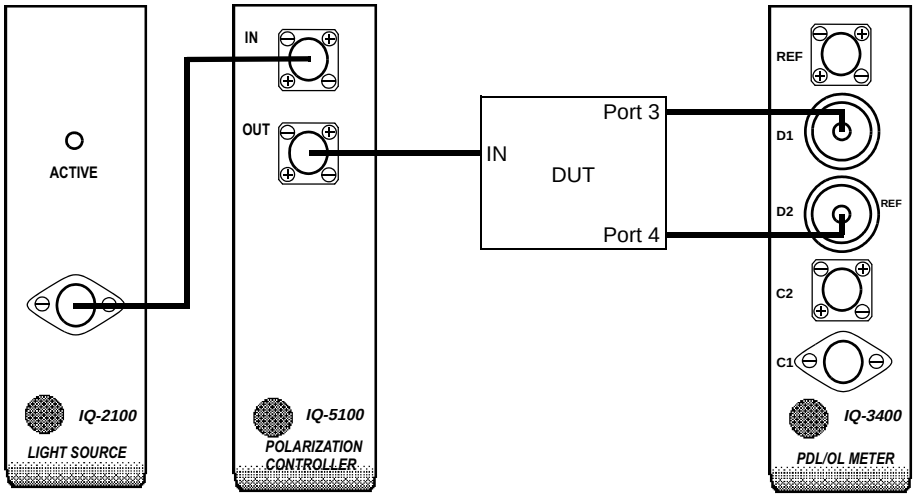


Figure 5-6 Coupler Test Mode Setup

4. Select manual scanning mode in the IQ-5100 Polarization Controller main window by clicking the **Stop** function button.

***Note**: If* **Stop** *does not appear in the main window, the module is already in manual scanning mode.*

5. On the IQ-3400 PDL/OL Meter main window, click the **Scan** function button.

   This first acquisition gives precise excess loss and insertion loss values, see Figure 5-7.

6. Select random scanning mode in the IQ-5100 Polarization Controller main window by clicking the **Scan** function button.

***Note**: If* **Scan** *does not appear in the main window, the module is already in manual scanning mode.*

7. On the IQ-3400 PDL/OL Meter main window, click the **Scan** function button.

   This second acquisition gives precise polarization dependent coupling ratio (PDCR) and coupling ratio measurements.

5.5.1 Coupler Results

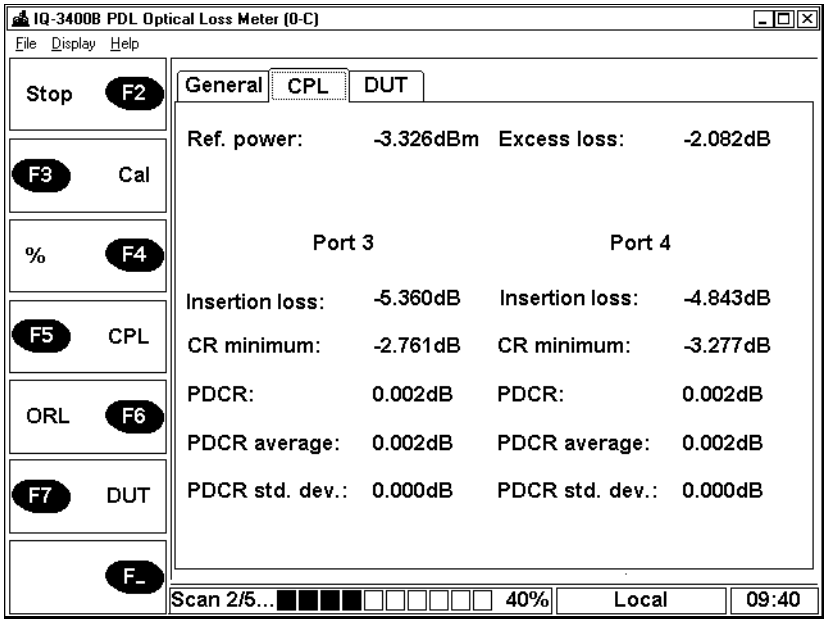


Figure 5-7 Coupler Test Mode Results Page

Ref. power
Calibration value obtained by following instructions in Section 5.4, *Coupler Calibration*.

Excess loss
In relation to multiport components, the excess loss is a measure of the insertion loss over and above that induced by the splitting ratio. Excess loss is normally defined (in dB units) as the ratio of the input power divided by the sum of the powers in the output ports.

Port 3, Port 4
Coupler under test output ports. Port 3 is connected to detector D1, and port 4 to detector D2.

Insertion loss/Transmission
The ratio of input power to output power (for a given output port) for an optical component such as a connector, splice, or coupler. For a multiport device, the insertion loss includes the splitting ratio and excess loss. Insertion loss is given in dB, while transmission is displayed in %.

CR minimum
The smallest of the values obtained by measuring the power at both output ports and providing the ratio between the output power for one port and the sum of the output power of both output ports.

PDCR
The polarization dependent coupling ratio for each output port.

PDCR average
The average polarization dependent coupling ratio for each output port.

PDCR std. dev.
Polarization dependent coupling ratio standard deviation for each output port.

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6 ORL TESTING WITH THE IQ-3400 PDL/OL METER

6.1 ORL Application General Description

The **ORL** function button in the main window activates the ORL test mode.

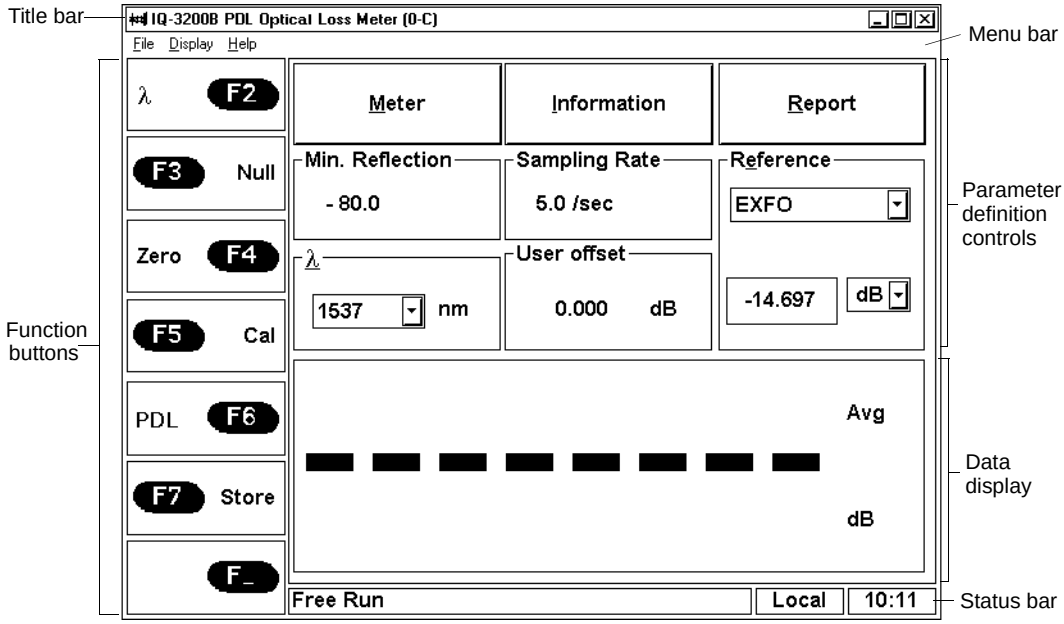


Figure 6-1 ORL Main Window

The ORL main window, shown in Figure 6-1, can be broken down into five sections:

- title bar and menu bar
- function buttons
- parameter definition controls
- data display
- status bar

6.1.1 ORL Mode Title Bar and Menu Bar

The title bar and menu bar are at the top of the main window (see Figure 6-1). The title bar indicates the type of return loss meter. The menu bar contains three drop-down menus that are explained in the following table.

