

Programmable Fiberoptic Switch

SC Series

User Manual



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Safety Information, Instructions, and Symbols

Safety Information

Classification

The unit consists of an exposed metal chassis that is connected directly to earth via a power cord and, therefore, is classified as a Class 1 instrument. Class 1 refers to equipment relying on ground protection as a means of shock protection.

The following symbol is used to indicate a protective conductor terminal in the unit.



Disconnecting from Line Power

Some of the circuits are powered whenever the unit is connected to the AC power source (line power). To ensure that the unit is not connected to the line power, disconnect the power cord from either the power inlet on the unit's rear panel or from the AC line-power source (receptacle). The power cord must always be accessible from one of these points. If the unit is installed in a cabinet, the operator must be able to disconnect the unit from the line power by the system's line-power switch.

Line Power Requirements

The unit can operate from any single-phase AC power source that supplies 110/115/230/240V at a frequency range of 50 to 60 Hz. The maximum power consumption is 100 VA.

Fuse Type

The fuse type used by the unit is (5x20) mm, T1.6A/250 V (Time Delay).

Safety Instructions

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

Before Initializing and Operating the Unit

- Inspect the unit for any signs of damage, and read the user's manual thoroughly.
- Install the unit as specified in the **Getting Started** section.
- Ensure that the unit and any devices or cords connected to it are properly grounded.

Operating the Unit

	<p>Warning</p> <p>To avoid the risk of injury or death, always observe the following precautions before initializing the unit:</p> <ul style="list-style-type: none">• If using a voltage-reducing autotransformer to power the unit, ensure that the common terminal connects to the earthed pole of the power source.• Use only the type of power cord supplied with the unit.• Connect the power cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord that is not equipped with this feature.• Willfully interrupting the protective earth connection is prohibited.• Never look into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible, and direct exposure can severely injure the human eye. For more information, see the user's manual of the laser source in use.• Turning off the power to the device does not always block the externally supplied radiation to the connector at the output of the unit.• Do not use the unit outdoors.• To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.• Do not operate the unit when its covers or panels have been removed.• Do not interrupt the protective earth grounding. Any such action can lead to a potential shock hazard that can result in serious personal injury.• Do not operate the unit if an interruption to the protective grounding is suspected. In this case, ensure that the unit remains inoperative.• Use only the type of fuse specified by the manufacturer as appropriate for this unit. Do not use repaired fuses, and avoid any situations that can short-circuit the fuse.
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|--|---|
| | <ul style="list-style-type: none">• Unless absolutely necessary, do not attempt to adjust or perform any maintenance or repair procedure when the unit is opened and connected to a power source.• Repairs are to be carried out only by a qualified professional.• Do not attempt any adjustment, maintenance, or repair procedure to the unit's internal mechanism if immediate first aid is not accessible.• Disconnect the power cord from the unit before adding or removing any components.• Operating the unit in the presence of flammable gases or fumes is extremely hazardous.• Do not perform any operating or maintenance procedure that is not described in the user's manual.• Some of the unit's capacitors can be charged even when the unit is not connected to the power source. |
|--|---|

Safety Symbols

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

Table 1: Safety Symbols

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

Compliance

FCC Compliance

The Federal Communications Commission (FCC) of the United States of America requires that equipment operating in that country does not cause interference to communications. The unit has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of Title 47 of the Code of Federal Regulations for Radio Frequency Devices. Operation is subject to the following two conditions, which the FCC requires to be labeled on the unit:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

FCC rules require that the following note and subsequent information be included in this manual:

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

These limits are designed to provide reasonable protection against harmful interference in a commercial installation. The unit generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with instructions, can cause harmful interference to radio communications.

Any user modification made to the unit voids the user's authority to operate the unit under the FCC rules.

If this unit is used in a residential setting, resulting interference must be corrected by the user.

For more information, see Title 47 of the Code of Federal Regulations at <http://www.access.gpo.gov/nara/cfr/cfr-table-search.html>.

CE Compliance

The unit has been designed and tested to comply with directive 73/23/EEC and its subsequent amendments by the European Community (EC or CE). The directive relates to electrical equipment designed for use within certain voltage limits. It ensures that electrical equipment is constructed with good engineering practice in safety matters.

The unit has been designed and tested to comply with directive 89/336/EEC and its subsequent amendments. The directive relates to electromagnetic compatibility. It demands that electromagnetic disturbance does not exceed a prescribed level; that the equipment be immune to a prescribed level of ambient level of interference; that the equipment be protected against electrostatic discharges; and that the equipment be immune to all electrical shock wave

disturbances. As of 1997, measures have been added to test for fire hazard, electric shock hazard, and also external exposure to other forms of energy.

The requirements specified by directive 89/336/EEC are as follows. CE compliance requires that the manufacturer or its authorized representative established within the Community affix the EC conformity mark to the apparatus or else to the packaging, instructions for use, or guarantee certificate. The EC conformity mark shall consist of the letters CE as specified and the figures of the year in which the mark was affixed. This mark should, where appropriate, be accompanied by the distinctive letters used by the notified body issuing the EC type-examination certificate. Where the apparatus is the subject of other Directives providing for the EC conformity mark, the affixing of the EC mark shall also indicate conformity with the relevant requirements of those other Directives.

CSA / IEC Compliance

The unit complies with certain standards of the Canadian Standards Association (CSA) and the International Electrotechnical Commission (IEC).

The unit is in Installation Category (Overvoltage Category) II under IEC 664. IEC 664 relates to impulse voltage levels and insulation coordination. The particular category is defined as: local level, appliances, portable equipment, etc, with smaller transient overvoltages than Installation Category (Overvoltage Category) III.

The unit is in the Pollution Degree 2 category under IEC 1010-1 and CAN/CSA-C22.2 No. 1010.1. The IEC standard on Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use relates to insulation coordination. The CSA standard is on Safety Requirements for Electrical Equipment for Measurement Control, and Laboratory Use, Part I: General Requirements. The Pollution Degree 2 category is defined as follows: "Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected."

UL¹ Compliance

The unit complies with Underwriters Laboratories (UL) standard 1950, the Standard for Safety Information Technology Equipment.

¹ UL is a registered trademark of Underwriters Laboratories Inc.

General Information and Specifications

General Information

This user's manual for the SC Series Fiberoptic Switch contains complete operating instructions.

The SC Series Fiberoptic Switch is a 1xN programmable switch (Figure 1) that connects a single fiberoptic input channel to any of N (up to 180) output channels. Performance, configuration, and flexibility are suitable for a wide range of applications, including fiberoptic component testing systems, remote fiber test systems in telecommunications, and research and development. Single-mode and multimode versions of the switch are available. The switch is bidirectional. The standard SC-Switch enclosure accommodates up to 90 channels; the double-height enclosure accommodates 180 channels.



Figure 1: SC Switch (single height shown)

The SC-Switch connects the input (C) to a selected output channel. The terminations are precisely aligned by a processor-controlled stepper motor. Collimating lenses terminate the fiberoptic attachments, minimizing the insertion loss of the switch and improving the repeatability and stability of its parameters.

The SC-Switch is equipped with an IEEE 488.1 parallel interface and an RS232C serial interface for remote control operation. The switch is operated manually using the front-panel controls.

