IQ-9100

Optical Switch

Instruction Manual

October 1998
P/N: MAN-069-I .4ACE

Fourth 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.*

CAUTION

The optical components inside this module are sensitive to physical shock. The module should be handled with care at all times. A freefall of greater than 10 cm (3.75 inches) could cause permanent damage. Damage due to mishandling is not covered by the product warranty.

CONTENTS

FIGURES

CERTIFICATION INFORMATION

F.C.C. INFORMATION TO USER

This unit has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. 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. However, there is no guarantee that interference will not occur in a particular installation. If this unit does cause harmful interference to radio or television reception, which can be determined by turning the unit off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the unit and receiver.
- Connect the unit into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

Changes or modifications not expressly approved by EXFO Electro-Optical Engineering Inc. 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 B digital device. Please see the Declaration of Conformity.

1 INTRODUCTION

1.1 Presentation

EXFO Electro-Optical Engineering Inc. (EXFO) is pleased to introduce the IQ-9100 Optical Switch 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-9100 Optical Switch will provide many years of reliable operation. To benefit fully from the many features offered by the IQ-9100, it is important to read the following instructions thoroughly.

1.2 IQ-200 Product Line

The IQ-200 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, 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*.

1.3 Unpacking and Inspection

The IQ-9100 is delivered with the following standard items:

- IQ-9100 Instruction Manual
- Back-up floppy disk
- Certificate of Quality
- Declaration of Conformity
- Accessory kit (optional)
- Warranty validation card

The IQ-9100 optical switch 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 packaging material in case you need to return the IQ-9100.

1.4 Safety Conventions

The following conventions 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 personal 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.

WARNING

Do not install or terminate fibers while a laser source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

1.5 Transportation and Storage

Maintain a temperature range within specifications when transporting or storing the unit. Transportation damage can occur from improper handling. Therefore, the following recommendations are given to minimize the possibility of damage.

- If the unit is to be shipped, pack it in the original packing material for best protection.
- When not in use, 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 shocks and vibrations.

1.6 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

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2 PRELIMINARY INFORMATION

2.1 General Description

The IQ-9100 is a precision optical switch for component testing, remote fault location, and signal routing. The switch provides highly accurate fiber-to-fiber positioning for either singlemode or multimode fibers (50 μm/125 μm, 62.5 μm/125 μm, and 100 μm/140 μm), thus resulting in low insertion loss and excellent repeatability. The IQ-9100 is particularly well suited for the most demanding laboratory applications.

Applications for the IQ-9100 include

- automated testing of cable, components, and active devices
- remote fiber testing systems
- optical signal routing/protection switching

The IQ-9100 is designed for laboratory and manufacturing measurement applications using the IQ-203 Mainframe or IQ-206 Expansion Unit.

The IQ-9100 supports both local and remote control. Local control is via the Windows compatible IQ-Software preinstalled on the IQ-203 or installed on a host PC when using the IQ-206 PC Expansion Card.

Remote control of the IQ-9100 is accomplished through one of these four ways:

- a GPIB interface
- an RS-232 external interface
- Windows OLE (Object Linking and Embedding) automation
- a Windows DDE (Dynamic Data Exchange) communication channel

Please refer to Section 5, *The GPIB Interface* 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.

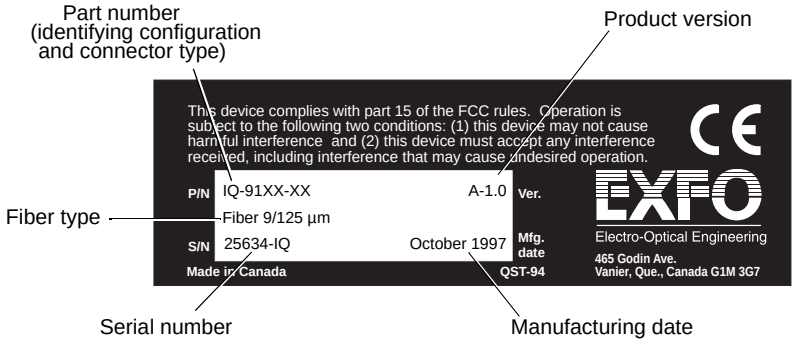

Figure 2-1. Module Nameplate

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

The optical switch comes in several configurations. The different configurations along with the required number of slots (module width) are identified in the following table.

Model	Number of channels	Number of IQ slots
IQ-9102	1×2	1
IQ-9104	1×4	1
IQ-9112	1×12	2
IQ-9116	1×16	3
IQ-9132	1×32	5
IQ-9122	2×2	1
IQ-9124	2×4	2

Table 2-1. Optical Switch Configurations

2.2 Front Panel Description

Figures 2-2 to 2-8 show the different switch configurations available. Note that actual connectors may differ from those depicted in the illustrations.