Menu	Option	Function
File	Open Config...	Opens a previously saved configuration.
	Save Config...	Saves the current configuration.
	Exit	Closes the application.
Display	Monitor	Opens the monitor window, which displays basic return loss meter data (see Section 3.5, *Monitor Window* for detailed information).
Help	Online Manual...	Displays the contents of the present instruction manual.
	About	Opens a window that provides the following information: • software version • technical assistance telephone numbers • available IQ-203 system memory (includes RAM and virtual memory) • remaining hard disk drive storage space

Table 6-1 Main Window Drop-Down Menus

6.1.2 ORL Function Buttons

The function buttons, located on the left side of the main window, are used for immediate control of the return loss meter.

Button	Description
λ F2	Switches to the next wavelength as defined by the contents of the λ list box.
F3 Null	Performs an internal null measurement.
Zero F4	Performs a zero-reflection measurement, which cancels the effect of small reflections between the IQ-3400 and the point of test (see Section 6.2, *ORL Calibration*).
F5 Cal	Performs a reference calibration (see Section 6.2, *ORL Calibration*).
PDL F6	Returns to the PDL application main window.
F7 Store	Stores the current ORL measurement for future printing (see Section 6.3, *ORL Testing*).
F_	Transfers control to the IQ-203 front panel function keys (refer to the *IQ-200 Optical Test System* Intruction Manual).

Table 6-2 Function Buttons

***Note**: The function buttons are also available in monitor window mode. Place the cursor in the monitor window and press the right mouse button.*

6.1.3 Parameter Definition Controls

Choosing any of the parameter definition controls opens a window or list permitting the user to define and customize various operating parameters.

Control	Description
Meter	Opens the **Meter Setup** window allowing the user to select various measurement parameters.
Info	Opens the **Setup Conditions** window where the test conditions are documented.
Report	Opens the **Report** window where measurements can be selected and printed.
Min. Reflection	Displays the minimum reflection (sensitivity) that can be measured under present conditions (see Section 6.2, *ORL Calibration*).
Sampling Rate	Displays the currently selected sampling rate set in the meter setup window.
λ	Displays the currently selected wavelength. • Open the list box to select a different wavelength.
User Offset	Displays the current offset value, which is added to the measured return loss.
Reference	Displays the selected reflection reference that will be used during the reference calibration. • Select between **EXFO** and **User**. • For the **EXFO** reflection reference, the value is automatically displayed (-14.65 dB @ 1310 nm, -14.70 dB @ 1550 nm). • For a **User** reflection reference, enter the value in the edit box and select the appropriate units (dB or %).

Table 6-3 Parameter Definition Buttons

6.1.4 ORL Data Display

The data display, shown in Figure 6-1, displays reflectance measurements in dB. A dashed line (-------) indicates that the reflected power is lower than the minimum reflection.

6.1.5 ORL Mode Status Bar

The status bar displays the current module status:

- **Free run** - Normal operation.
- **Processing** - the IQ-3400 is processing user commands.

For more information on the status bar, see Section 3.4, *Status Bar*.

6.2 ORL Calibration

During ORL calibration, the IQ-3400 compares measured reflectance to a reflection reference value, and then computes and applies the necessary correction factor. The calibration can be performed with either the reference patchcord provided by EXFO or with any other reference patchcord, as long as the accurate reflection reference value is provided.

The software stores different calibration constants for each available wavelength (i.e. the two wavelengths defined in the *Meter Setup* window).

IMPORTANT

If testing at two wavelengths, the reference calibration must be performed at both wavelengths.

To perform the reference calibration

1. With the calibration reference connected as shown in Figure 6-4, ensure that the source is activated and stable at the desired wavelength.

2. Choose **F2** λ to set the IQ-3400 to the same wavelength as the source.

3. From the main window, open the **Reference** list box, as shown in Figure 6-2, and select the desired reference, **EXFO** or **User**.

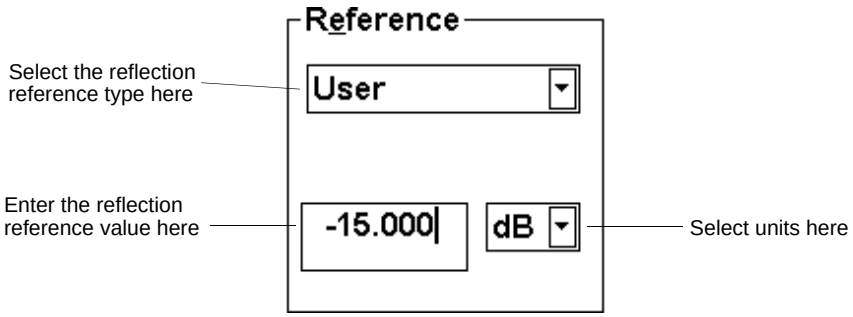


Figure 6-2 Reference Box

4. If **User** reference is selected, enter the reference value in the provided edit box (double-click on the edit box). Depending on the known units of the reference value, select % or **dB**.

If **EXFO** reference is selected, the software displays the reference value corrected for the current active wavelength.

- -14.65 dB ±0.1 dB @ 1310 nm
- -14.70 dB ±0.1 dB @ 1550 nm

5. Terminate the reference jumper as shown in Figure 6-3 (minimum of 8 turns). The mandrel termination attenuates reflections from the reference reflector so that a zero-reflection measurement can be performed. The displayed value should now be very close to the sensitivity limit (≈ -65 dB or --------) of the IQ-3400.

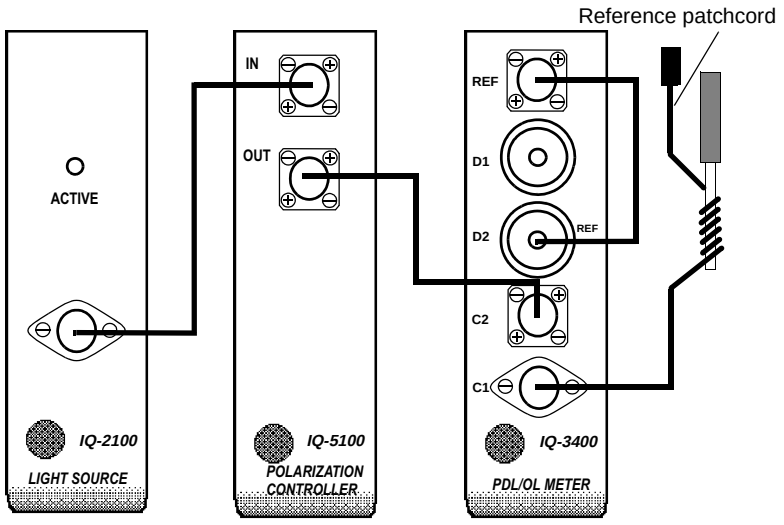


Figure 6-3 Reference Calibration—Zero Measurement

6. Choose **Zero** to perform the zero-reflection measurement. The zero measurement allows the software to measure and correct for any parasitic reflections resulting from the measurement setup (e.g. internal reflections and IQ-3200 to test jumper interface reflections).