The SC-Switch is available in single-common (SC-C) and dual-common (SC-D, SC-E, and SC-F) configurations. The dual-common units support two (paired) fiberoptic input channels.

Single-Common (SC-C) Switch Configuration

The common input channel (C) is connected to the output channel (1). The reset position (0) of the switch is an open circuit. Figure 2 shows this configuration.

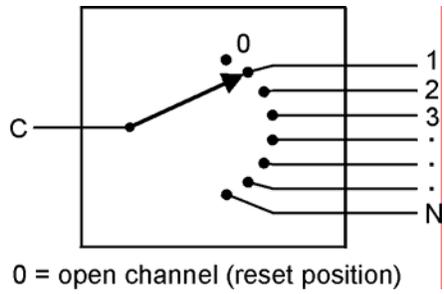


Figure 2: Single-Common Configuration

Dual-Common (SC-D) Switch Configuration

This configuration provides simultaneous connection of a bank of inputs to outputs (Figure 3). The input A can be connected to 1A or 1B or ... $(N/2)A$. In this configuration, channel connections are stepped in pairs. The channel displayed is the current channel pair (A and B). The number of channel pairs is equal to one-half of the total number of channels (N).

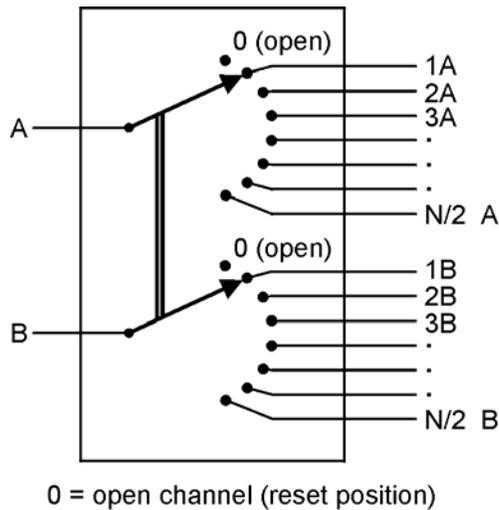


Figure 3: Dual-Common Configuration

Single-Step Dual-Common (SC-E) Switch Configuration

This non-blocking configuration allows any input to be connected to any output while at the same time adjacent inputs align with adjacent outputs (Figure 4). This configuration allows for single-step movement of paired input channels (A and B). The channel connection displayed is B path; A input channel is connected to B path minus one.

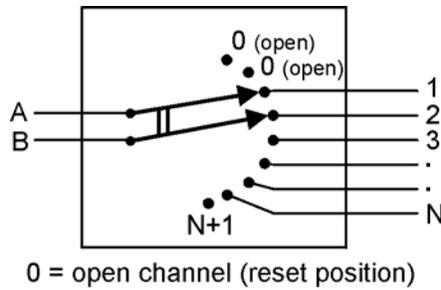


Figure 4: Single-Step Dual-Common Configuration

Dual-Common Blocking (SC-F) Switch Configuration

This configuration allows one of the inputs to be aligned with an output in a blocking sense, with reduced output channel counts available (Figure 5).

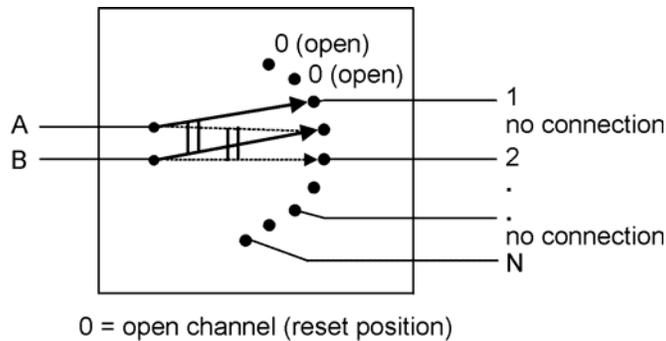


Figure 5: Dual-Common Blocking Configuration

Key Features

- Up to 180 channels
- Typical insertion loss 0.4 dB
- Typical repeatability 0.003 dB
- Typical return loss greater than 65 dB
- Local and remote control via IEEE 488 and RS232 interfaces

Applications

- Fiberoptic component testing
- Transmitter/receiver measurement
- Research and development

Standard Accessories

- AC power cord
- User's manual

Optional Accessories

- Rack-mount kit

Specifications

The following optical specifications describe the warranted characteristics of the unit (Table 2). Supplementary specifications describe the typical non-warranted performance of the unit (Table 3 and Table 4).

Table 2: Optical Specifications

Parameter	Typical	Maximum
Insertion Loss Single-Mode ¹ Multimode ¹	0.4 dB 0.4 dB	0.7 dB 0.7 dB
Return Loss Single-Mode ² Standard/Analog Multimode ² Standard/Analog	65 dB/>65 dB 25 dB/35 dB	60 dB/65 dB (minimum) 20 dB/30 dB (minimum)
Polarization Dependent Loss (Single-Mode)	0.02 dB	0.05 dB
Insertion Loss Stability ³	±0.03 dB	±0.05 dB
Repeatability ⁴ Sequential Switching Random Switching	±0.003 dB ±0.01 dB	±0.005 dB ±0.025 dB
Crosstalk (Single-Mode)	-100 dB	-80 dB
Input Power (Continuous Wave)	300 mW	—
Channel Options Front-Panel FC or ST Connectors Front-Panel SC Connectors 5 m Rear-Panel Pigtail		32 (maximum) 56 (maximum) 90 (maximum)
Switching Time One channel Each additional channel		300 ms (typical) +12 ms (typical)

¹ Insertion loss does not include connectors. Include 0.2 dB (typical), 0.5 dB (maximum) for each connector.

² Excluding connectors.

³ Drift of any channel relative to one assigned reference channel at ±3 °C deviation of ambient temperature over a seven-day period.

⁴ Optimum repeatability after one hour warm-up.

Table 3: Operating Specifications

Local control	<ul style="list-style-type: none"> • Step-up, step-down channel selection • Control of eight relay drivers • IEEE 488.1 address selection • Return-to-local function • Language selection
Remote control	<ul style="list-style-type: none"> • GPIB interface: IEEE 488.1 1987 capability SH1, AH1, T6, L4, SR1, PP0, DC1, C0, E1 • RS232C interface: setting 8 bits, 1200 baud, 1 stop bit, no parity
Command set	Revised command set. Capable of emulating command set of JDSU SC-0 and SX-0 Series switch models.
Drivers	Eight open collector outputs, sink current 100 mA maximum per output (driver): <ul style="list-style-type: none"> • Drivers 1, 2, 3, 4, +5V and GND (ground) are accessible from back panel connector • Drivers 5, 6, 7, and 8 are internal
Warm-up time ¹	1 hour at 25 °C ambient temperature

¹ Applicable for optimum repeatability performance.

Table 4: Other Specifications

Electrical	
Input voltage	110/115/230/240V AC, 50 to 60 Hz
Power consumption	100 VA maximum
Physical	
Dimensions (W x H x D)	
Bench-Top	44 x 13.25 x 38 cm
Single-height with rack mount ¹	48 x 13.25 x 38 cm
Double-height with rack mount ¹	48 x 25.6 x 43 cm
Weight	
Single-height	9 kg
Double-height	14 kg
Environmental	
Operating temperature	0 to 55 °C
Storage temperature	-40 to 70 °C
Humidity (non-condensing)	Maximum 95% RH from 0 to 55 °C

¹ Rack-mount kit is optional.