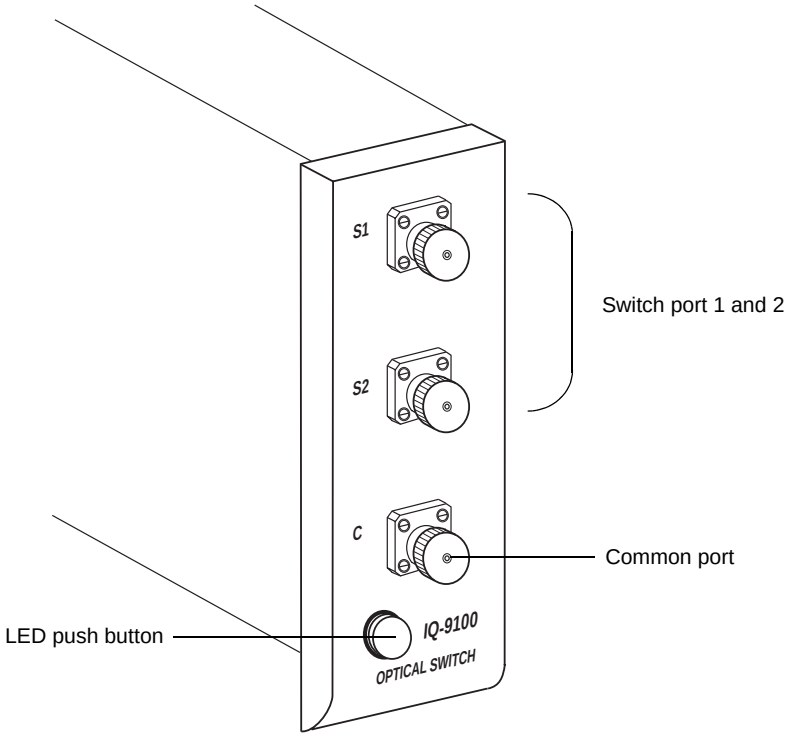

Figure 2-2. 1 × 2 Optical Switch Module

Note: *Actual connectors may differ from those depicted in the illustrations.*

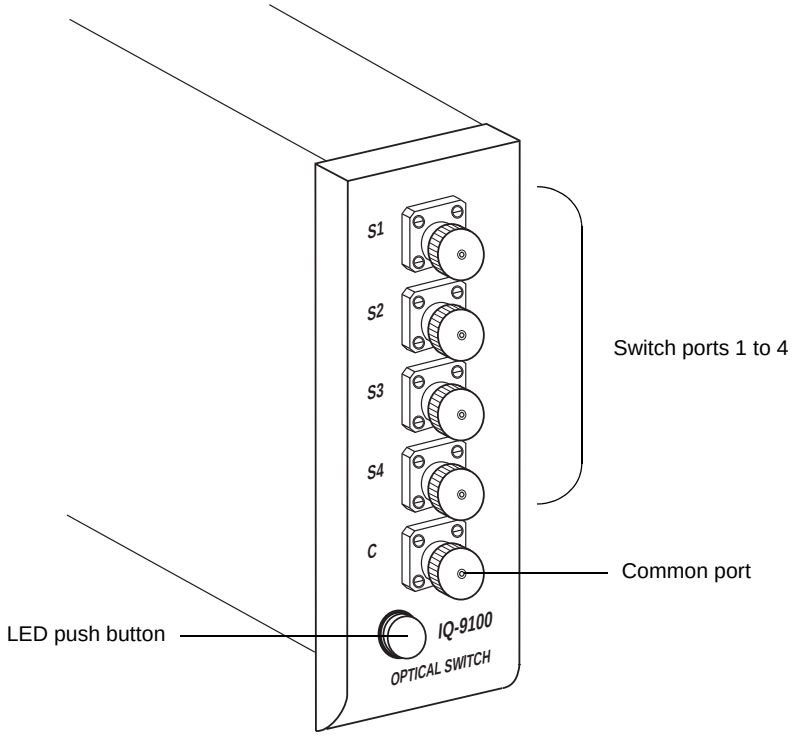

Figure 2-3. 1 × 4 Optical Switch Module

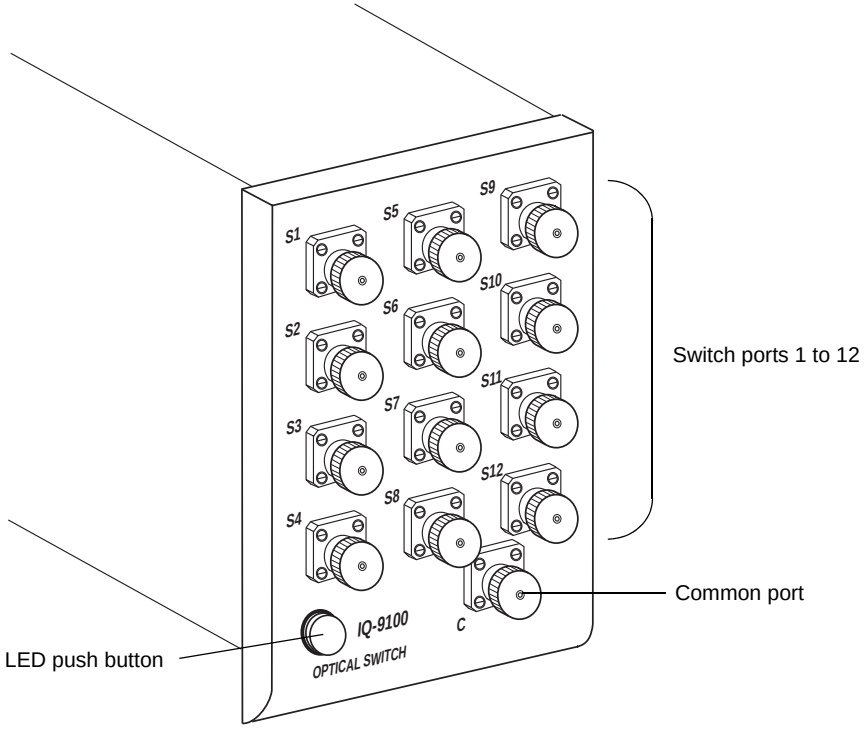

Figure 2-4. 1 × 12 Optical Switch Module

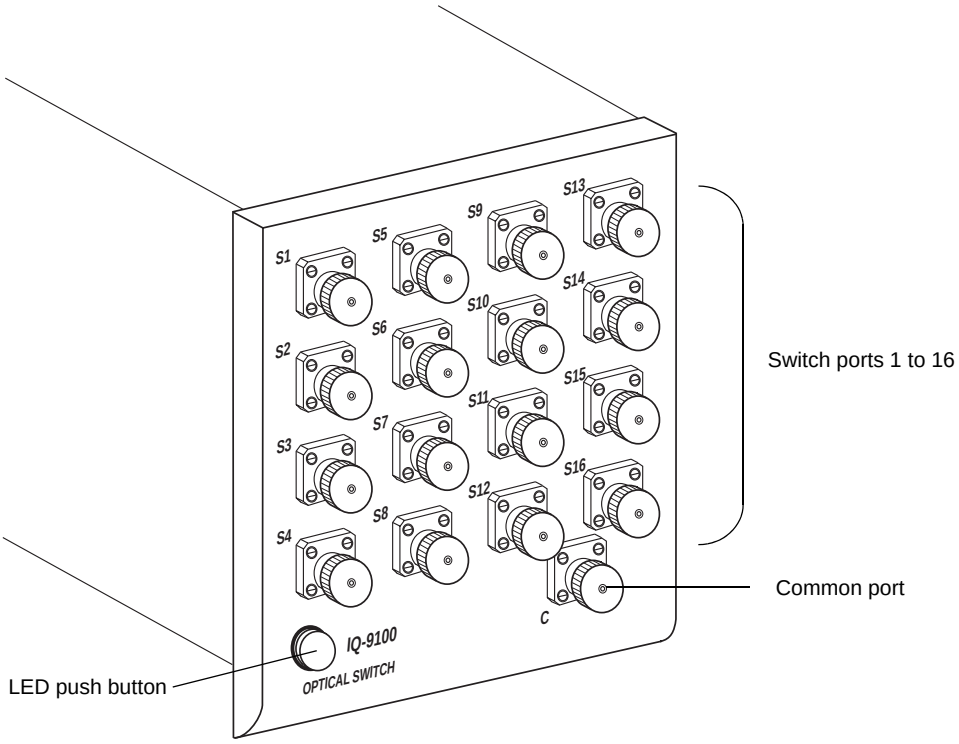

Figure 2-5. 1 × 16 Optical Switch Module

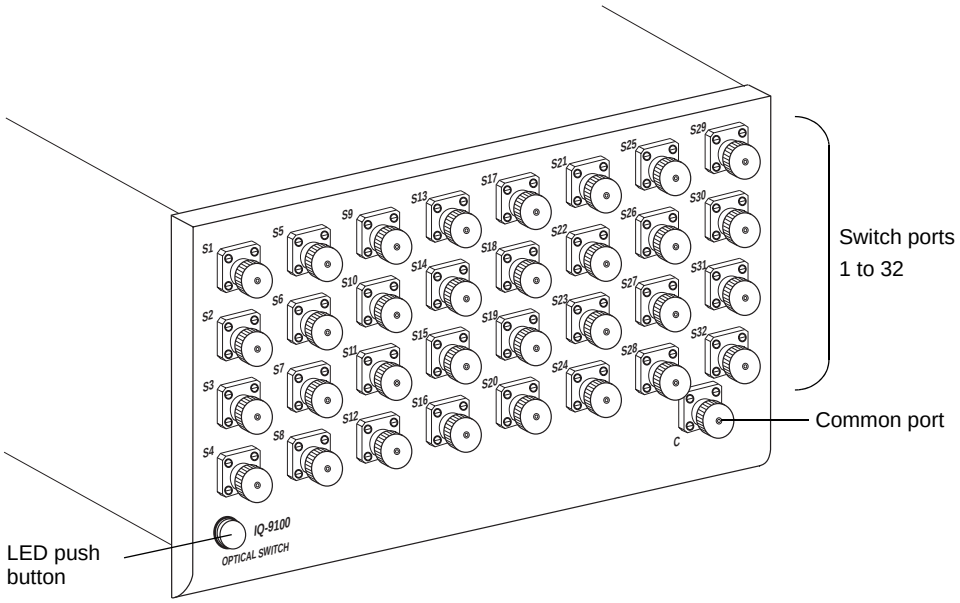

Figure 2-6. 1 × 32 Optical Switch Module

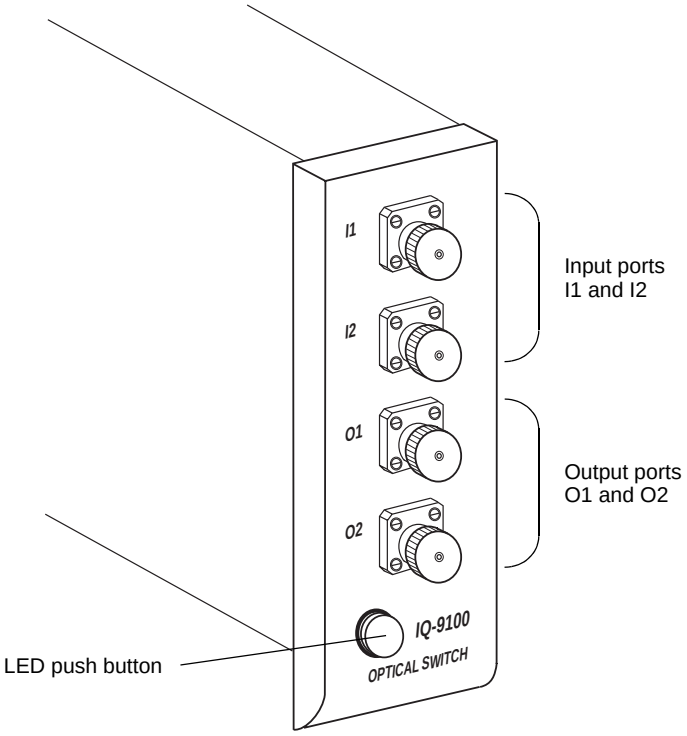

Figure 2-7. 2 × 2 Optical Switch Module

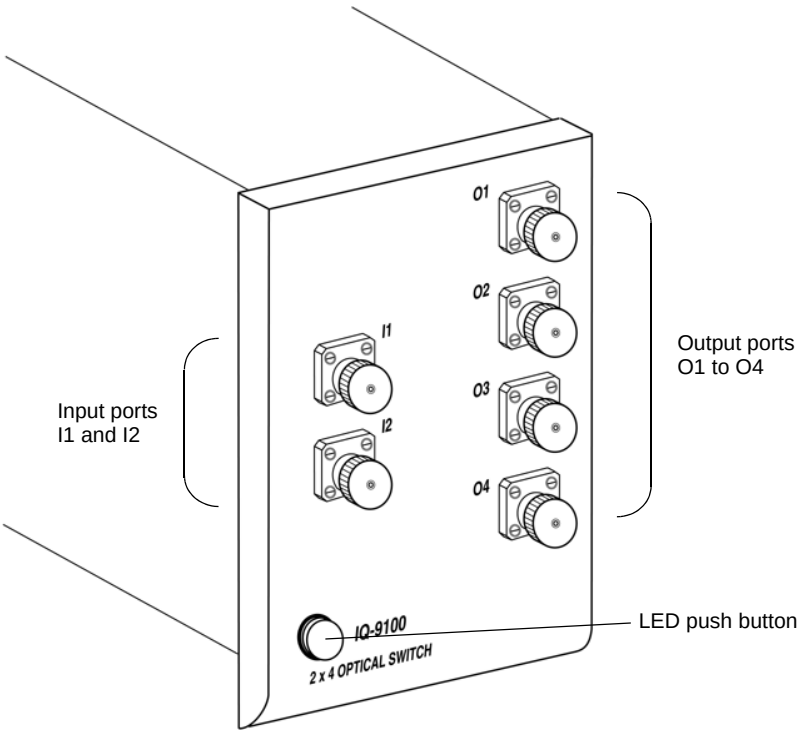

Figure 2-8. 2 × 4 Optical Switch Module

2.2.1 Ports

The switch ports of 1× N optical switches are numbered on the front panel while the common port is identified with a "C." These switches are bidirectional. This means that the optical signal can either enter through the common port and be directed toward any switch port or enter through any switch port, then be directed toward the common port.

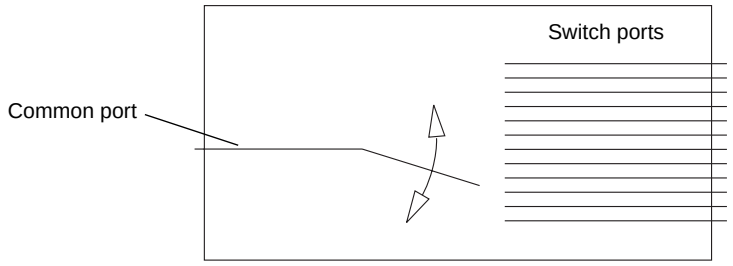

Figure 2-9. 1 × N Optical Switch Principle

The IQ-9122 (2 × 2 configuration) is also a bidirectional switch. The two positions for this switch are known as inserted state and bypass state. As illustrated in Figure 2-10, in bypass state, the possible paths for the optical signal are known as bypass path and loopback path. Figure 2-11 illustrates the three possible positions for the 2 × 4 switch.