IMPORTANT

Upon completion of the zero measurement, a new minimum reflection value may be displayed. The minimum reflection represents the sensitivity of the measurement setup and is calculated based on the reflected power measured during the zero measurement. A normal zero measurement should produce a minimum reflection of -65 dB (with the user offset = 0.000 dB).

7. Unwrap and straighten the reflection reference jumper.

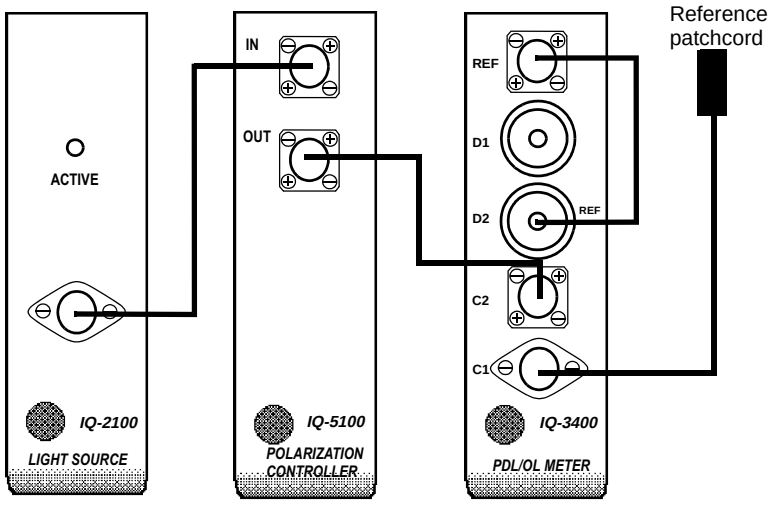


Figure 6-4 ORL Calibration Setup

8. Choose **Cal** to complete the reference calibration. Upon completion, the displayed value will equal the reference value.

IMPORTANT

Disconnecting the source, either at the source output port or at the IQ-3400 input port, will void the reference calibration. When testing at two wavelengths, a dual-wavelength source with a common output port must be used.

9. If measuring at two wavelengths, repeat this procedure for the second wavelength.

6.3 ORL Testing

To perform a return loss measurement

1. Ensure that the source and IQ-3400 are set to the same wavelength.
2. Using a suitable test jumper, connect the DUT as shown in Figure 6-5.

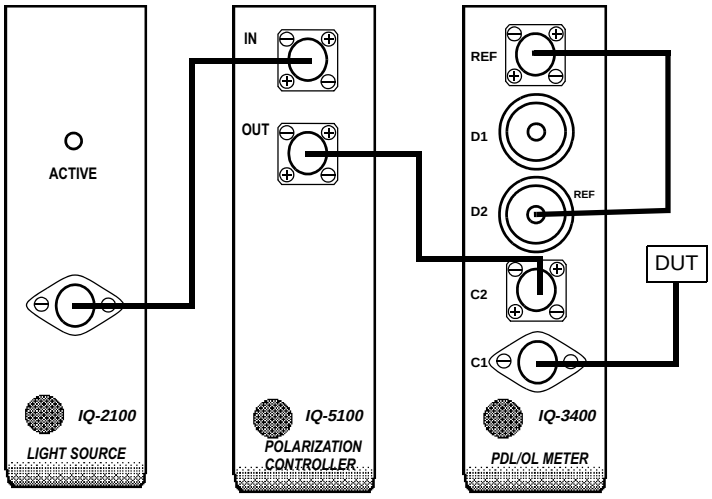


Figure 6-5 ORL Test Mode Setup

3. Terminate the test jumper as close as possible to the DUT, as shown in Figure 6-6. The displayed value should now be very close to the sensitivity limit (-65 dB or --------) of the IQ-3400.

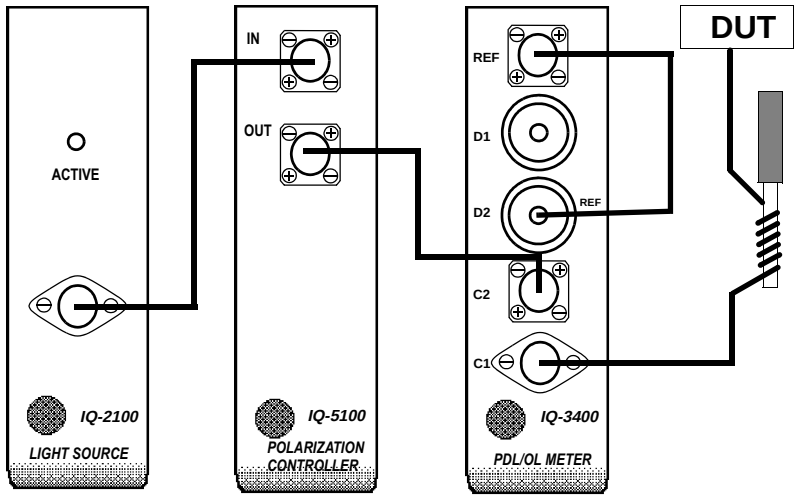


Figure 6-6 Terminating the Test Jumper—ORL Measurement

4. Choose **Zero** to perform a zero measurement.

IMPORTANT

A normal zero measurement should produce a minimum reflection of -65 dB (with the user offset = 0.000 dB).

5. Unwrap and straighten the test jumper.

The value displayed is the optical return loss of the DUT (see Figure 6-7).