Getting Started

The SC Series Fiberoptic Switch consists of the switch unit and a power cord. The rack-mount kit is optional.

Before Initializing and Operating the Unit

- Inspect the unit for any signs of damage.
- Read the user's manual thoroughly, and become familiar with all safety symbols and instructions to ensure that the unit is operated and maintained safely.

Initial Inspection

	<p>Warning</p> <p>To avoid electrical shock, do not initialize or operate the unit if it bears any sign of damage to any portion of its exterior surface, such as the outer cover or panels.</p>
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Check that the unit and contents are complete:

1. Wear an anti-static wrist strap, and work in an electrostatic discharge (ESD) controlled area.
2. Inspect the shipping container for any indication of excessive shock to the contents, and inspect the contents to ensure that the shipment is complete.
3. Inspect the unit for structural damage that can have occurred during shipping.
4. Connect the unit to a power source, using the AC power cord provided.
5. Set the power switch to **I** (on). All key lamps and status LEDs light. The model number and the firmware version are displayed, followed by the active interface command set, the message terminating sequence, and the GPIB address. For example, the factory settings for this sequence are SC (CR LF) 7, followed by Channel 0. If no malfunction is detected during power-up, all lamps and LEDs turn off, and the display reads 0. If a malfunction is detected during the power-up sequence, an error message is displayed.
6. Set the power switch to **O** (off), and disconnect the AC power cord from the power supply and from the SC-Switch.
7. Keep the packaging.

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

Operating Environment

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

Temperature

The unit can be operated in the temperature range of 0 to 55 °C.

Humidity

The unit can be operated in environments with up to 95% humidity (0 to 55 °C). Do not expose it to any environmental conditions or changes to environmental conditions that can cause condensation to form inside the unit.

Ventilation

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



Warning

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

Storing and Shipping

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

Claims and Repackaging

Immediately inform JDSU and, if necessary, the carrier, if

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

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

Returning Shipments to JDSU

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

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

1. Wear an anti-static wrist strap and work in an ESD controlled area.
2. Cover the front panel, if applicable, with a strip of cardboard.
3. Wrap the unit in anti-static packaging. Use anti-static connector covers, if applicable.
4. Pack the unit in a reliable shipping container.
5. Use enough shock-absorbing material (10 to 15 cm or 4 to 6 in on all sides) to cushion the unit and prevent it from moving inside the container. Pink poly anti-static foam is the best material.
6. Seal the shipping container securely.
7. Clearly mark FRAGILE on its surface.
8. Always provide the model and serial number of the unit and, if necessary, the RMA number on any accompanying documentation.
9. Ship the unit only to the address given at the beginning of this document.

Cleaning Connectors

	<p>Caution</p> <ul style="list-style-type: none"> • Connecting damaged or dirty fibers to the unit can damage the connectors on the unit. • Never force an optical connector. Some connectors have a ceramic ferrule that can easily be broken.
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Optical cable ends need to be cleaned before using them with the unit.

The following items are required for cleaning:

- Filtered compressed air or dusting gas (for example, Tech Spray Envi-Ro-Tech Duster 1671 gas, available from <http://www.techspray.com/1671.htm>)
- Lint-free pipe cleaners (for example, from 3M²) or lint-free swab
- Lint-free towels (for example, 10 x 10 cm or 4 x 4 in HydroSorb III wipers, available from http://www.focenter.com/acctech/hydrosobr_wipers.htm)
- Optical grade isopropyl alcohol or optical grade 200° ethanol (do not use rubbing alcohol, which contains 30% water)

To clean the connectors:

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

² 3M is a trademark of 3M.

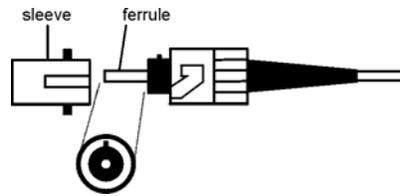


Figure 6: Connector Cleaning (connector type can vary)

2. Apply optical grade isopropyl alcohol or optical grade ethanol (do not use rubbing alcohol) to a small area of a lint-free towel and rub the end of the ferrule over the wet area.
3. Wipe the ferrule on a dry area of the lint-free towel.
4. Using the dusting gas or compressed air, blow the end of the ferrule.
5. Apply the alcohol or ethanol to a lint-free pipe cleaner or swab and wipe off the remaining parts of the connector.
6. With the other end of the pipe cleaner or swab, dry the areas cleaned.
7. Using the dusting gas or compressed air, blow the areas cleaned.

Installing the Switch

	<p>Caution</p> <p>In sensitive applications, to avoid shock and vibration, do not mount the switch in non-rigid racks or on top of raised floors or tables. Avoid use with high-impact doors that lack impact-reducing bumpers upon closing.</p>
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To install the switch:

1. Place the SC-Switch into its intended operating location. The rack-mounting flanges fully support the weight of the switch.
2. Avoid blocking the ventilation holes at the back and at the bottom of the instrument.
3. Do not pull on the fibers exiting through the rear-panel strain relief. Excessive force can damage the optics.
4. Route the fiber cables in such a way as to avoid creating bends that have a radius of less than 1.5 cm; do not lay cables across sharp corners or tie bundles of cables together tightly.
5. Reattach the AC power cord and reinitialize the switch.

Operating and Maintenance Instructions

Front Panel

The front of the unit is shown in Figure 7. A close-up of the key panel is shown in Figure 8.