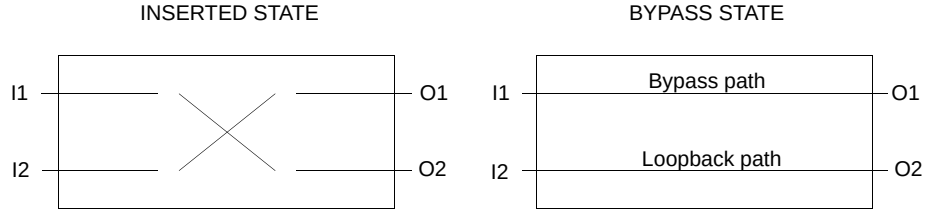

Figure 2-10. 2 × 2 Optical Switch Principle

Note: *The insertion loss and maximum repeatability are a little greater for the loopback path. For complete specifications, see Section 7,* Technical Specifications.

The IQ-9124 (2 × 4 configuration) is also a bidirectional switch. As illustrated in Figure 2-11, the IQ-9124 cans be set to three positions.

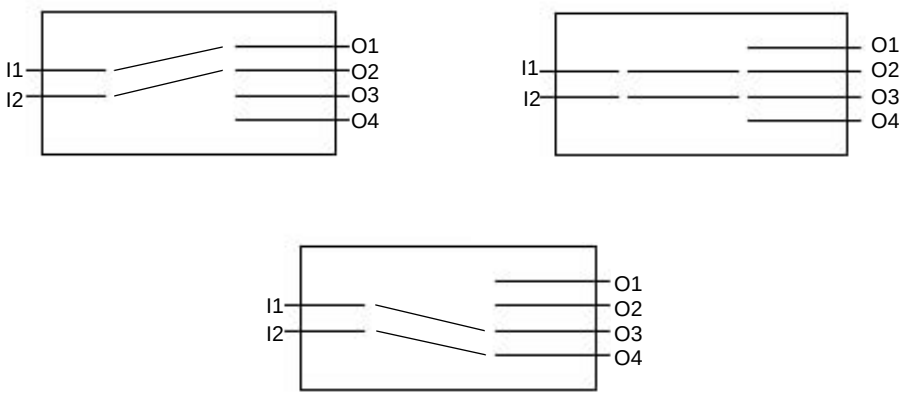

Figure 2-11. 2 × 4 Optical Switch Principle

2.2.2 LED Push Button

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

- When system is powered ON, the LED push button will illuminate.
- Pressing the LED push button activates the main window.
- Pressing the LED push button when the main window is open activates the monitor window.

Note: *The monitor window is a compact window displaying basic data and is fully explained in Section 3.3,* Monitor Window.

2.3 Module Insertion

CAUTION

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

To insert a module,

1. Power off the IQ-203/IQ-206.

2. Insert the module into any available slot. The IQ-203/IQ-206 will automatically recognize the module no matter what slot it is inserted in.

IMPORTANT

Be sure to insert the module all the way to the back of the IQ-203/IQ-206 to ensure 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.

2.4 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.

2.5 Module Removal

CAUTION

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

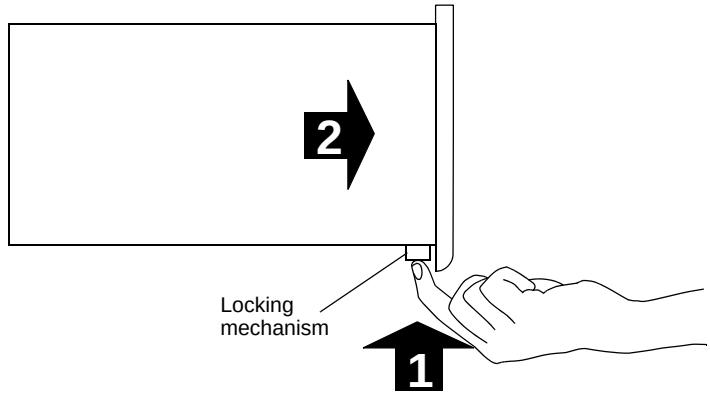

Figure 2-12. Removing an IQ Module

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

3 OPERATION

The many features of the optical switch are controlled using the Windows compatible IQ software. Please refer to the *IQ-200 Optical Test System* Instruction Manual for information regarding the IQ-200 Optical Test System, the IQ-203 Mainframe, and IQ software conventions.

3.1 Loading the Application Software

There are two ways to load the application software:

- Push the LED push button on the front panel.
- Double-click on the IQ-9100 icon in the IQ-200 Optical Test System main window.

Once the application software is loaded, the main window opens. The main window contains all necessary commands to control the optical switch. Depending on the optical switch configurations, the main window appears as follows:

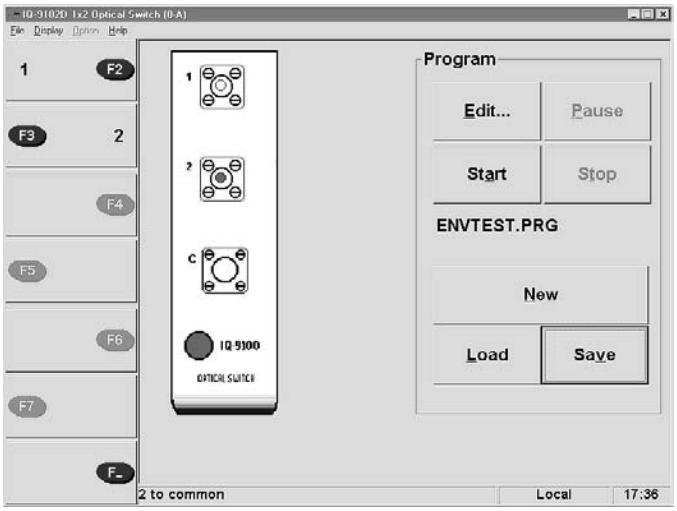

Figure 3-1. 1 × 2 Optical Switch Main Window

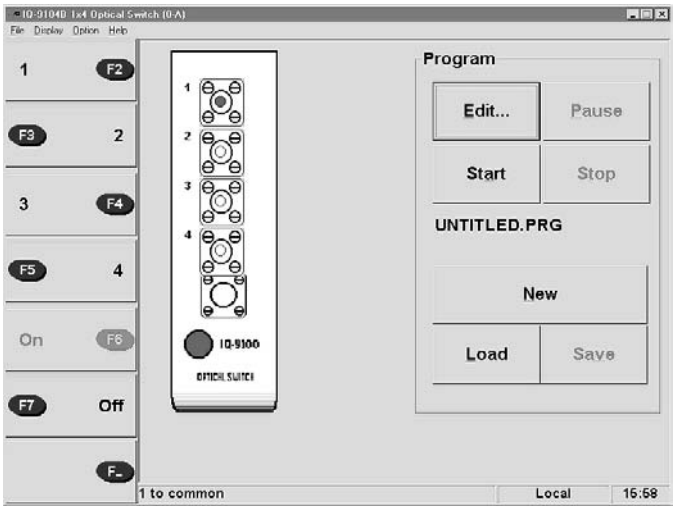

Figure 3-2. 1 × 4 Optical Switch Main Window

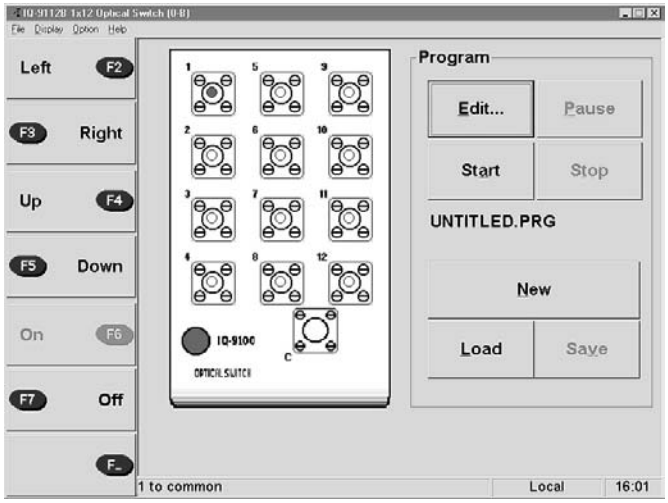

Figure 3-3. 1 × 12 Optical Switch Main Window

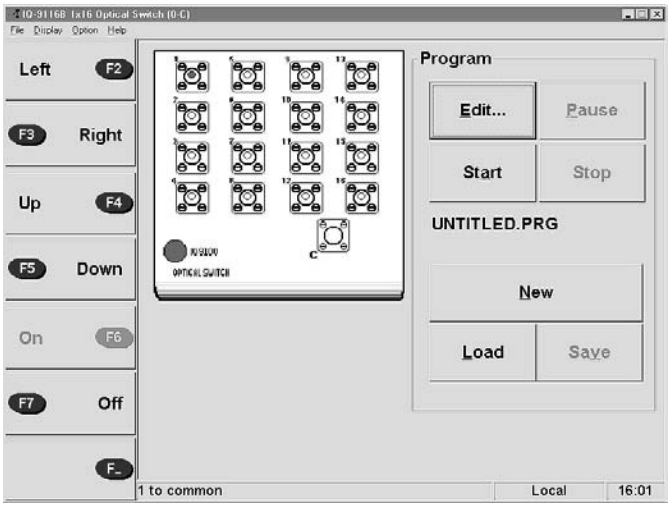

Figure 3-4. 1 × 16 Optical Switch Main Window

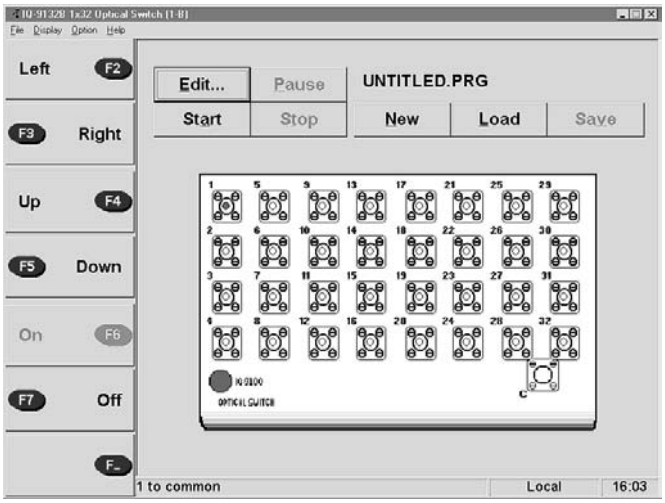

Figure 3-5. 1 × 32 Optical Switch Main Window

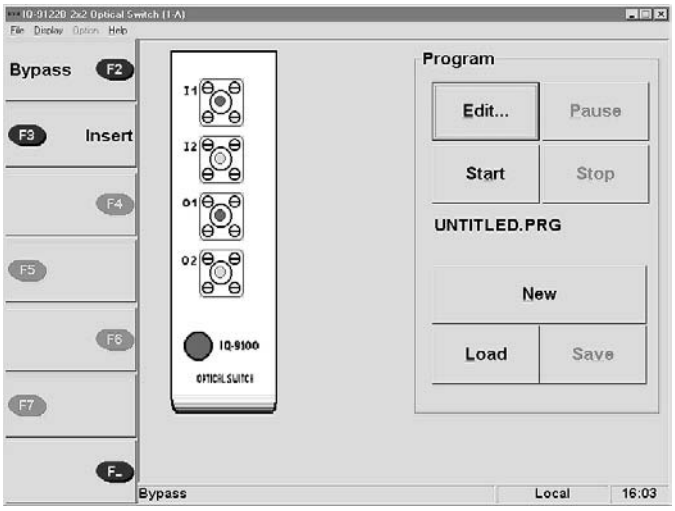

Figure 3-6. 2 × 2 Optical Switch Main Window

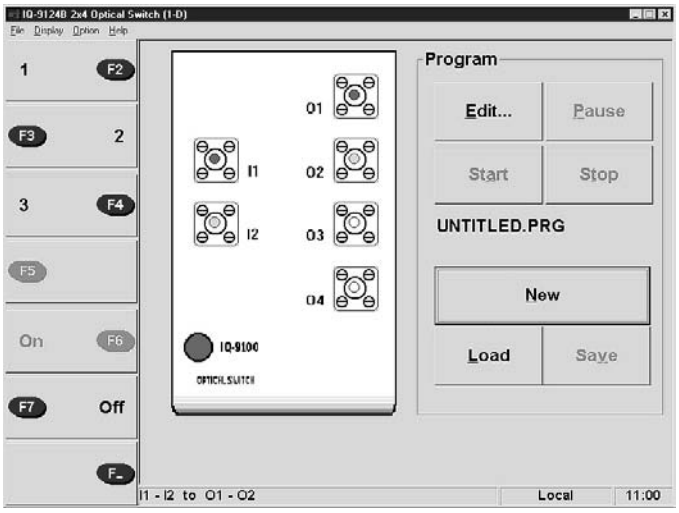

Figure 3-7. 2 × 4 Optical Switch Main Window

3.2 Main Window Description

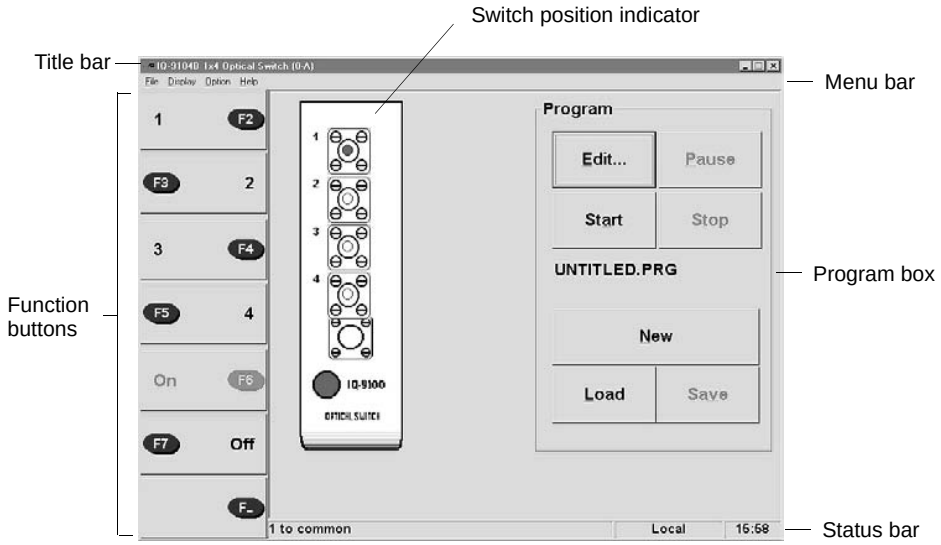

Figure 3-8. Main Window

The IQ-9100 main window, shown in Figure 3-8, can be broken down into five sections:

- title bar and menu bar
- function buttons
- program box buttons
- status bar
- switch position indicator

3.2.1 Title Bar and Menu Bar

The title bar and the menu bar are at the top of the main window (see Figure 3-8). The title bar indicates the optical switch number and switch channel configuration. The menu bar contains four pull 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 switch data (see Section 3.3, *Monitor Window*).
Option	Optimize for repeatability	When this option is selected (default), the switch mechanism returns to a reference position before aligning to a new channel position. This ensures optimum repeatability. When this option is not selected, the switch mechanism goes directly to the new channel position. This provides faster switching times with less optimum repeatability. This option is not available on the IQ-9102 and IQ-9122.

Table 3-1. Main Window Menus (part 1 of 2)

Menu	Option	Function
Help	Online Manual	Opens the application Help file which contains the text of the present instruction manual.
	About...	Opens a window which provides the following information: • module model number • software version • technical assistance telephone numbers, e-mail and website addresses • available IQ-203 system memory (RAM) • remaining hard disk drive storage

Table 3-1. Main Window Menus (part 2 of 2)

3.2.2 Function Buttons

The function buttons, found on the left side of the main window (see Figure 3-8), are used to directly control the optical switch.

Button	Description
1 F2	Activates switch for channel 1 (for 1 × 2, 1 × 4, and 2 × 4 switches).
F3 2	Activates switch for channel 2 (for 1 × 2, 1 × 4, and 2 × 4 switches).
3 F4	Activates switch for channel 3 (for 1 × 4 and 2 × 4 switches).
F5 4	Activates switch for channel 4 (for 1 × 4 switch).

Table 3-2. Main Window Function Buttons (part 1 of 2)

Button	Description
Left F2	Moves left within switch position indicator (for 1 × 12, 1 × 16, and 1 × 32 main window).
F3 Right	Moves right within switch position indicator (for 1 × 12, 1 × 16, and 1 × 32 main window).
Up F4	Moves up within switch position indicator (for 1 × 12, 1 × 16, and 1 × 32 main window).
F5 Down	Moves down within switch position indicator (for 1 × 12, 1 × 16, and 1 × 32 main window).
Bypass F2	Sets the 2 × 2 switch to bypass state: in bypass state, I_1 is connected to O_1 and I_2 is connected to O_2.
F3 Insert	Sets the 2 × 2 switch to inserted state: in inserted state, I_1 is connected to O_2 and I_2 is connected to O_1.
On F6	Reactivates switches if **OFF** has been pressed (for 1 × 4, 1 × 12, 1 × 16, 1 × 32, and 2 × 4 switches).
F7 Off	Sets the switch to a position where there is no optical continuity (for 1 × 4, 1 × 12, 1 × 16, 1 × 32, and 2 × 4 switches).
F_	Transfers control between software function buttons and IQ-203 front panel hardware function keys for all switches (refer to *IQ-200 Optical Test System Instruction Manual*). ***Note:*** *When software function buttons are disabled, they appear dark gray.*

Table 3-2. Main Window Function Buttons (part 2 of 2)

Note: *IQ-9100 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.*

3.2.3 Program Box Buttons

The program box buttons, found on the right side of the main window (see Figure 3-8), permit the definition of automatic switching programs (see Section 3.5, *Using the Program Mode*).

Button	Description
Edit...	Opens the program setting window where the switch time configurations may be customized.
Start	Starts the program defined in the program setting window.
Stop	Stops the program defined in the program setting window.
Pause	Momentarily pauses the currently running program.
New	Allows you to create a new program file.
Load	Opens a dialog box to load a specific program file.
Save	Opens a dialog box to save the program in use.

Table 3-3. Program Box Buttons

3.2.4 Status Bar

The status bar, found at the bottom of the main window (see Figure 3-8), identifies the current operational status of the switch.

On the status bar, you also find the inscription Local, Remote, or Lockout, which indicates if the IQ-9100 is controlled locally or remotely. The table below explains the meaning of these inscriptions. For more information on how to control the different IQ modules remotely, 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 remotely but local commands can still be used.
Lockout	The unit is exclusively controlled remotely.

Table 3-4. Module Control Status

3.2.5 Switch Position Indicator

The switch position indicator, found at the center of the main window (see Figure 3-8), illustrates the actual switch front panel, pointing out the currently activated switch channel with a dot, red if using a color monitor.

➤ ***Tip:*** *To modify the switch status, you can click directly on the desired channel, on the switch position indicator.*

Note: *In the case of the 2 × 4 switch, clicking on* **O4** *will not modify the switch status. Clicking on any of the other three ports selects the configuration having this port connected to* **I1**.

3.3 Monitor Window

The monitor window displays basic switch data. Using the monitor window with other IQ monitor windows allows 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.