6. Choose **Store** to save the measurement for future printing.

7. If measuring at two wavelengths, repeat this procedure for the second wavelength.

***Note**: Up to 100 values can be stored for each DUT at each wavelength.*

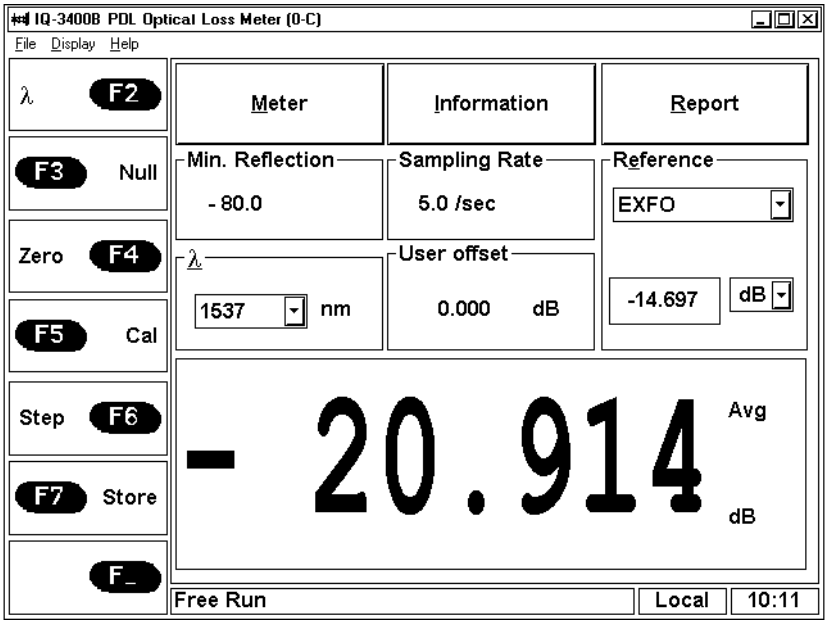


Figure 6-7 Display when Making ORL Measurements

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7 GRAPHICAL DISPLAY MODE

The graphical display mode simultaneously offers a real-time sampling display of up to four channels in a tabular format and up to eight channels in a graphical format. Other features include zoom, adjustable markers with automatic delta calculation, minimum and maximum alarm, tabular data display, and printing capabilities. The graphical display mode is accessed by choosing **Graph** from the IQ-3400 main window.

***Note**: The graphical display mode is only available when* **Continuous Scan** *is selected in the PDL/OL Meter main window.*

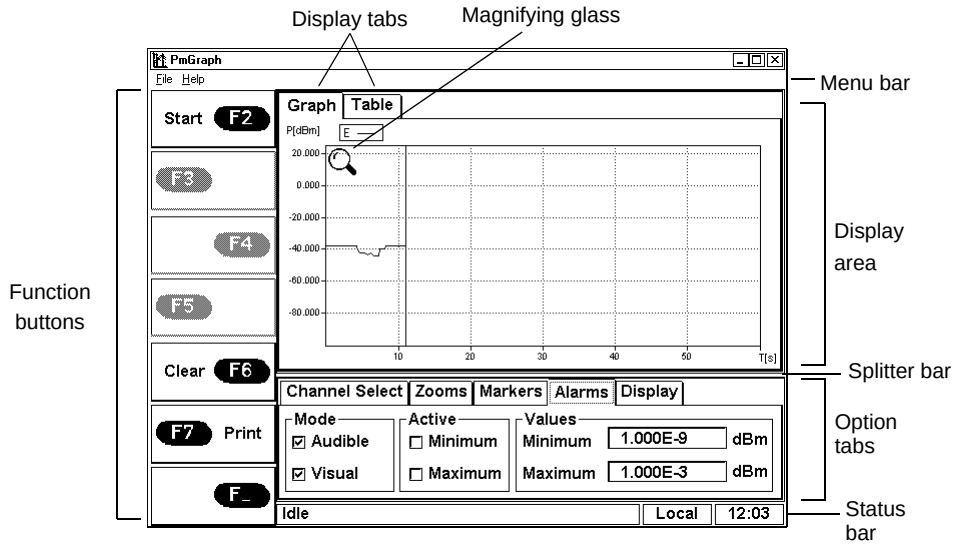


Figure 7-1 Graphical Display Mode Window

The *Graphical Display Mode* window can be broken down into five sections:

- menu bar
- function buttons
- display tabs and display area

- option tabs
- status bar

7.1 Graphical Display Mode Menu Bar

The title bar and the menu bar are at the top of the *Graphical Display Mode* window (see Figure 7-1). The menu bar contains drop-down menus that are explained in the following table:

Menu	Option	Function
File	Exit	Exits the graphical display mode and returns to the previously used IQ application. Saves the configuration at exit and later reopens in the same parameters.
Help	Online Manual...	Displays the contents of the present instruction manual.
	About	Opens a window that provides the following information: • software version • technical assistance telephone numbers and e-mail and Web site addresses • available IQ-203 system memory (RAM) • remaining hard drive storage space

Table 7-1 Main Window Drop-Down Menus

7.2 Function Buttons

The function buttons, along the left side of the *Graphical Display Mode* window (see Figure 7-1), are used for direct control of graphical display mode features.

Button	Description
Start F2	Launches real-time sampling according to the parameters set in the *Option* tabs. The **Start** button changes to **Stop** when sampling is in progress.
Clear F6	Clears the data displayed in the display area.
F7 Print	Initiates printing of the display area.
F_	Transfers control to the IQ-203 front panel function keys (refer to the *IQ-200 Optical Test System Instruction Manual*).

Table 7-2 Graphical Display Mode Function Buttons

7.3 Display Tabs and Display Area

The display tabs are located above the *Display area* (see Figure 7-1). Select **Graph** to display the real-time power readings as a curve (one curve per channel). Select **Table** to display the real-time power readings in a table (one column per channel).

Clicking and dragging down the splitter bar (see Figure 7-1) will allow you to increase the size of the display area. To return to the display area's original size, simply click and drag it back in place.

Here are two examples showing typical power readings displayed in graphical and tabular formats.

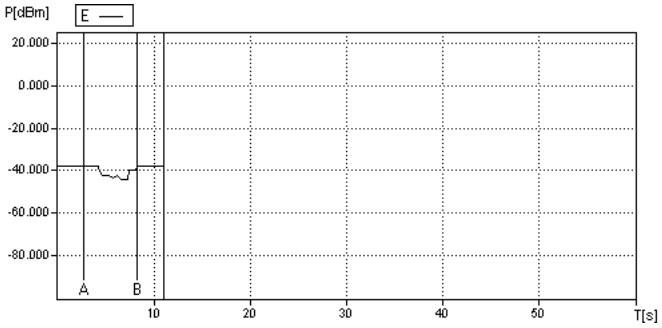


Figure 7-2 Curve in Display Area (Graph)

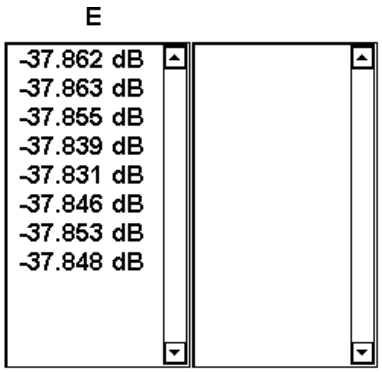


Figure 7-3 Channel Results in Display Area (Table)

7.4 Channel Selection

Readings from up to eight channels can be displayed on a curve, whereas readings from up to four channels can be displayed in a table. Channels must be selected and attributed a character for their readings to be displayed.

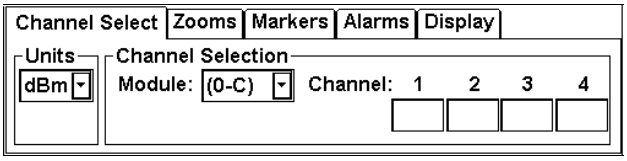


Figure 7-4 Channel Selection Page

1. Select the measurement units (dBm, dB, and %) in which the readings will be displayed (on the y axis).

Note: *The measurement units selected must be the same as those selected in the PDL/OL meter main window.*

2. Scroll through the list of available IQ modules and select the IQ-3400 PDL/OL Meter module.

   The position of an IQ module is identified both with a number and a letter. The number indicates in which unit the module is inserted (0 for the IQ-203 Mainframe and 1 to 4 for the IQ-206 Expansion Units connected to the Mainframe). The letter indicates in which slot the module is inserted.