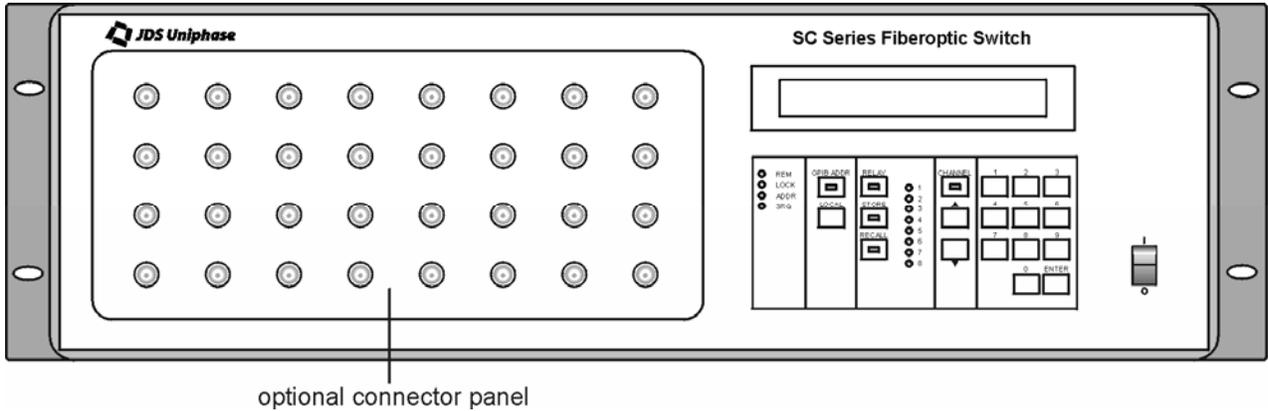


Figure 7: Front of Switch

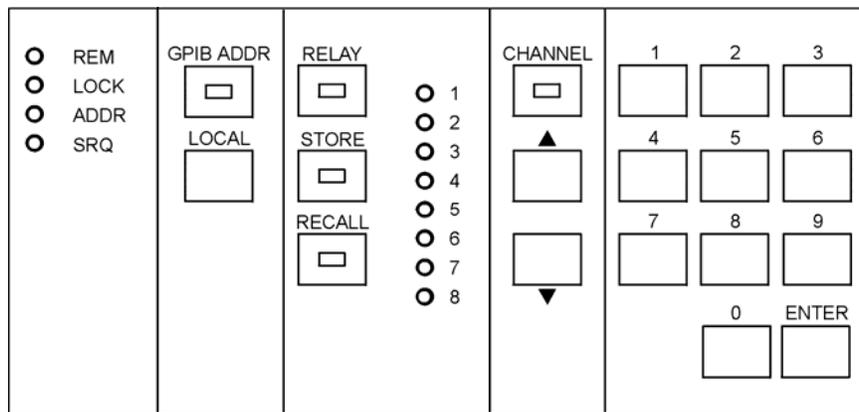


Figure 8: Operating Keys and Status LEDs

Operating Keys

The operating keys are described in Table 5.

Table 5: Operating Keys

I / O	Power on (I) and off (O) switch
GPIB ADDR	Sets the switch to GPIB Address (IEEE 488.1) mode.
LOCAL	Returns the switch to Local mode from Remote mode, unless the switch is in Local Lockout mode.
RELAY	Sets the switch to Relay (driver control) mode.
STORE	Stores relay driver patterns in non-volatile memory.
RECALL	Recalls a stored driver pattern.
CHANNEL	Sets the switch to Channel Control mode.
σ	Channel increment key.
τ	Channel decrement key.
□ (0 to 9)	Numeric entry key pad.
ENTER	Terminates an entry, for example, channel number or GPIB address.

Status LEDs

The status LEDs are described in Table 6.

Table 6: Status LEDs

REM	Indicates that the GPIB or RS232 interface is in Remote mode. All front-panel keys except Local are locked out.
LOCK	Indicates that the switch is in Local Lockout mode. This mode prevents the Local key from returning the switch to Local mode.
ADDR	Indicates that the GPIB interface is in talk or listen state.
SRQ	Indicates that the interrupt logic of the switch has generated a service request interrupt on the GPIB interface.
O (1 to 8)	Indicates the on/off state of the relay drivers (driver is on when LED is lit and off when LED is dark).

Rear Panel

The back of the unit is shown in Figure 9.

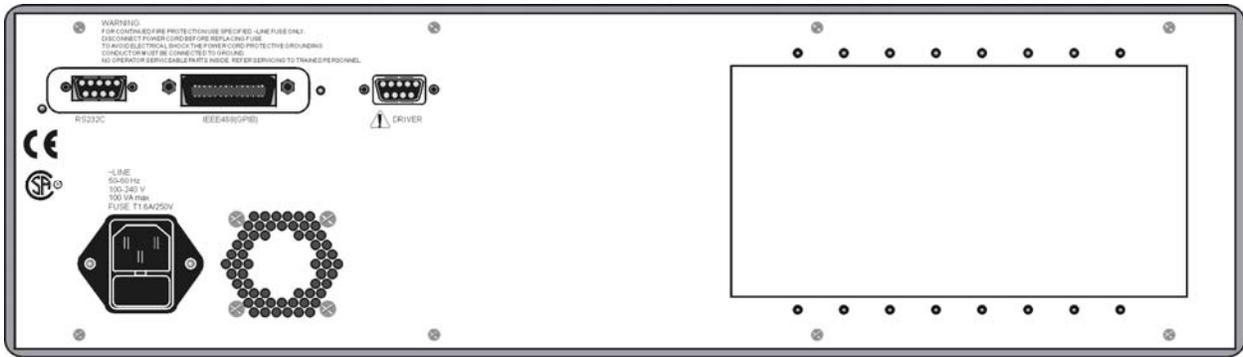


Figure 9: Back of Switch

External Switch Module Connections

External Switch Module without TTL Input Controls

The setup for a switch without transistor-transistor logic (TTL) is shown in Figure 10.

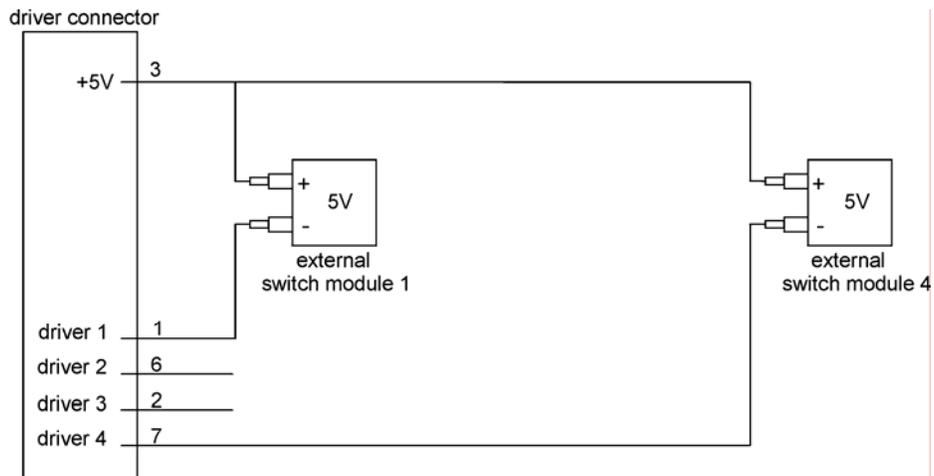


Figure 10: Switch Setup without TTL

External Switch Module with TTL Input Controls

The setup for a switch with TTL is shown in Figure 11.

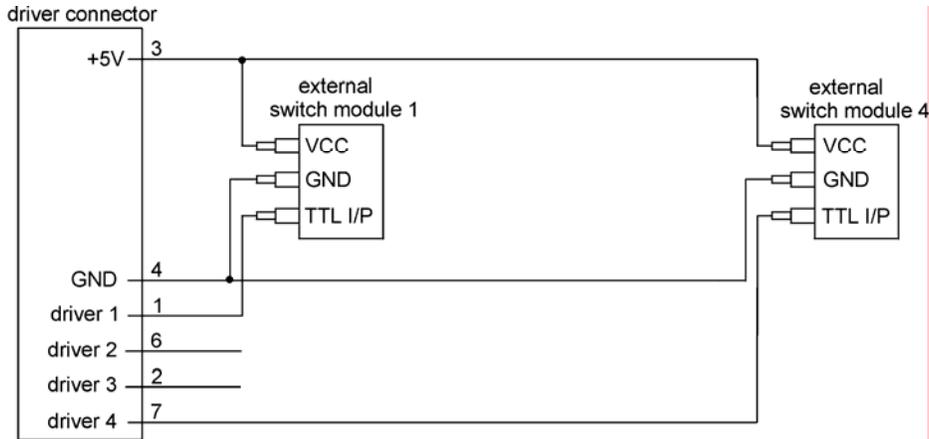


Figure 11: Switch Setup with TTL

Sample Driver Application: Electrical Equivalent of Driver

A sample driver application is shown in Figure 12.