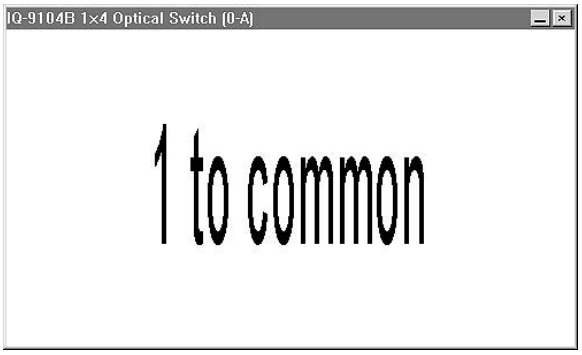

Figure 3-9. 1 × N Monitor Window

3.3.1 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 (in the top right corner).
- Push the LED push button (on the front panel of the switch module).

3.3.2 Closing the Monitor Window

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

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

3.4 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 either from the main window or monitor window.

3.4.1 From the Main Window

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

- Click on ☒ (in the top right corner of the main window).
- Choose **Exit** from the *File* menu.
- Click on the module icon (in the top left corner of the main window) and select **Close**.

3.4.2 From the Monitor Window

To exit the application software from the monitor window, click on ☒ (in the top right corner of the monitor window).

3.5 Using the Program Mode

Useful automatic switching programs may be created to suit specific testing needs. For each step, a different switch position is activated for a preset amount of time.

3.5.1 Creating a New Program

To create a new program,

1. From the main window, select **New** to open the program setting window.

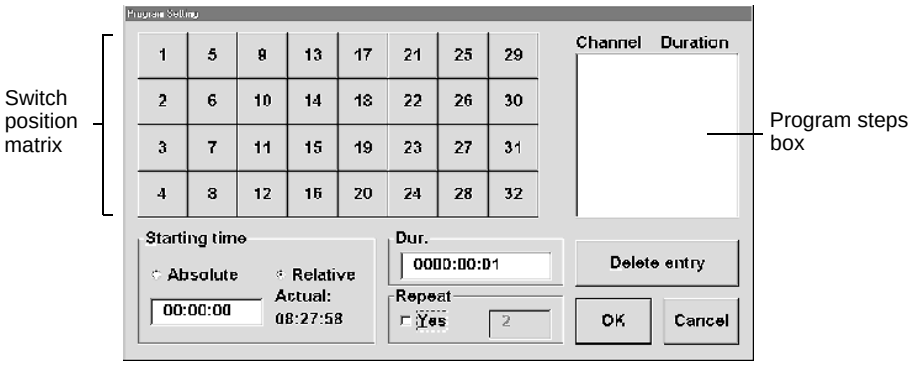

Figure 3-10. 1 × N Optical Switch Program Setting Window

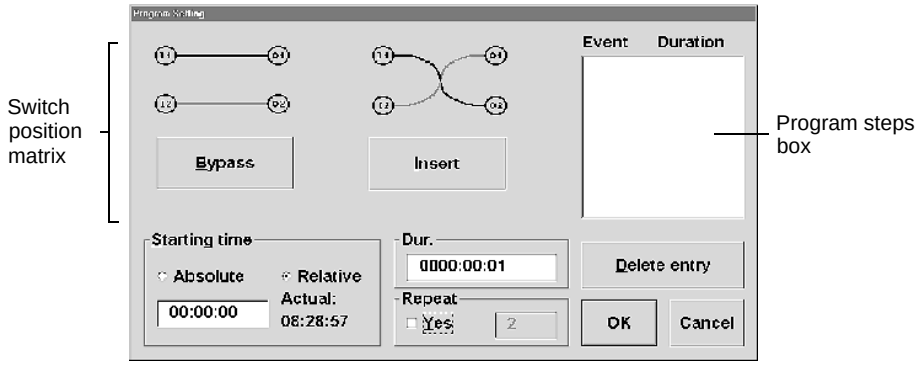

Figure 3-11. 2 × 2 Optical Switch Program Setting Window

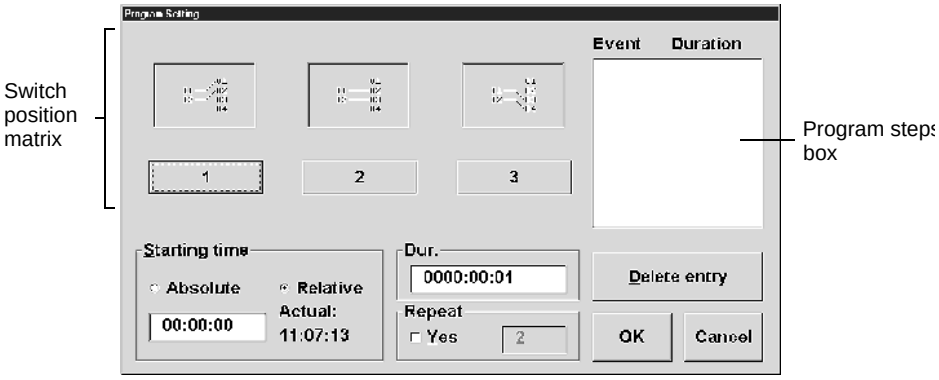

Figure 3-12. 2 × 4 Optical Switch Program Setting Window

2. Double-click on the **Dur.** edit box and enter the desired duration for the first step. The format for the duration value is HHHH:MM:SS.

3. From the switch position matrix, choose the channel you want to activate for the first step. The channel number and step duration (as defined in the **Dur.** edit box) will appear in the program steps box.

Note: *When using the 2 × 2 Optical Switch, select* **Bypass** *or* **Insert** *to confirm your entry in the event table. When using the 2 × 4 Optical Switch, select* **1**, **2**, *or* **3**.

4. Repeat step 2 and 3 of this procedure until all the program steps are entered.

Note: *To remove a step, highlight it in the program steps box then choose* **Delete entry**.

5. If you want the program to loop, click on the **Repeat** check box. When repeat is selected, the value displayed in the adjacent edit box determines the number of program loops. Edit the number of loops as needed.

Note: *Entering "0" in the Repeat edit box makes the program loop continuously.*

6. To accept the program and return to the main window, choose **OK**.

3.5.2 Saving a Program

To save a program you just created, choose **Save** from the main window.

3.5.3 Loading a Program File

To load a program file that was previously saved, choose **Load** from the main window.

3.5.4 Editing a Program File

To edit a program file you just created, once you are back in the main window, choose **Edit**. To edit a program file that is saved on a disk, you must load it first, then choose **Edit**. In either case, choosing **Edit** opens the program setting window.

Once in the program setting window, you see all the program steps in the program steps box. From there you can

- Delete a step by highlighting it and choosing **Delete entry**.
- Insert new steps anywhere in the program (a new step is always inserted after the one that is highlighted in the program steps box). To insert a new step, define the activation time in the **Dur.** edit box, then, from the switch position matrix, choose the desired channel for this step. The new step then appears in the program steps box.

Once all the desired changes have been made, choose **OK** to accept the changes and return to the main window. To quit the program setting window without recording the current changes, choose **Cancel**.

3.5.5 Executing a Program File

To execute a program file,

1. Create a switch program as explained in Section 3.5.1, *Creating a New Program*, or load an existing program as explained in Section 3.5.3, *Loading a Program File*.

2. From the program setting window, select the appropriate **Starting time** radio button.

   Select **Absolute** where the program is to start running at a specified time (24-hour format, e.g. 18:06:00).

   Select **Relative** when the program is to start running after a specified time interval (e.g. 00:10:00, the program will start running 10 minutes after choosing **Start** in the main window).

3. Double-click on the **Starting time** edit box and enter a program starting time value (either an absolute time if you chose the **Absolute** radio button or a time interval if you chose the **Relative** radio button). The format for the time value is HH:MM:SS.

Note: *The default starting time settings are* **Relative** *and* **00:00:00** *(i.e. the program will start as soon as* **Start** *is chosen).*

4. Click on the **Repeat** check box if you want the program to loop. When repeat is selected, the value displayed in the adjacent box determines the number of program loops. The value in this box may be edited by double-clicking on it (up to 9999 loops).

Note: *Entering "0" in the Repeat edit box makes the program loop continuously.*

5. Once all the settings are chosen, choose **OK** to close the program setting window and return to the main window.

6. To start the program, choose **Start** from the main window.

   - If the starting time settings are **Relative** and **00:00:00**, the program will start as soon as **Start** is chosen.
   - If the program is set to start at a specific time, the status bar will indicate the time at which the program is to start.
   - If the program is set to start after a preset interval, the time remaining before program start will be displayed in the status bar.

Once the program is started,

- The switch automatically sequences through the program steps.
- The program status is always displayed in the status bar.
- The switch position indicator will display a dot in the center of the corresponding activated channel port.
- Program execution can be paused at any time by choosing **Pause**. To resume execution choose **Start**.
- Choose **Stop** to terminate program execution prematurely.

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4 SUGGESTED APPLICATIONS

By using the optical switch with other IQ Series modules, the number of possible applications is almost unlimited. Here are only a few suggestions.

4.1 Multiple Device Testing

Using two optical switches, an IQ-2100 light source, and IQ-1100 power meter, it is possible to perform automated qualification and production testing for multiple devices.

1. Connect the IQ-2100 output port to the common port of the first IQ-9100.
2. Connect an IQ-9100 switch port to each device under test.
3. Connect the devices to the switch ports of the second IQ-9100.
4. Connect the common port of the second IQ-9100 to the IQ-1100 detector port.