Note: *Only the IQ modules whose application is set to the same measurement unit as those specified in the* **Units** *box will be listed.*

3. Depending on the number of channels available on the selected module, the boxes **1**, **2**, **3**, and **4** will activate.

4. To activate a channel for display, type a character (either a letter or number) in the corresponding box. This character will be used to identify the channel displayed.

Note: *The same character cannot be used more than once.*

5. Repeat steps 2, 3, and 4 for each desired channel.

Note: *You need to fill in the information for the* **Channel Select**, **Alarms**, *and* **Display** *before pressing* **Start**.

7.5 Zoom Control

The **Zooms** page controls the view by increasing or diminishing the axis scales.

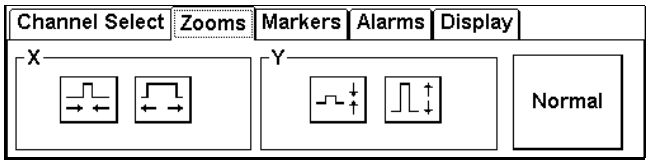


Figure 7-5 Zooms Control Page

The **Zooms** option will not be enabled until a few points have been acquired on the curve. Select the desired button, whether you want to diminish or increase the x axis, shrink or spread the y axis, or return to the original settings.



Figure 7-6 Magnifying Glass

The magnifying glass allows you to move the visible portion of the curve horizontally and vertically by dragging the magnifying glass with the left mouse button on the corresponding border of the display area.

7.6 Markers

The markers determine the exact coordinates of a particular point on a curve. You can also find the difference between the coordinates of two points on a curve. To use the marker feature, choose the **Markers** tab at the bottom of the *Graphical Display Mode* window.

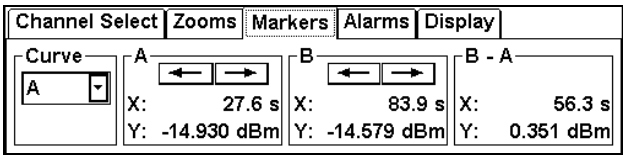


Figure 7-7 Markers Page

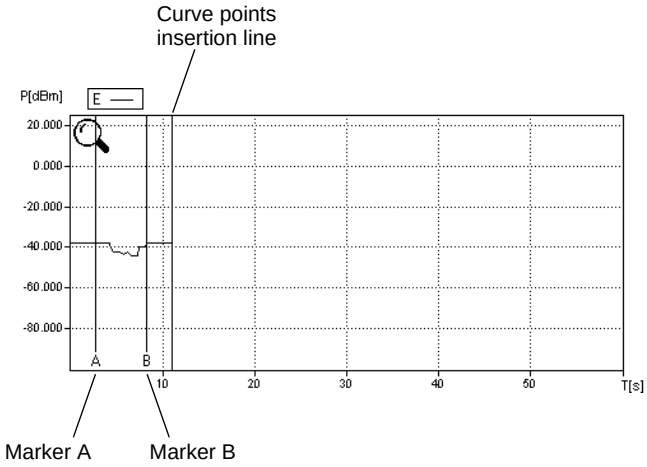


Figure 7-8 Display Area

- Markers A and B appear in the display area.
- The A box (see Figure 7-7) gives the coordinates of the point met by marker A on the selected curve.
- The B box (see Figure 7-7) gives the coordinates of the point met by marker B on the selected curve.
- The B-A box (see Figure 7-7) gives the difference between the coordinates of the points met by marker A and B on the selected curve.

Only two markers are displayed at the same time on the curve selected in the **Markers** page.

7.7 Alarms

Alarms can be set to warn you when power levels of either channel go below or above set thresholds or outside specified limits. An audible or visual alarm is activated when the power level on any of the displayed channels go above or below the set thresholds.

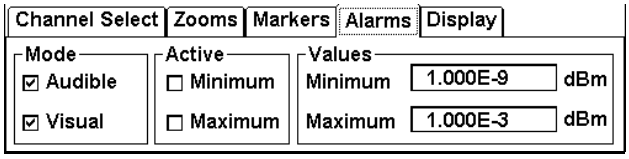


Figure 7-9 Alarms Page

First, select an audible and/or visual alarm. Then, enter the maximum and/or minimum alarm threshold values. Any value entered for the minimum and maximum values will be automatically transformed in scientific notation.

An audible alarm consists of small beeps generated by the computer. For a visual alarm, the **Min** and/or **Max** indication in the *Display Area* will be outlined in red horizontal dotted lines. The alarm status is displayed in the status bar, alternating between the system status and alarm status. Only the first occurrence, either the minimum or maximum alarm will be displayed in the status bar. To stop the alarm, press **Stop**.

7.8 Display

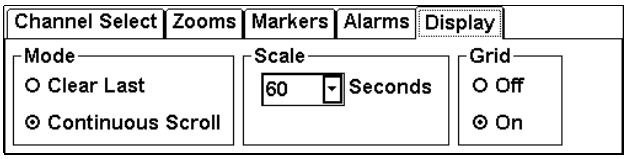


Figure 7-10 Display Page

Two curve plotting displays can be selected:

Clear Last — After having gone through a complete sweep of a time scale, curve plotting begins again at the zero point. The previous curve is overwritten as a new one is plotted.

Continuous Scroll — After having gone through a complete sweep of a time scale, curve plotting keeps going on the same curve. Only the portion of the curve plotted within the last time scale is kept in memory and displayed.

Notice that an insertion line moves along the x axis as curve plotting progresses.

The scale setting determines the length of the x axis (time) when the zoom control is set to full view. It therefore determines how long the curve plotting process will take to do a complete sweep of the display (in full view). Six choices are available in the **Display** page: 60, 120, 300, 600, 1800, and 3600 seconds.

A grid can be displayed over the curve(s) in the graphical display area so it is easier to refer to the x and y axes from a point on a curve. To turn the grid on or off, choose the appropriate radio button in the **Display** page.

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8 MAINTENANCE AND TROUBLESHOOTING

8.1 Maintenance

The equipment designed for the IQ-200 Optical Test System is sold separately. The modules contain fragile electrical and optical connectors. Before installation, verify that the electrical connector pins are free of foreign objects and that the individual pins are not bent or otherwise damaged.

Clean the module front panel regularly to avoid build-up of dirt, dust, and other foreign substances. To do so, use a cloth dampened with soapy water, rinse with a damp cloth, and dry.

There are no user-serviceable components in the IQ-3400, notwithstanding the procedure described in this section. The module has been designed to require minimum maintenance and provide reliable operation for many years to come.