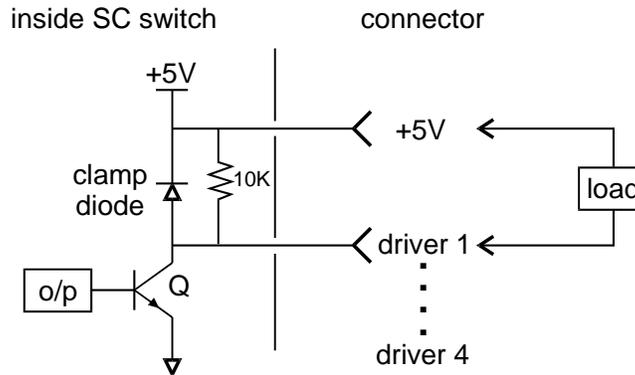


Figure 12: Sample Driver Application: Electrical Equivalent of Driver

	<p>Caution</p> <p>Do not exceed 100 mA per driver.</p>
---	---

Powering Up the Switch

To power up the switch:

1. Connect the switch to the AC power source with the AC power cord provided.
2. Set the power switch to **I** (on) to initialize the SC-Switch. All key lamps and status LEDs light. The model number and the firmware version are displayed, followed by the active interface command set, the message terminating sequence, and the GPIB address. For example, the factory settings for this sequence are SC (CR LF) 7, followed by Channel 0. If no malfunction is detected during power-up, all lamps and LEDs turn off, and the display reads 0.

Using and Selecting a Channel

To use the switch:

1. Connect a channel to the front of the switch (Figure 13).

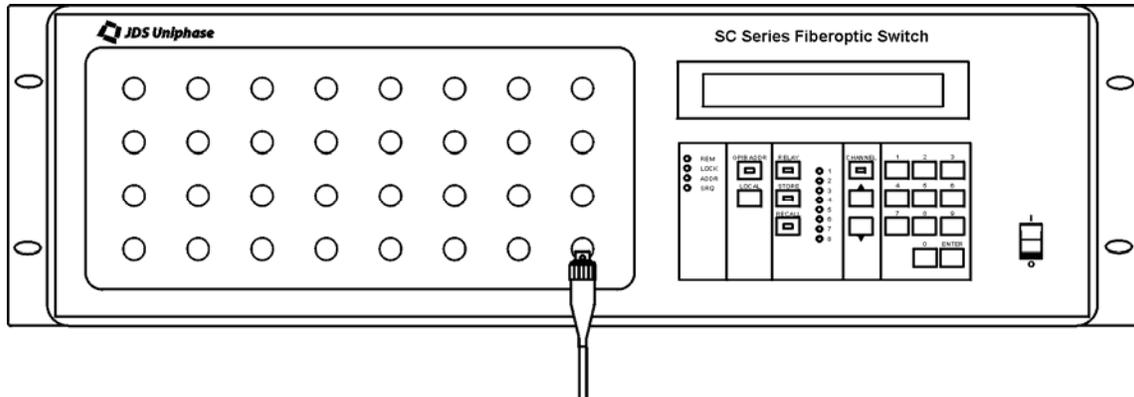


Figure 13: Using a Channel

Channel numbers entered using the numbered keys are accepted only when the SC-Switch is set to Channel Control mode.

To select a channel:

1. Press the Channel key to set the switch to Channel Control mode.
2. Enter the channel number (one to two digits). Single-digit channel numbers, for example, channel 4, can be entered as 04 or as 4. Or press the σ or τ key to scroll through the channels sequentially.
3. Press the Enter key.

The σ and τ keys can also be used for channel selection while the SC-Switch is set to Relay mode.

In SC-C models (SCxxxx–Cxxx), the channel number displayed is the current channel number connected to the common fiber C (the switch has one common fiber).

In the SC-D models (SCxxxx–Dxxx), the channel number displayed is the current channel pair (the switch has two common fibers).

In the SC-E models (SCxxxx–Exxx), the channel number displayed is the channel connected to the common fiber B. The channel connected to the common fiber A is B - 1 (the switch has two common fibers).

In SC-F models (SCxxxx–Fxxx), the channel number displayed is the channel connected to the common fiber B. A blocked connection with B shows as an even-numbered channel and the connected channels with B show as odd-numbered. The path connected to common fiber A is B - 1.

In all configurations, channel 0 is an open circuit; for example, the switch is in an unconnected state.

Changing or Verifying the GPIB Address

To change or check the GPIB address:

1. Press the GPIB ADDR key. The current GPIB address, appended with an asterisk, is displayed.
2. To change the address, scroll to the required address using the σ or τ key, or enter the address via the numeric keypad.
3. Press the Enter key to activate the new address. To leave the GPIB address unchanged, press a mode key (GPIB ADDR, Relay, or Channel).

Setting the Interface Command Set for SC and SX Switches

The SC-Switch can be set to emulate the interface command sets of earlier models of JDSU SC Series switches (SCxxxx-0xxx) and the JDSU SX Series switches (SXxxxx-0xxx).

To set the interface command set:

1. Press and hold the Local key while the SC-Switch powers up. The active interface command set is displayed.
2. Press the σ key to scroll to the required command set, for example, SC, OLD SC, or SX.
3. Press a mode key (GPIB, Relay, or Channel) to save the setting.

The GPIB message terminating characters are also displayed.

Controlling the Drivers

The SC-Switch has four drivers (drivers 1, 2, 3, and 4) for driving external switch modules and four drivers (drivers 5, 6, 7, and 8) for driving internal switch modules in custom applications. Set the switch to Relay mode to control the drivers:

1. Press the Relay key. Relay mode is activated.
2. Enter a number (1 to 8), using the keypad to toggle the corresponding driver on or off. The status LED of the driver lights. The driver is now selected.

The SC-Switch has 10 non-volatile memory locations available for storing relay driver patterns. To store a driver pattern:

1. Set the eight drivers individually to the required on/off state, as previously outlined.
2. Press the Store key.
3. Enter a number using the keypad to assign that number to the pattern.
4. To recall the pattern, press the Recall key followed by the number assigned to the pattern.

Controlling the Switch Locally

To operate the switch using its front panel:

1. If the REM status LED is lit, press the Local key once to set the SC-Switch to Local mode.
2. Press the σ or τ key to select the switch position required. In SC-E configurations, the display shows the common B switch position. Common A is set to the display reading minus one.
3. To toggle a driver, press the Relay key and then a numbered key (1 to 8). A driver can be used to operate a 1x2 source select switch.