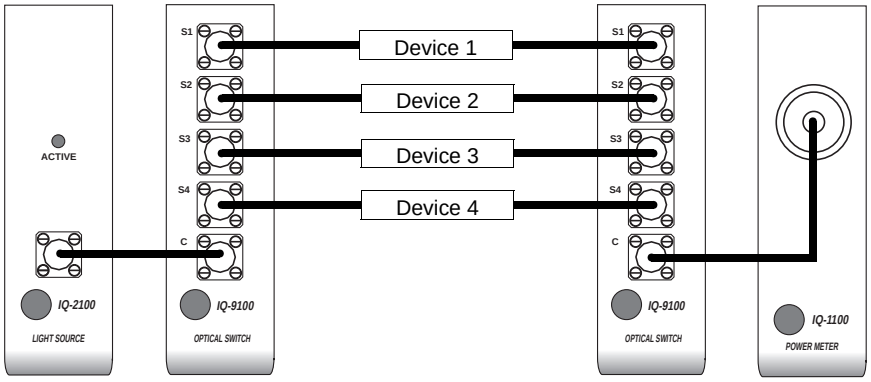

Figure 4-1. Multiple Device Testing Setup

5. Measure the devices under test using the IQ-1100.

4.2 Optical Switch Port Insertion Loss

The insertion loss of any switch port can be measured using an IQ-2100 light source, IQ-1100 power meter, and the IQ-9100 optical switch.

1. Connect the IQ-2100 output port to IQ-1100 detector port using two test jumpers linked with a bulkhead connector.

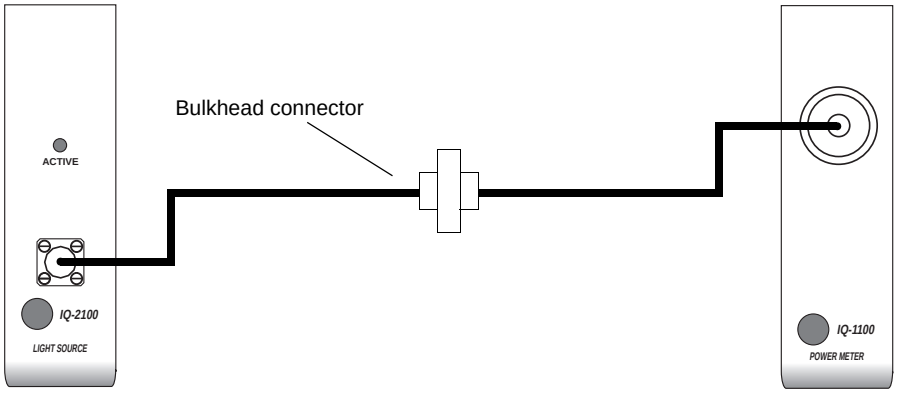

Figure 4-2. Reference Setup

2. Store the power reading obtained as a reference value in the IQ-1100.

3. Using the same test jumpers, connect the IQ-2100 to one of the IQ-9100 switch ports, and connect the IQ-9100 common port to the IQ-1100 detector port (the IQ-9100 now replaces the bulkhead connector).

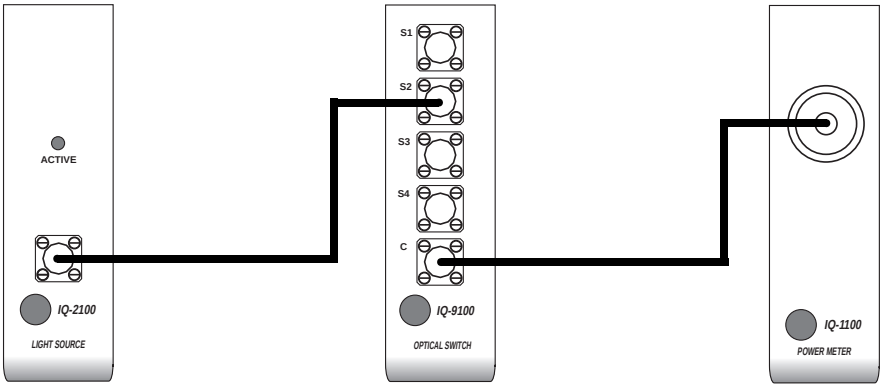

Figure 4-3. Insertion Loss Testing Setup

4. The insertion loss registered on the IQ-1100 will then be the IQ-9100 switch port insertion loss including connectors.

4.3 Creating Customized Switch Configurations

By interconnecting two or more switch modules, custom switch configurations can be built. For example, 1×2 and 1×16 switches can be connected to create a 2×16 switch configuration. To do so, simply connect the common ports of both switches.

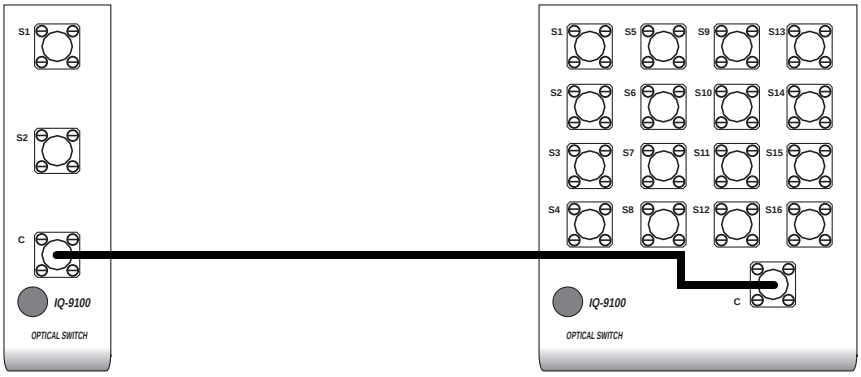

Figure 4-4. 2× 16 Customized Switch Configuration

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5 THE GPIB INTERFACE

5.1 Command Structure

The GPIB commands follow the guidelines determined by the Standard-Commands-for-Programmable-Interface (SCPI) consortium. For example, the command syntax

FORM(0..26):READ[:DATA]<space><digit>

is used to change the measurement display resolution (number of digits after the decimal point) of a given module.

In this particular example,

- FORM identifies that the command is a part of the SCPI FORMat subset of commands
- (0..26) is a whole number between 0 and 26 that identifies the module
- READ and DATA are keywords that define the function of the command
- [ ] indicates that a keyword or a parameter is optional
- <space> is included to indicate that a space is required
- <digit> is the command parameter

All keywords must be CAPITAL characters separated by a colon. A typical command would be

FORM4:READ:DATA 1

This command instructs a power meter module to display a power measurement with 1 digit after the decimal point.

5.2 Common Commands

The IQ-9100 recognizes all of the common commands identified as mandatory by IEEE-488.2. These commands, as well as some optional common commands, are summarized in Table 5-1.

Command	Function
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*LOK	Set Lockout programming state
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*REM	Set Remote programming state
*RST	Reset Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TRG	Trigger Command
*TST?	Self Test Query
*WAI	Wait to Continue Command

Table 5-1. Common Commands Summary

The common commands are fully explained on the following pages.

*CLS

Description This command sets the contents of the Standard Event Register (ESR), the Status Byte Register (STB), and the Error Queue (ERR) to zero. This command is commonly used to clear the status registers before enabling SRQ. Note that the output queue, the Standard Event Status Enable Register (ESE), and the Service Request Enable Register (SRE) are not affected.

Syntax *CLS

*ESE

Description This command is used to set bits in the Standard Events Status Enable Register (ESE) to a new value (initial value is 255). The contents of the ESE register are logically ANDed with the ESR register. A non zero result will set the Event Summary Bit (ESB) of the Status Byte register (STB). This command is useful for selecting which events may generate an SRQ.

Syntax *ESE<space><value>

Parameters The <value> parameter must be between 0 and 255.

*ESE?

Description This query reads the contents of the Events Status Register.

Syntax *ESE?

Response A binary integer with a value between 0 and 255.

*ESR?

Description This query reads the contents of the Standard Event Status Register (ESR).

Syntax *ESR?

Response A binary integer with a value between 0 and 255.

*IDN?

Description This query reads the IQ-9100 identification string.

Syntax *IDN?

Response “EXFO E.O. Engineering IQ-9100 Vxx.xx” where xx.xx is the current product version.

*LOK

Description This command is used to set the Lockout programming state.

Syntax *LOK

*OPC

Description This command will cause the SCPI Manager to generate the operation complete message in the Standard Event Status Register (ESR) when all pending selected SCPI Manager’s operations have been completed.

Syntax *OPC

Example *OPC;*IDN?

*OPC?

Description This query puts an ASCII 1 in the output queue when the content of the input queue has been processed. This query is useful to prevent another command from processing until the current command is complete.

Syntax *OPC?

Response "1"

*REM

Description This command is used to set the Remote programming state.

Syntax *REM

*RST

Description This command empties the step response list. It is only seen when it is part of another multiple command. In the example below, by adding this command after *IDN?, you will not be able to access the answer. The *RST, in this instance, erases the identification string. In addition, this command performs the following operations:

1. Return to initial state before command was sent, and not necessarily to previous settings.
2. Force the device to enter into an Operation Complete Command Idle State (OCIS).
3. Force the device to enter into an Operation Complete Query Active State (OQAS).
4. Initialize previous responses unless there has been a program message terminator preceded by an *RST.

Syntax *RST

Example *IDN?;*RST<NL>

*SRE

Description This command sets bits in the Service Request Enable Register (SRE; initial value is 255), and enables the corresponding bit in the Status Byte Register (STB). The command can be used to select which events can initiate a service request.

Syntax *SRE<space><value>

Parameter The <value> parameter must be between 0 and 255.

*SRE?

Description This query returns the contents of the Service Request Enable Register (SRE).

Syntax *SRE?

Response A binary integer between 0 and 255

*STB?

Description This query returns the contents of the Status Byte Register (STB).

Syntax *STB?

Response A binary integer between 0 and 255

*TRG

Description Not supported

Syntax *TRG

*TST?

Description This query initiates an internal self test, and returns a binary value indicating the results of the test.

Syntax *TST?

Response A binary value:
"0" -test is complete with no errors
"1" -test is complete with errors

*WAI

Description Not supported

Syntax *WAI

5.3 System Commands

STATus:OPERation:CONDition?

Description This command returns the value of the CONDITION register in the OPERATION node.

Syntax STAT:OPER:COND?

STATus:OPERation:ENABle

Description This command resets the value of the ENABLE register for the OPERATION node.

Syntax STAT:OPER:ENAB<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:OPERation:ENABle?

Description This command returns the value of the ENABLE register for the OPERATION node.

Syntax STAT:OPER:ENAB?

Response A binary integer between 0 and 65 536

STATus:OPERation:EVENt?