The cleaning swabs supplied with EXFO test equipment are especially designed to clean inside output ports of all types with 2.5-mm ferrule without having to disassemble them. No cleaning solution is required as the tips are used dry. The ease of use allows for frequent maintenance, thereby ensuring clean connectors. The ports should be cleaned occasionally to ensure minimum insertion loss.

1. Take a swab from the package without touching the soft end.

2. Slowly insert the swab into the port until it reaches the ferrule inside (a slight clockwise rotating movement can help).

3. Applying moderate pressure to the inside surfaces, twist the swab one full turn.

4. Continue to turn as you withdraw the swab.

5. Dispose of the used swab after 5 uses or as soon as it is visibly dirty.

The cleaning swabs can also be used to clean adapters before inserting connectors. Note, however, that individual connectors still need to be cleaned according to standard cleaning methods.

The fiber ends must be kept clean at all times, as explained in Section 2.2, *Module Setup*, to ensure optimum performance.

IMPORTANT

When the module is not being used, the protective caps should be fitted over the ports.

8.2 Calibration

Calibration of the power meters in the IQ-3400 PDL/OL Meter module is recommended once a year.

8.3 Troubleshooting

Problem	Probable Cause	Recommended Action
LED push button does not illuminate	Power is not on.	Check AC power cord and power on the IQ system.
		Refer to IQ-200 manual to locate and verify fuse.
	Module is not properly inserted.	Power off the IQ system, remove and reinstall the module.
	Computer is locked up.	Reboot the IQ system.
	LED is burnt.	Call EXFO.

Table 8-1 Problems, Causes, and Recommended Actions (Part 1 of 2)

Problem	Probable Cause	Recommended Action
Pushing the LED push button does not open the main window	Computer is locked up.	Reboot the IQ system.
Dashed line is displayed (--------)	Power level is below the minimum detectable power.	No action is required.
Questionable ORL measurements	Optical connectors are dirty.	Clean all optical connections.
	Calibration is incorrect.	Perform a new null measurement and reference calibration.
	Improper wavelength is selected.	Switch to the correct wavelength on all instruments being used.
	Optical source is unstable. There are loops in the test jumper.	Wait for source to stabilize. Remove loops.

Table 8-1 Problems, Causes, and Recommended Actions (Part 2 of 2)

In all cases, if problem persists after performing recommended action, call EXFO.

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9 TECHNICAL SPECIFICATIONS

IMPORTANT

The specifications stated in this section correspond to a scanning period of five seconds.

PDL/Optical Loss Meter	
General	
Wavelength range (nm)	1200 to 1625
Resolution (dB)	0.01/0.001
Fiber (μm)	9/125
PDL/PDG Measurements	
PDL absolute accuracy	± 0.015 + 5% of PDL
PDL repeatability	± 0.0025 + 5% of PDL
Measurement speed (sec)	5 (typical)
Measurement rate	2500 per second
PDL range (dB)[a]	0.015 to 5 (0.015 to 20 with DFB option)
PDCR Measurements	
PDCR absolute accuracy[b]	± 0.005 + 5% of PDCR
PDCR repeatability	± 0.001 + 5% of PDCR
Measurement speed (sec)	5 (typical)
Measurement rate	2500 per second
PDCR range (dB)[c]	0.005 to 5 (0.005 to 20 with DFB option)

PDL/Optical Loss Meter	
Insertion loss and reference power measurements	
Insertion loss accuracy (dB)[d]	± 0.05
Reference power accuracy (dBm)	± 0.2 (± 5%)
ORL Measurements[e]	
Dynamic range (dB)	0 to -45[f]
Absolute accuracy (dB)	< ± 0.25[g]
Polarization sensitivity (dB)	0.01

a. Higher ranges are achieved with accuracy degradation or the use of a DFB laser.
b. Accuracy degradation at very weak DUT output power levels: 0.143 (typ. error) at -60 dBm and 0.511 (typ. error) at -65 dBm.
c. Higher ranges are achieved with accuracy degradation or the use of a DFB laser.
d. For insertion loss measurements in coupler mode IL accuracy is ± 0.05 + PDCR of measured coupler.
e. ORL specifications require FP-ORL source.
f. Referenced to a 0-dBm light source.
g. For 0 dB to -25 dB range.

Source[a]	
Type	LED Singlemode Polarized, DFB or external source[b]
LED option (nm)	1310 + 20/- 25, 1550 + 10/- 40, 1310/1550 + 20/- 25/+ 10/- 40
Wavelength DFB option (nm)[c]	1310 ± 10 or 1550 ± 10

a. Source specifications for PDL/PDG or PDCR measurements.
b. External source with spectral width ≤ 0.2 nm at -3 dB.
c. DFB with spectral width ≤ 0.2 nm at -3 dB.

Environmental Specifications	
Operating temperature	32° to 122°F/0° to 50°C
Storage Temperature	-40° to 158°F/-40° to 70°C
Relative humidity	0 to 95% non-condensing

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10 WARRANTY

10.1 General Information

EXFO Electro-Optical Engineering, Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of two years from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product. This warranty also covers recalibration during two years if the equipment is repaired or if the original calibration is erroneous.

IMPORTANT

The warranty can become null and void if

- ***the equipment has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel,***
- ***the warranty sticker has been removed,***
- ***case screws, other than those specified in this manual, have been removed,***
- ***the case has been opened, other than as explained in this manual,***
- ***the equipment serial number has been altered, erased, or removed,***
- ***the equipment has been misused, neglected, or damaged by accident.***

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

10.2 Liability

EXFO shall not be liable for damages resulting from the use of the purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the operation of any system of which the purchased product may be a part.

10.3 Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps and batteries used with EXFO's products are not covered by this warranty.

10.4 Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

10.5 Service and Repairs

To obtain service or repair for any equipment, follow the procedure below.

1. Call EXFO Customer Service Group. Support personnel will determine if the equipment requires service, repair, or calibration.

2. If the equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) and an address for return.

3. If the unit has an internal storage device, do a backup of your data before sending the unit for repairs.

4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.

IMPORTANT

Never send any unit or accessory back to EXFO without a Return Merchandise Authorization (RMA).

5. Return the equipment, prepaid, to the address given by the support personnel. Be sure to write the RMA on the shipping slip. EXFO will refuse and return any package which does not bear an RMA.

Note: *A test setup fee will apply to any returned unit which, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, the customer will be invoiced for the cost appearing on this report. Return-to-customer shipping costs will be paid by EXFO for equipment under warranty. Shipping insurance is at the customer's expense.