Controlling the Switch Remotely by GPIB Interface

To control the switch by GPIB interface:

1. With a user-supplied GPIB cable, connect the cable to the computer and to the IEEE 488 (GPIB) port at the back of the switch.
2. Verify that the interface command set is set to SC and that the GPIB address is set to 7. To do this, turn the SC-Switch off and then on again. The correct display reading is SC (CR LF) 7. See the **Setting the Interface Command Set** section for instructions on changing the interface command set.
3. At the computer that controls the GPIB, set the message terminating character sequence to carriage return - line feed (<CR><LF>), for example, ASCII character code 13, 10. The <CR><LF> characters must be appended to the end of any messages sent to the SC-Switch. Similarly, the switch appends the same characters to all messages it returns.
4. Send a sample command to the SC-Switch; for example, use an OUTPUT statement (or equivalent) to send the command **CLOSE 10** at GPIB address 7. The channel setting changes to 10. Most programming languages automatically append the terminating characters to the message.
5. Send a sample query command, for example, **CLOSE?**; then use an INPUT statement to receive the message 10 from GPIB address 7.

Controlling the Switch Remotely by RS232 Interface

To control the switch by RS232 interface:

1. Connect an RS232 cable to the RS232 port at the back of the SC-Switch and to a computer.
2. At the computer, initialize the serial port to 1200 baud, eight bit ASCII character code, one stop bit, and no parity. Use the following MS-DOS³ QBASIC program as an example:

```
OPEN "COM2;1200,N,8,1" FOR RANDOM AS #1
PRINT #1, "CLOSE 5"
PRINT #1, "CLOSE?"
INPUT #1,A$
```

³ MS-DOS is a registered trademark of Microsoft Corporation.

PRINT A\$
END

Calibrating the Switch

No calibration is required.

Maintaining the Switch

Clean the connector ends with a lint-free tissue and alcohol before every mating. See the **Cleaning Connectors** section.

Clean the internal connectors and the panel-mounted connector bulkheads periodically or when high losses are suspected. The internal connectors can be accessed by removing the connector panel.

1. Loosen the retaining screws of the connector panel (Figure 14).

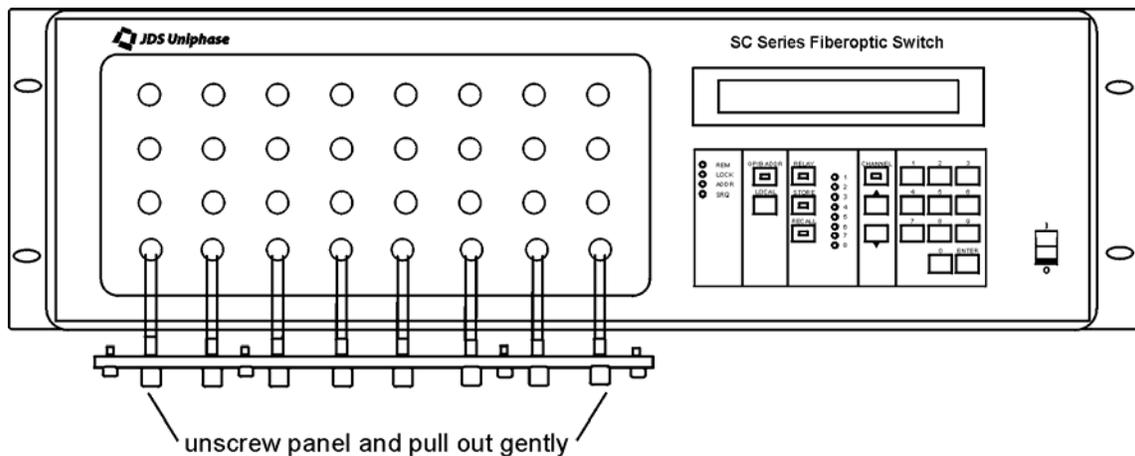


Figure 14: Removing the Connector Panel



Caution

Do not extend the connector panel more than 10 cm (4 in) from the body of the SC-Switch.

2. Pull the panel out carefully, extending it no more than 10 cm (4 in) from the body of the switch.
3. Remove the connectors from the connector bulkheads.
4. Clean the connector ends and the bulkhead mating sleeves with a lint-free tissue and alcohol.
5. Reinstall the connectors into the bulkheads.
6. Reinstall the connector panel, guiding the fibers back to ensure that they do not bend sharply.

Programming Guide

The following programming instructions for the SC-Switch are intended for users who are familiar with the GPIB interface and how to send or receive messages over a device. A detailed description of the GPIB interface is contained in *ANSI/IEEE Std. 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation*, published by the Institute of Electrical and Electronics Engineers.

The SC-Switch is equipped with a GPIB parallel interface and an RS232 serial interface. The switch accepts the same device dependent commands (commands that control the instrument) over either interface.

The SC-Switch can be set to emulate the interface command sets, status reporting, and service request interrupt control of the SC Series and SX Series switches. The active interface command set is displayed when the switch is powered on. See the **Setting the Interface Command Set** section for instructions on changing the interface command set.

GPIB Pin Assignment

The GPI B pin assignment is shown in Figure 15.

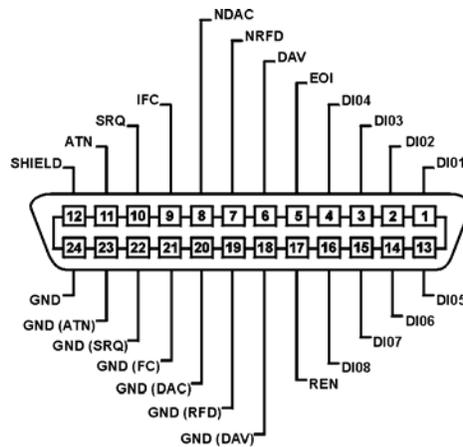


Figure 15: GPIB Pin Assignment



Caution

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

Setting the GPIB Address

To set the GPIB address:

1. Press the GPIB ADDR key. The current GPIB address, appended with an asterisk, is displayed. (The factory-set GPIB address is 7.)
2. To change the address, scroll to the required address using the σ or τ key, or enter the address using the numeric keypad.

- Press the Enter key to activate the new address. To leave the GPIB address unchanged, press a mode key (GPIB ADDR, Relay, or Channel).

GPIB Interface Functions

The GPIB interface functions are listed in Table 7.

Table 7: GPIB Interface Functions

Mnemonic	Function
SH1	Source Handshake, complete capability
AH1	Acceptor Handshake, complete capability
T6	Basic Talker, serial poll, not addressed if MLA
L4	Basic Listener, not addressed if MTA
SR1	Service Request capability
RL1	Remote/Local, complete capability
PP0	Parallel Poll, no capability
DC1	Device Clear, complete capability
DT0	Device Trigger, no capability
C0	Controller, no capability
E1	Electrical Interface, open collector drivers

RS232 Pin Assignment

The RS232 pin assignment is shown in Figure 16.

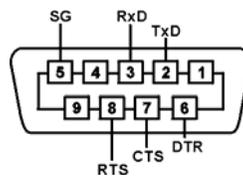


Figure 16: RS232 Pin Assignment

RS232 Interface Specifications

The RS232 interface specifications are listed in Table 8.

Table 8: RS232 Specifications

Name	Symbol	Pin Number	Signal Direction
Transmitted Data	TxD	2	Out
Received Data	RxD	3	In
Request To Send	RTS	8	Out
Clear To Send	CTS	7	In
Data Terminal Ready	DTR	6	Out
Signal Ground	SG	5	—

The data protocol is permanently set to 1200 baud, ASCII character code, with eight bits per character, one stop bit, and no parity bit. The serial port of the controlling computer must be configured with the same settings.