Description This command returns the value of the EVENT register in the OPERATION node. The command STAT:OPER? gives the same result.

Syntax STAT:OPER:EVEN?

STATus:OPERation:NegativeTRansition

Description This command resets the value of the NEGATIVE TRANSITION register for the OPERATION node.

Syntax STAT:OPER:NTR<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:OPERation:NegativeTRansition?

Description This command returns the value of the NEGATIVE TRANSITION register for the OPERATION node.

Syntax STAT:OPER:NTR?

Response A binary integer between 0 and 65 536.

STATus:OPERation:PositiveTRansition

Description This command resets the value of the POSITIVE TRANSITION register for the OPERATION node.

Syntax STAT:OPER:PTR<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:OPERation:PositiveTRansition?

Description This command returns the value of the POSITIVE TRANSITION register for the OPERATION node.

Syntax STAT:OPER:PTR?

Response A binary integer between 0 and 65 536.

STATus:PRESet

Description This command sets all the registers for all the nodes to a default value.

Syntax STAT:PRES<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:QUEStionable:CONDition?

Description This query returns the value of the CONDITION register for the QUESTIONNABLE node.

Syntax STAT:QUES:COND?

Response A binary integer between 0 and 65 536.

STATus:QUEStionable:ENABle

Description This command resets the value of the ENABLE register for the QUESTIONNABLE node.

Syntax STAT:QUES:ENAB<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:QUEStionable:ENABle?

Description This command returns the value of the ENABLE register for the QUESTIONNABLE node.

Syntax STAT:QUES:ENAB?

Response A binary integer between 0 and 65 536.

STATus:QUEStionable:EVENt?

Description This command returns the value of the EVENT register for the QUESTIONNABLE node.

Syntax STAT:QUES:EVEN?

Response A binary integer between 0 and 65 536.

STATus:QUEStionable:NegativeTRansition

Description This command resets the value of the NEGATIVE TRANSITION register for the QUESTIONNABLE node.

Syntax STAT:QUES:NTR<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:QUEStionable:NegativeTRansition?

Description This command returns the value of the POSITIVE TRANSTION register for the QUESTIONNABLE node.

Syntax STAT:QUES:NTR?

Response A binary integer between 0 and 65 536.

STATus:QUEStionable:PositiveTRansition

Description This command resets the value of the POSITIVE TRANSITION register for the QUESTIONNABLE node.

Syntax STAT:QUES:PTR<space><numeric>

Parameters The <numeric> parameter must be between 0 and 65 536.

STATus:QUEStionable:PositiveTRansition?

Description This command returns the value of the POSITIVE TRANSTION register for the QUESTIONNABLE node.

Syntax STAT:QUES:PTR?

Response A binary integer between 0 and 65 536.

SYSTem:ERRor?

Description This query returns the next error in the list. When an error is generated, an error number is sent to the error list. The error list is accessed with the query SYST:ERR?. If the list contains 20 errors and a new error occurs, the new error will replace the first error in the list.

Syntax SYST:ERR?

Response The next error in the list. See error list and descriptions in Section 5.6, *GPIB Error Messages*.

SYSTem:VERSion?

Description This commands returns the IQ-9100 identification string.

Syntax SYST:VERS?

Response “1998.0”

5.4 Specific Commands

PROGram[:SELected]:EXECute

Description This command initiates execution of the program currently loaded in the module's memory.

Syntax PROG(0..26)[:SEL]:EXEC

Example PROG3:SEL:EXEC

PROGram[:SELected]:NAME

Description This command loads a previously defined switch program into the module's memory. See the module instruction manual for information about creating a switching program.

Syntax PROG(0..26)[:SEL]:NAME<space><string>

Parameter The <string> parameter is the path and filename of the program to be loaded.

Example PROG3:SEL:NAME C:\IQ\USERFILE\PROG1X4.PRG

Note This command will terminate any program that may be running.

PROGram[:SELected]:NAME?

Description This query returns the name and path of the currently loaded program.

Syntax PROG(0..26)[:SEL]:NAME?

Response Returns a string identifying the path and name of the program file in the format "C:\IQ\USERFILE\PROG1X4.PRG".

Example PROG3:SEL:NAME?

PROGram[:SELected]:STATe

Description This command controls the program currently loaded in the module's memory.

Syntax PROG(0..26)[:SEL]:STAT<space><value>

Parameters The <value> parameter can be:
"0" or "RUN" -start the program
"1" or "PAUS" -pause the program
"2" or "STOP" -stop program execution
"3" or "CONT" -resume a paused program

Example PROG3:SEL:STAT RUN

PROGram[:SELected]:STATe?

Description This query returns a value indicating the current state of the loaded program.

Syntax PROG(0..26)[:SEL]:STAT?

Response "STOPPED" -the program is stopped
"PAUSED" -the program is paused
"RUNNING" -the program is in progress

Example PROG3:SEL:STAT?

ROUTe:CLOSe

Description This command positions the optical switch to the reset position. In this position, there is no optical continuity.

Syntax ROUT(0..26):CLOS

Example ROUT3:CLOS

ROUTe:OPEN

Description This command makes the switch change from the reset position (no optical continuity) to the channel position in effect when the switch was closed.

Syntax ROUT(0..26):OPEN

Example ROUT3:OPEN

ROUTe:OPEN?

Description This query returns a value indicating whether the switch is optically open or closed.

Syntax ROUT(0..26):OPEN?

Response "1" -there is optical continuity
"0" -there is no optical continuity

Example ROUT3:OPEN?

ROUTe:PATH:CATalog?

Description This query returns a value indicating the type of switch in use (e.g. 1 x 2, 1 x 4, 1 x 12, 1 x 16, 1 x 32, 2 x 2 or 2 x 4).

Syntax ROUT(0..26):PATH:CAT?

Response The response is in the format “9 x 99”.

Example ROUT3:PATH:CAT?

ROUTe:SCAN

Description This command sets the switch to a specific channel.

Syntax ROUT(0..26):SCAN<space><value>

Parameters The <value> parameter can be:
“1” to “32” -depending on the 1 x N switch configuration
“1” to “3” -for the 2 x 4 switch
“BYPASS” -2 x 2 switch only
“INSERT” -2 x 2 switch only

Example ROUT3:SCAN 4

ROUTe:SCAN?

Description This query returns a value indicating the current switch position.

Syntax ROUT(0..26):SCAN?

Response “99” -number 1 to 32 indicating the position for 1 x N and 2 x 4
“1” -in Bypass position (2 x 2 switch only)
“2” -in Insert state (2 x 2 switch only)

Example ROUT3:SCAN?

5.5 Quick Reference Command Tree

Command			Parameter/ Response	Description
PROG	[SEL]	EXEC	—	Execute program
		NAME	<string>	Load program
		NAME?	(string)	Get program name and path
		STAT	<0..3|RUN|PAUS|STOP|CONT>	Control program
		STAT?	(STOPPED|PAUSED|RUNNING)	Get program state
ROUT	CLOS		—	Turn off Optical Switch
	OPEN		—	Turn on Optical Switch
	OPEN?		(0|1)	Optical Switch active?
	PATH	CAT?	(9 x 99)	Get type of switch
	SCAN		<1..32|BYPASS|INSERT>	Set channel
	SCAN?		(99)	Get channel

Table 5-2. IQ-9100 Optical Switch Command Tree

5.6 GPIB Error Messages

System and device specific errors are managed by the SCPI Manager. The generic format for error messages is illustrated in Figure 5-1.

Figure 5-1. GPIB Error Message Format

As shown in the above figure, the message contains three parts; the error number, the error description, and device dependent information. All error messages are stacked in a FIFO buffer. When there is at least one message in the buffer, bit 2 of the Status Byte Register is set to 1. Use the command **SYST:ERR?** , **ERR?**, or **LERR?** to read the most recent message. The error message buffer is initialized when starting the IQ-5500, when executing the command ***CLS**, or by reading the last message stored in the buffer.

Error Number	Description	Probable Cause
502	"Communication error."	A command has taken longer than expected to complete execution.
503	"Illegal program name."	An illegal or nonexistent path or filename has been received.
504	"Settings conflict."	There is a conflict between the current state of the program and the program control command just received.
505	"Channel out of range."	An invalid channel number has been requested.

Table 5-3. IQ-9100 Optical Switch Error Messages (Part 1 of 2)

Error Number	Description	Probable Cause
506	"Program running."	• A command that cannot halt the currently running program has been received. • An attempt has been made to override a program setting.
507	"Illegal parameter value."	A parameter was outside the expected range.

Table 5-3. IQ-9100 Optical Switch Error Messages (Part 2 of 2)

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6 MAINTENANCE AND TROUBLESHOOTING

6.1 Module Maintenance

The IQ modules have been designed to require a minimum of maintenance and provide reliable operation for many years. To help ensure long, trouble-free operation

- keep the IQ modules free of dust;
- Be careful not to spill liquids into or on the modules. If the modules do get wet, turn the power off immediately, and let the modules dry completely before turning the unit on again;
- clean the IQ modules with a slightly damp (with water) cloth.

CAUTION

During cleaning, handle the module cautiously and be careful not to damage the connector pins.

6.2 Cleaning Fiber Ends

Prior to testing, it is important that the fiber ends connected to the optical ports of the IQ-9100 be clean. Always cleaning connectors before plugging them to the IQ-9100 is also a good way to prevent dirt and dust from entering the port housing. To clean the fiber ends,

1. Make sure the fiber is not active.
2. Remove the protective caps.
3. Gently wipe the fiber end with a lint-free pad dipped in isopropyl alcohol (98% pure or more).
4. Blow-dry using clean compressed air.