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GLOSSARY

adapter	A device for coupling two connectors.
amplitude	The distance between high and low points of a waveform or signal.
ASCII	American Standard Code for Information Interchange. A system used to represent letters, numbers, symbols, and punctuation as bytes of binary signals.
attenuation	The diminution of average optical power. Attenuation results from absorption, scattering, and other radiation losses. Attenuation is generally expressed in dB without a negative sign.
attenuation coefficient	A factor expressing attenuation per unit length, expressed in dB/km.
attenuator	An optical device, either fixed or adjustable, that reduces the intensity of light propagating through it.
backscattering	That portion of scattered light that returns in a direction generally opposite to the direction of propagation.
baud rate	Measurement of data transmission speed, expressed in bits per second or bps.
Bellcore	Bell communications research, an organization that contains much of the former Bell labs. It specializes in telephone network technology, standards and interfaces.
BER	Bit error rate. On a transmission link, the number of digital “highs” that are interpreted as “lows”, and vice versa, divided by the total number of bits received. In modern networks, BERs much better than 10^{-9} are expected.
c	Velocity of light in a vacuum = 2.997925 x 10^8 m/s
°C	Degree Celsius. To convert to Fahrenheit: $F = \frac{9}{5}C + 32$.
CFR	Code of Federal Regulations

connector	A junction that allows an optical fiber or cable to be repeatedly connected or disconnected to a device such as a source or detector.
coupler	A device whose purpose is to distribute optical power among two or more ports or to combine optical power from two or more fibers into a single port.
CW	Abbreviation for continuous wave. Refers to non-modulated, constant-intensity light.
dB	Decibel
dBm	Decibel referenced to a milliwatt.
DDE	Dynamic Data Exchange
decibel (dB)	The standard unit used to express gain or loss of optical power. A standard logarithmic unit for the ratio of two powers.
directivity	In a 3-port optical circulator, the ratio of power launched into port 1 that exits via port 2 vs. the fraction that exits via port 3.
DLL	Dynamic Link Library
DMA	Direct Memory Addressing
DUT	Device under test
dynamic range	For an optical instrument, generally defined as the ratio (in dB) of the smallest signal that can be observed (at a specified wavelength separation) in the presence of a strong, nearly saturating signal.
EDFFA	Erbium doped fluoride fiber amplifier
EDFSA	Erbium doped silica fiber amplifier
EIA	Electronics Industries Association
electromagnetic interference	Any electrical or electromagnetic interference that causes degradation, failure in electronic equipment, or undesirable response. Optical fibers neither emit nor are affected by EMI.

EMI	Electromagnetic interference.
EOI	End of Image Marker
EOS	Effective Opening Size
ESB	Event Summary Bit
ESE	Standard Event Status Enable Register
ESR	Standard Event Status Register
f	Abbreviation for femto, which indicates 10^{-15} units.
f	Frequency, often also designated by ν.
FCC	Federal Communications Commission. A U.S. government body overseeing and regulating national electrical and radio communications. The FCC, formed in 1934, also deals with licences, tariffs, and limitations. The members of the commission are appointed by the U.S. president.
FIFO	First In First Out
frequency	The number of cycles per second, denoted by hertz (Hz).
Fresnel reflection	Reflection of a portion of the light incident on a planar interface between two homogeneous media having different refractive indices. For a perpendicularly-cleaved fiber terminated in air, the Fresnel reflection is -14 dB.
G	Abbreviation for giga, which indicates 10^{9} units.
Ge	Germanium
GeX	High power germanium
GPIB	General Purpose Interface Bus
hr	Hour
Hz	Hertz. Denotes number of cycles per second.
IEC	International Electrotechnical Commission. A standardization body at the same level as ISO.
IEE	Institute of Electronic Engineering. It is a professional body covering all aspects of electronics and electrical

	engineering, including software, network, and computer engineering.
IEEE	Institute of Electrical and Electronics Engineering. It is a professional body very active, among other things, in many fiber-optic and opto-electronic related fields.
index matching material	A material, often a liquid or a cement, whose refractive index is nearly equal to the core index, used to reduce Fresnel reflections from a fiber's endface.
index of refraction	The ratio of the group velocity of light in a vacuum to the group velocity of light in a given medium.
InGaAs	Indium gallium arsenide.
ISA	Industry Standard Architecture
ISO	International Organization for Standardization. Commonly believed to stand for International Standards Organization. In fact, ISO is not an abbreviation—it is intended to signify uniformity (derived from the Greek *iso* meaning "equal"). ISO is responsible for many standards including those for data communications and computing.
ITU	International Telecommunications Union. The ruling body for telecommunications and the source of many network standards.
jumper	Fiber-optic cable that has connectors terminated on both ends. Used to connect two pieces of equipment, modules, or components.
LD	Laser diode
LED	Light emitting diode
loopback	Type of diagnostic test in which the transmitted signal is returned to the sending device after passing through a communications link or network.
M	Abbreviation for mega, 10^6 units.
m	Abbreviation for milli, 10^{-3} units.

min	Minute
n	Abbreviation for nano, 10^{-9} units.
n	Refractive index. For the silica glass used in optical fibers, $n \approx 1.465$.
NIST	National Institute of Standards and Technology. U.S. governmental body that provides the assistance in developing standards. It was formerly the National Bureau of Standards.
noise figure	A measure of the quality of an amplifier, defined as the ratio of output to input SNRs.
OFDR	Optical frequency domain reflectometer
optical time domain reflectometer	A method of characterizing a fiber wherein an optical pulse is transmitted through the fiber and the resulting backscatter and reflections are measured as a function of time and, hence, as a function of distance.
OTDR	Optical time domain reflectometer
p	Abbreviation for pico, 10^{-12} units
P	Power
PCS	Plastic-clad silica (fiber)
POTDR	Polarization OTDR
principal states of polarization (PSP)	The two generally orthogonal states of polarization of a monochromatic light beam launched into a fiber (input PSP) that will propagate through the fiber without spreading or distortion. The SOP of this light beam as it exits the fiber will be in one of two, generally orthogonal, output PSPs. In general, the output PSPs are not the same as the input PSPs, and the orientation of these PSPs changes with wavelength. Not to be confused with axes of birefringence. Only in the spectral case of a single HiBi fiber are the PSPs and the axes of birefringence the same.
Rayleigh scattering	Scattering by inhomogeneities in the fiber that are small with respect to wavelength. This scattering mechanism is present

	in all silica-based fibers. The OTDR principle is based upon the measurement of this backscattering.
RMA	Return merchandise authorization
s	Second
SCPI	Standard Commands for Programmable Instruments
sensitivity	For an optical instrument, the smallest signal that can be detected in the absence of any other signal.
Si	Silicon
SNR	Signal-to-noise ratio. The ratio of the received optical power, divided by the noise floor for the optical system.
SRE	Service Request Enable Register
SRQ	Service Request
STB	Status Byte Register
t	Time
T	Abbreviation for tera, 10^{12} units.
V	volt
VA	volt-ampere
W	watt
wavelength	For monochromatic light, the distance between two successive peaks (or troughs) of the sinusoidally-varying electric-field amplitude. Note that, unlike frequency, the wavelength of light is inversely proportional to the refractive index of the medium through which it propagates. It is for this reason that accurate wavelength measurements are generally specified as being determined in “air” or in “vacuum”.
λ	lambda. Greek letter used to denote wavelength.
μ	Abbreviation for micro, 10^{-6} units.

ν	nu. Greek letter used to denote frequency. Traditionally, the physics community uses "ν" to denote frequency whereas the engineering community uses "*f*".