RS232 Driver Pin Assignment

The RS232 driver pin assignment is shown in Figure 17.

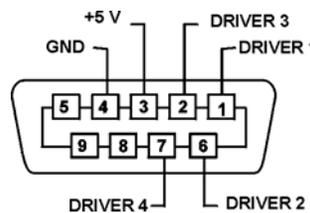


Figure 17: RS232 Driver Pin Assignment



Caution

Do not exceed 100 mA per driver.

Operation and Query Commands

Operation and query commands control instrument functions and are interface independent.

Command Parser Rules

- A command consists of a mnemonic (for example, CLOSE) and, if required, a data parameter. The mnemonic and the data parameter must be separated by at least one space.
- Parameters can be entered in various formats; for example, 10, 10.0, and 1.0e1 are recognized as the same value.
- Commands can be sent in uppercase or lowercase characters.

- A command is contained in a message, and messages can contain more than one command, each one separated by a semicolon (;). For example, **CLOSE 6;XDR 2 1 <CR> <LF>** contains two commands.
- All GPIB commands must end with the terminating sequence <CR> <LF>.
- All RS232 commands must be terminated with a single <CR> character.
- The input buffer of the switch can hold as many as 100 characters. If the buffer becomes full, the switch holds the handshaking line on the GPIB interface until space is available. Similarly, over the RS232C interface, the switch sets the Clear-To-Send line low. Any characters received after the line goes low are ignored.
- Commands are executed as they are parsed; consequently, a command can be executed before the entire message in which it is contained is received.
- The switch delays accepting new characters sent over the GPIB interface while the switch mechanism is moving, but no data are lost. The switch is always ready to accept characters over the RS232C interface.
- A query command is used to extract status information from the switch. For example, **SRE? <CR> <LF>** returns the contents of the status register.
- Multiple-command messages can contain only one query command. A query must be the last command in the message, for example, **CLOSE 20; XDRS? <CR> <LF>**.

Operation Commands

RESET	Reset
--------------	--------------

Returns the switch to the power-up state, for example, channel 0, relay drivers off.

CLOSE i	Set Optical Channel
----------------	----------------------------

Closes the optical path represented by the integer i.

XDR i k	Driver Control
----------------	-----------------------

Sets the specified external driver on or off:

- i = driver number (1 to 8)
- k = 1 (on)
- k = 0 (off)

XDRS i**Drivers Control**

Sets all eight relay drivers according to the binary conversion of i. The binary weight of the drivers is as follows:

- Driver 1 = 1
- Driver 2 = 2
- Driver 3 = 4
- Driver 4 = 8
- Driver 5 = 16
- Driver 6 = 32
- Driver 7 = 64
- Driver 8 = 128

Add together the weights of the drivers to be activated, and send the total. For example, when i = 255, all eight relay drivers are turned on.

SRE i**Clear Status Byte**

Writes a decimal number to the SRQ mask register (see the **Status Reporting and Service Request Control** section). Setting a bit to 1 generates an SRQ interrupt when the corresponding bit in the status register changes from 0 to 1.

CSB**Clear Status Byte**

Resets the status byte.

CLR**Clear Device**

Clears the SRQ mask register and the status register.

Query Commands

CLOSE?**Optical Switch Path**

Returns the current optical path number. If the switch has two common input fibers (A and B), **CLOSE?** returns the position of fiber B. **CLOSE? MAX** returns the maximum channel number. **CLOSE? MIN** returns 0, the minimum channel number.

XDR? i**Driver**

Returns the state of an external relay driver (i):

- 0 = relay driver is off
- 1 = relay driver is on

XDRS?**Drivers**

Returns the states of all drivers in a binary-coded integer.

LRN?**Learn**

Returns a string containing three commands that, if sent, reset the switch to its current state, for example, **CLOSE i;XDRS k;SRE I**, where *i* represents the current path number, *k* represents the states of the external drivers, and *I* represents the value of the service request enable register.

STB?**Status Register**

Returns a three-digit integer and automatically clears the status register if the SRQ bit is set.

SRE?**SRQ Mask**

Returns the contents of the SRQ mask register.

CNB?**Condition Register**

Returns the contents of the condition register.

TST?**Self-Test**

Executes a self-test operation. An error code that can be queried with **ERR?** or **LERR?** is placed in an error queue. The query **TST?** also sets bit 7 in the status register.

- 0 = self-test passed
- 1 = self-test failed

Self-Test requires approximately 1.5 seconds delay between issuing the “TST?” command and reading the response. The time to respond depends on the current position of the switch. The further the switch is from its home position, the more time needed to complete the self test.

ERR?**Error Number**

Returns an error number if the self-test fails:

- 330 = self-test failed
- 0 = self-test did not fail

LERR?**Last Number Error**

Returns a three-digit error number from the error queue. The queue can contain as many as five error numbers. The first error read is the last error that occurred. **LERR?** returns 000 if the error queue is empty.

OPC?	Operation Complete
-------------	---------------------------

Returns the status of the input buffer:

- 1 = the input buffer is empty, for example, all commands have been executed
- 0 = the input buffer is not empty, for example, commands are still pending

IDN?	Identifier
-------------	-------------------

Returns a string that identifies the manufacturer, the switch series, and the firmware level, for example, "JDSU, SC Switch, 0, 3.14".

Status Reporting and Service Request Control

The SC-Switch maintains three eight-bit registers that are used for status reporting and enabling the GPIB service request interrupt:

- Condition register
- Status register
- SRQ mask register

Condition Register

The condition register monitors the current state of the switch mechanism (Table 9). Bit 2, the settled condition bit, is 1 when the switch mechanism has stopped at the desired channel and 0 when the switch is moving to a new output channel. The **CNB?** query command returns the value of the condition register. When the settled bit is true, **CNB?** query returns 4.

Table 9: Condition Register

Condition Register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	settled	0	0

Status Register

The status register records errors and other events that have occurred in the switch (Table 10). When an event occurs, the switch status logic sets the corresponding bit to 1. The status register can be read at any time because the bits stay set until the register is read at least once.

Table 10: Status Register

Status Register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
self-test error	service request	syntax error	message available	0	settled	0	parameter error

- Bit 7 (self-test error) is set if a calibration error is detected after power-up or after the self-test query (**TST?**) is executed. At all other times it is 0.
- Bit 6 (service request) is set when the interrupt request logic of the switch detects a reason to generate a service request interrupt on the GPIB interface.
- Bit 5 (syntax error) is set when the parser detects a syntax error in a command mnemonic.
- Bit 4 (message available) is set when a message is available in the output buffer.
- Bit 2 (settled) is set when bit 2 in the condition register changes from 0 to 1.
- Bit 0 (parameter error) is set when a parameter value is out of the range of the SC-Switch.

The status register can be read with the status register query (**STB?**) or by serial polling the GPIB interface. During power-up, the status register contains 0 and can only be read by serial polling. After initial power-up, only the settled bit (bit 2) is set to 1. The clear status byte command (**CSB**) and the clear device command (**CLR**) clear the status register. **STB?** also clears the status register, but only if the service request bit (bit 6) is set to 1.