6.3 Cleaning Optical Ports

Dirty ports may affect the performance of the IQ-9100. To prevent dust and dirt from entering the port housing, always put back the protective caps on the optical ports when the IQ-9100 is not in use and make sure the connectors are clean before plugging them to the ports. To clean the optical ports,

1. Make sure no optical beam come out of the ports.

2. Remove the protective caps.

3. Gently wipe the ports with a lint-free swab dipped in isopropyl alcohol (98% pure or more).

4. Blow-dry using clean compressed air.

6.4 Troubleshooting

Problem	Possible Cause	Recommended Action
LED push button does not light up.	Power not on.	Check AC power cord and power on the IQ-203 and IQ-206. Refer to *IQ-200 Optical Test System* Instruction Manual to verify fuse.
	Module is not properly inserted.	Power off the IQ-203 and IQ-206, then remove and reinstall the module.
	Computer is locked up.	Reboot the IQ-203.
	LED is burnt.	Call EXFO.

Table 6-1. Problem, Possible Cause, and Recommended Action (part 1 of 2)

Problem	Possible Cause	Recommended Action
Pushing the LED push button does not open the module main window.	Computer is locked up.	Reboot the IQ-203.
Impossible to open a window.	Too many windows are open at the same time.	Close unused windows, then try to open the needed window again.
Higher than expected insertion loss.	Dirty optical connectors.	Clean all optical connections.
	Improper wavelength selected on other instruments.	Switch to the correct wavelength on all instruments being used.
Poor repeatability.	Optical source is unstable.	Wait for source to stabilize.
	Optimize for repeatability not selected.	Select option "Optimize for repeatability."
No optical continuity.	Switch is off.	Choose the ON button.

Table 6-1. Problem, Possible Cause, and Recommended Action (part 2 of 2)

Note: *In all cases, if problem persists after performing the recommended actions, call EXFO (see Section 1.6,* Getting Help*).*

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7 TECHNICAL SPECIFICATIONS

IQ-9102		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.5	0.5
	Maximum	1.7	1.0
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.02 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching Time		180 ms	
Number of channels		1 × 2	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9104		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.7	0.5
	Maximum	1.7	1.2
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.01 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching time		25 ms per channel + 825 ms (debouncing)	
Number of channels		1 × 4	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9112		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.7	0.5
	Maximum	1.7	1.2
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.01 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching time		25 ms per channel + 825 ms (debouncing)	
Number of channels		1 × 12	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9116		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.7	0.5
	Maximum	1.7	1.2
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.01 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching time		25 ms per channel + 825 ms (debouncing)	
Number of channels		1 × 16	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9132		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.7	0.5
	Maximum	1.7	1.2
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.01 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching time		25 ms per channel + 825 ms (debouncing)	
Number of channels		1 × 32	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9122		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.8	0.5
	Maximum	1.7	1.0
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.03 max.	0.03 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.15	N/A
	Maximum (upon request)	0.1	N/A
Switching time		180 ms	
Number of channels		2 × 2	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm. For loopback path, maximum insertion loss is 2.0 dB without connectors (for more information on the loopback path, refer to Section 2.2.1).
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm. For loopback path, maximum repeatability is 0.05 dB (for more information on the loopback path, refer to Section 2.2.1).
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

IQ-9124		Singlemode	Multimode
Insertion loss[a] (dB)	Typical	0.7	0.5
	Maximum	1.7	1.2
Back reflection[b] (dB)		-40 or -55 max.	-24 max.
Repeatability[c] (dB)		0.01 max.	0.01 max.
Operating wavelength (nm)		1200 and 1600	750 to 1350
Polarization dependent loss[d] (dB)	Typical	≤0.05	N/A
	Maximum (standard)	0.1	N/A
	Maximum (upon request)	0.05	N/A
Switching time		25 ms per channel + 825 ms (debouncing)	
Number of channels		2 × 4	
Crosstalk (dB)		-80 max.	
Switch life		10 million cycles min.	

a. Insertion loss per module, excluding connectors, measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
b. Back reflection is measured at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
c. Repeatability values are for 200 cycles per switch module at constant temperature for 1 hour with stabilized source/meter at singlemode wavelengths of 1310 and 1550 nm, and multimode wavelength of 850 nm.
d. Lower polarization dependent losses are available on request.

Specifications are subject to change without notice.

Operating Environment	
Operating temperature	+50° to +104°F (+10° to + 40°C)
Storage temperature	-4° to +140°F (-20° to + 60°C)
Relative humidity	80% max. between 32° and 104°F (0° and 40°C) 40% max. over 104°F (40°C)

Mechanical Specifications					
Model Number	Number of Slots	Dimensions (inch/cm)			Weight (lb/kg)
		Width	Height	Length	
IQ-9102	1	1.5/3.8	4.75/12.0	10.3/26.2	1.1/0.5
IQ-9104	1	1.5/3.8	4.75/12.0	10.3/26.2	1.8/0.8
IQ-9112	2	3.0/7.6	4.75/12.0	10.3/26.2	2.0/0.9
IQ-9116	3	4.5/11.4	4.75/12.0	10.3/26.2	2.0/0.9
IQ-9132	5	9.2/23.4	4.75/12.0	10.3/26.2	3.2/1.4
IQ-9122	1	1.5/3.8	4.75/12.0	10.3/26.2	1.1/0.5
IQ-9124	2	3.0/7.6	4.75/12.0	10.3/26.2	2.3/1.0

8 WARRANTY

8.1 General Information

EXFO Electro-Optical Engineering, Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year 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 one year 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.

8.2 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.

8.3 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.

8.4 Certification

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

8.5 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

AC	Alternating current
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 is often used as a synonym for attenuation coefficient, expressed in dB/km.
attenuation coefficient	A factor expressing optical power loss per unit of 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.
beamsplitter	A device for dividing an optical beam into two or more separate beams. It is often a partially reflecting mirror.
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 modem networks, BERs much better than 10^{-9} are expected.

c	Velocity of light in a vacuum = 3.998 x 10^8 km/s
°C	Degree Celsius
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 concentrate optical power from two or more fibers into a single port. Couplers may be active or passive.
CPU	Central processing unit
CW	Abbreviation for continuous wave. Refers to non-modulated, constant-intensity light.
dB	Decibel
dBm	Decibel referenced to a milliwatt.
DC	Direct current
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.
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.
EIA	Electronics Industries Association
electromagnetic interference	Any electrical or electromagnetic interference that causes degradation, failure in electronic equipment, or undesirable response. Optical fiber neither emit nor receive EMI.

EMI	Electromagnetic interference.
f	Abbreviation for femto, which indicates 10^{-12} 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.
frequency	The number of cycles per unit of time, denoted by Hertz (Hz). 1 Hertz = 1 cycle per second.
G	Abbreviation for giga, which indicates 10^{9} units.
Ge	Germanium
GeX	High power germanium
hr	Hour
Hz	Hertz
IEC	International Electrotechnical Commission. A standardization body at the same level as ISO.
IEE	U.K. equivalent of the IEEE. 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. The world's largest professional society, based in the United States. It was founded in 1884 by a handful of practitioners of the new electrical engineering discipline. Today's institute has more than 320,000 members in the world and is 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 a light in a vacuum to the group velocity of light in a given medium.
InGaAs	Indium gallium arsenide, a popular detector material.
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
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.

optical return loss (ORL)	The ratio (expressed in units of dB) of optical power, reflected by a component or an assembly, to the optical power incident on a component or assembly that is introduced into a link or system.
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.
OSA	Optical spectrum analyzer
OTDR	Optical time domain reflectometer
p	Abbreviation for pico, 10^{-12} units
P	Power
PCS	Plastic-clad silica (fiber)
	A transmission loss that varies with input polarization state. Normally defined as $T_{max}(dB) - T_{min}(dB)$
	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.
RMA	Return merchandise authorization
S/N	Signal-to-noise ratio. Also written SNR. The ratio of the received optical power, divided by the noise floor for the optical system.
s	Second
sensitivity	For an optical instrument, the smallest signal that can be detected in the absence of any other signal.

Si	Silicon
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 the case of frequency, the wavelength of light depends (linearly) on the refractive index of the medium through which it propagates.
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*".

INDEX

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

V

W

ADDENDUM

This Information Applies Only To The *IQ-9100 Optical Switch* Instruction Manual

New Switch Configuration Supported through GPIB

Page 5-16 - The parameters for the 2 x 4 switch have changed:

ROUTe:SCAN

Description This command sets the switch to a specific channel.

Syntax ROUT(0..26):SCAN<space><value>

Parameters The <value> parameter can be:
"1" to "32" -depending on the 1 x N switch configuration
"0" to "4" -for the 2 x 4 switch
"BYPASS" -2 x 2 switch only
"INSERT" -2 x 2 switch only

For the 2 x 4 Switch:

Position 0 = Input 1 > no continuity and Input 2 > Output 1.
Position 1 = Input 1 > Output 1 and Input 2 > Output 2.
Position 2 = Input 1 > Output 2 and Input 2 > Output 3.
Position 3 = Input 1 > Output 3 and Input 2 > Output 4
Position 4 = Input 1 > Output 4 and Input 2 > no continuity.

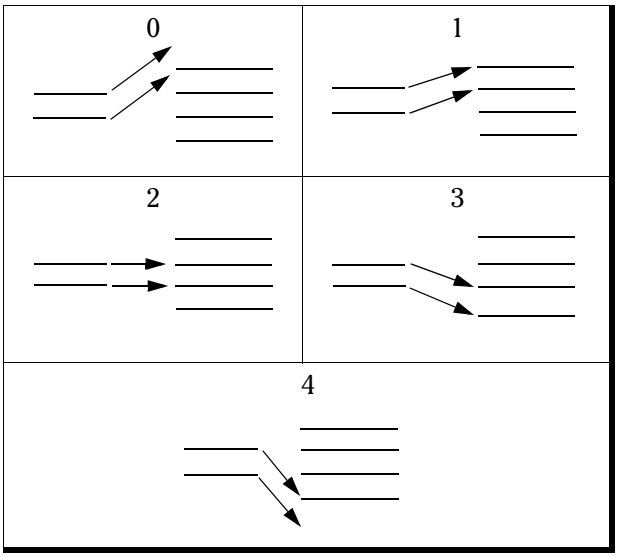

Table 5-1. Input/Output positions for 2 x 4 switch

Example ROUT3:SCAN 4