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INDEX

λ button 6-3

A

abbreviations Glossary-1
accessing ORL mode 3-3
acquiring, status bar 3-7
acquisition button 3-4
after sales service 10-2
alarm box 7-8
alarm thresholds, entering 7-8
application software
  exiting 4-8
  launching 4-1
audible alarm 7-8

B

backplane connectors 2-4
button
  λ 6-3
  acquisition 3-4
  cal, ORL 6-3
  cal, PDL 3-3
  F_ 3-3
  graph 3-4
  ORL 3-3
  scan, PDL 3-3
  setup 3-4
  start, graphical display mode 7-3
  stop, graphical display mode 7-3
  stop, PDL 3-3
  units, PDL 3-3

C

calibration
  button, ORL 6-3
  button, PDL 3-3
  coupler 5-6
  CPL 5-1, 5-6
  DUT 5-1, 5-2
calibration setup
  CPL 5-6
  DUT 5-2
  ORL 6-7, 6-8
caps, protective 8-2
caution of product hazard 1-3
certification information vi
certification, warranty 10-2
channel
  identification 7-4
  page 7-4
cleaning the fiber end 2-5
clear last 7-9
clearing the graphical display area 7-3
closing the monitor window 3-8
connections 2-5
contacting EXFO 1-4
continuous scroll 7-9
control
  local 2-1
  remote 2-1
  status 3-7
control transfer 3-3
coordinates
  difference between two points 7-6
  finding out 7-6
coupler
  calibration 5-1, 5-6
  mode 3-3
coupler testing, calibration 5-1
coupling ratio 5-9
CPL
  calibration 5-1, 5-6
  calibration setup 5-6
current module status 3-7
curve plotting displays

clear last 7-9
continuous scroll 7-9
curve plotting modes. *see* curve plotting displays
curve sweep 7-9
customization of operating parameters 3-4

D

data and status display
graphical display mode 7-3
ORL 6-5
date of manufacture 2-1
DDE communication channel 2-1
detector ports 2-2
device under test
testing 5-3
device under test, calibration 5-2
display options 7-9
DUT
calibration 5-1, 5-2
calibration setup 5-2
mode, selection 3-3
testing 5-3
testing setup 5-4

E

equipment returns 10-3
excess loss 5-9
exiting the application software 4-8

F

F_ button 3-3, 6-3, 7-3
fiber end, cleaning 2-5
fiber type 2-1
free run, status bar 6-5
front panel description 2-2
function buttons
in graphical display mode 7-3
ORL 6-3
PDL 3-3

G

general sheet 3-4
getting help 1-4
glossary Glossary-1
GPIB
interface 2-1
link 3-7
graph button 3-4
graphical display mode
access 3-4
channel selection 7-4
clearing the display 7-3
description 7-1
display options 7-9
function buttons 7-3
menu bar 7-2
menu items 7-2
opening 7-1
power readings 7-3
printing 7-3
title bar 7-2

I

inserting a module 2-4
insertion loss 5-5
inspection upon receipt 1-2
IQ Software 1-1
IQ-200 product line 1-1
items 1-2

L

last calibration 5-3, 5-6
launching real-time sampling 7-3
launching the application software 4-1
LED push button 2-4
list of wavelengths 3-4
loading the application software 4-1
local 3-7
local control 2-1
lockout 3-7

M

main window
- data and status display, ORL 6-5
- menu bar 6-2
- parameter definition buttons 6-4
- PDL 3-1
- title bar 6-2

marker control buttons 7-6
menu bar
- graphical display mode 7-2
- ORL 6-2
- PDL 3-2

menu items
- graphical display mode 7-2
- PDL 3-2

minimum coupling ratio 5-9
minimum reflection 6-4
module
- insertion 2-4
- installation 2-4
- removal 2-5
- setup 2-4

monitor window
- closing 3-8
- description 3-7
- opening 2-4, 3-8

N

nameplate 2-1
next calibration 5-2, 5-6
null button
- ORL 6-3
- PDL 4-1, 5-1

O

offset null button
- ORL 6-3
- PDL 5-1

opening the monitor window 3-8
optical connections 2-3, 2-5, 5-1, 6-1
optical ports 2-2
ORL
- button 3-3
- cal button 6-3
- calibration setup 6-7, 6-8
- display, data and status 6-5
- function buttons 6-3
- measurement 2-2
- meter 3-3
- mode, accessing 3-3
- null button 6-3
- title bar 6-2
- zero button 6-3

P

packing list 1-2
part number 2-1
pausing real-time sampling 7-3
PC expansion card 2-1
PDCR, *see* polarization dependent coupling ratio
PDL
- cal button 3-3
- coupler mode 3-3
- display units 3-3
- DUT mode 3-3
- function buttons 3-3
- launching 2-4
- main window 3-1
- menu bar 3-2
- menu items 3-2
- null button 4-1
- nulling button 5-1
- scan button 3-3
- stop button 3-3
- title bar 3-2
- units button 3-3

PDL/OL general description 3-1
polarization dependent coupling ratio 5-9
polarization dependent loss 5-5
ports

connecting fiber-optic cable to 2-5
coupler 5-9
description of..... 2-2
power readings, graphical display mode 7-3
printing, graphical display mode 7-3
processing 3-7, 6-5
product
overview..... 2-1
version 2-1
protective caps 2-3, 8-2

R

range of wavelengths 4-2
rate, sampling 6-4
real-time sampling
display..... 7-1
launching..... 7-3
pausing 7-3
resuming 7-3
starting 7-3
stopping 7-3
reference
calibration..... 6-6
measurement..... 2-3
power value..... 5-5, 5-9
reflection
minimum 6-4
reference..... 6-4
see also ORL
remote 3-7
remote control..... 2-1
removing a module 2-5
resuming real-time sampling 7-3
return loss, *see* optical return loss
return merchandise authorization *see* RMA
RMA..... 10-3

S

safety
caution 1-3
important..... 1-3
warning 1-3
safety conventions.....1-3
sampling rate.....6-4
scan setup page 4-1
serial number.....2-1
service
after sales 10-2
setting the wavelength.....4-2
settings page 4-1
setup
button.....3-4
DUT testing.....5-4
window.....4-1
shipping to EXFO 10-3
software
exiting 4-8
launching 4-1
version 7-2
starting real-time sampling 7-3
status bar.....3-7
stop command.....7-3
stopping real-time sampling 7-3
storage 1-3
sweep of the display.....7-9
symbols Glossary-1

T

testing in DUT mode.....5-3
time scale 7-9
title bar
graphical display mode.....7-2
ORL 6-2
PDL.....3-2
transmission loss.....5-9
transportation 1-3
troubleshooting.....8-1

U

UltraTech Engineering Labs Inc. vi
user offset.....6-4

V

visual alarm 7-8

W

waiting for trigger or start time 3-7
warning of personal hazard 1-3
warranty
- certification 10-2
- exclusions 10-2
- general 10-1
- liability 10-2
- null and void 10-1

wavelength
- calibration, constant for 6-5
- dual-, source 6-8
- dual, testing 6-5
- list of 3-4
- page 3-4, 4-2
- range 4-2
- reference calibration 6-6
- selected, display 6-4
- selection button 6-3
- setting 4-2
- setup page 4-1
- storing capacity for each 6-10

Z

zero reflection measurement 6-7
zoom 7-6

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