SRQ Mask Register

The SRQ mask register unmask specific events in the status register that generate a service request interrupt on the GPIB interface (Table 11). The SRQ mask command (**SRE**) writes to the SRQ mask register. When a bit in the SRQ mask register is set to 1, the interrupt logic of the switch monitors the corresponding event bit in the status register. When a bit changes from 0 to 1, a service request interrupt is generated and bit 6 in the status register is set.

Table 11: SRQ Mask Register

SRQ Mask Register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
self-test error	n/a	syntax error	message available	n/a	settled	n/a	parameter error

The SRQ mask register can unmask more than one event at a time. The first unmasked event to change from 0 to 1 causes an interrupt. To acknowledge this interrupt, the GPIB interface can be serial polled or the status register can be read with **STB?**. The first time the switch is serial polled after an SRQ is generated, bit 6 is on. Subsequent serial polling returns a value with bit 6 off. Similarly, **STB?** returns the status register with the SRQ set, but then the switch logic automatically clears the register. As a result, subsequent **STB?** queries return 0.

The SRQ mask register is cleared by powering up the SC-Switch, by the clear device command (**CLR**), or by the universal device clear command (**DC1**).

GPIB Programming Examples

This section provides programming examples for controlling the SC-Switch over the GPIB interface. The examples were written in MS-DOS QBASIC and run on a personal computer equipped with a National Instruments⁴ GPIB interface board with National Instruments Universal Language Interface drivers loaded. The commands that control the GPIB are very similar to Hewlett Packard⁵ HP Basic commands. Most other controller board manufacturers provide basic output and input statements for communicating messages to a GPIB instrument.

Before using any of these examples, ensure that the GPIB address is set to 7, the interface command set is SC, the ULI.EXE driver is loaded, and the switch is connected to the computer via a GPIB cable.

The GPIB commands provided in this section do not always show the terminating sequence <CR><LF>; however, it is implied.

Sending Commands

This example sets the SC-Switch to channel 6 and turns on all the external relay drivers.

```
' Set up the interface card and drivers
OPEN "GPIB0" FOR OUTPUT AS #1
OPEN "GPIB0" FOR INPUT AS #2
PRINT #1, "ABORT"
' Set terminating character to CR LF sequence
PRINT #1, "GPIBEOS OUT CR LF"
PRINT #1, "GPIBEOS IN CR LF"
' Sample commands "close 6; xdrs 255"
PRINT #1, "OUTPUT 07;CLOSE 6;XDRS 255"
' Sample queries
PRINT #1, "OUTPUT 07;CLOSE?"
PRINT #1, "ENTER 07"
INPUT #2, a
PRINT "channel ", a
PRINT #1, "OUTPUT 07;XDRS?"
PRINT #1, "ENTER 07"
INPUT #2, a
PRINT "driver state ", a
END
```

Serial Polling the Status Register

This example changes the channel setting and reads the status register continuously until the output has settled.

```
PRINT #1, "OUTPUT 07;csb"           ' Clearing the status byte clears the settling bit
PRINT #1, "OUTPUT 07;CLOSE 12"     ' Change channel
sr = 0                               ' Initialize sr variable to enter the while loop
```

⁴ National Instruments is a trademark of National Instruments.

⁵ Hewlett Packard is a registered trademark of Hewlett-Packard Co.

```

WHILE (( sr AND 4 ) = 0)           ' Loop until settled bit is true
  PRINT #1, "SPOLL 07"           ' Serial poll the switch
  INPUT #2, sr
WEND
PRINT sr                           ' Print final value of sr
END

```

Generating a Service Request Interrupt

This example tests the service request interrupt function. It unmask the settled bit in the SRQ mask register and selects a channel. An interrupt is generated when the switch reaches the channel.

```

ON PEN GOSUB SPOLL                ' Enable SRQ interrupt
PEN ON
PRINT #1, "OUTPUT 07;CSB;SRE 4"  ' Clear status register and unmask
                                  ' settled bit in SRQ mask register
PRINT #1 "OUTPUT 07;CLOSE 6"     ' Change channel
' More code executed while switch channel set
'
'
WHILE (INKEY$ = "")              ' Endless loop to simulate bigger program
WEND                              ' Ends when any key is pressed
PEN OFF
END

SPOLL:
  PRINT #1, "SPOLL 07"           ' Serial poll the switch
  INPUT #2, sr                   ' Read status register
  PRINT sr                       ' Verify SRQ bit is set
  PRINT #1, "SPOLL 07"           ' Serial poll again to verify SRQ bit is now cleared
  INPUT #2, sr                   ' Read status register
  PRINT sr
RETURN

```

Learn Query (LRN?)

This example demonstrates the use of the **Learn** query.

```

DIM LEARN$(100)
PRINT #1, "OUTPUT 07;LRN?"       ' Send the learn query command
PRINT #1, "ENTER 07"
LINE INPUT #2, LEARN$
' The above variables can be saved in a data file before quitting the program and
' then later read back and used to restore the switch to a same state.
' Like this...
PRINT#1, "OUTPUT 07;"LEARN$
' SC settings are now restored
END

```

RS232 Programming Examples

This section provides programming examples for controlling the SC-Switch over the RS232 interface. The examples were written in MS-DOS QBASIC and run on a personal computer equipped with a serial port. COM port 2 of the computer is designated as the serial port and is connected to the switch.

Before using any of these examples, ensure that the active interface command set is SC.

The RS232 interface cannot receive an SRQ interrupt.

The RS232 commands that appear in this section do not always show the terminating character <CR>; however, it is implied.

Sending Commands

```
OPEN "COM2:1200,N,8,1" FOR RANDOM AS #3
A = 10
PRINT#3, "CLOSE "; A
PRINT#3, "XDRS 255"
END
```

Querying Status

This example queries and displays the current channel setting.

```
PRINT#3, "CLOSE?"
INPUT#3, A
PRINT A
END
```

Reading the Status Register

The serial polling function is not supported on any RS232C interface, but the **STB?** command can be used to query the status register because it performs the same function as serial polling.

This example changes the channel setting and reads the status register continuously until the output has settled.

```
OPEN "COM2:1200,N,8,1" FOR RANDOM AS #3
PRINT#3, "CSB"           ' Clear status register
PRINT#3, "CLOSE 5"
DO                       ' Loop until motor settles
    PRINT#3, "STB?"
    INPUT#3, SR1
LOOP UNTIL (SR1 AND 4)
PRINT SR1
END
```

Setting the Interface Command Set

The SC-Switch can be set to emulate the interface command sets of earlier models of JDSU SC Series switches (SCxxxx-0xxx) and JDSU SX Series switches (SXxxxx-0xxx).

To change the command set:

1. Press and hold the Local key while the SC-Switch powers up. The active interface setting is displayed.
2. Press the σ key to scroll to the required command set, for example, SC, OLD SC, or SX.
3. Press the GPIB ADDR key to save the setting.

SC Series Switch Command Set

The syntax and functions for the SC Series switch commands (SCxxxx-0xxx models) are provided in Table 12.

Table 12: SC Series Switch Command Set

Syntax	Function
AnE	Switch to channel n
FE	Verify channel *
XE	Turn driver on
YE	Turn driver off

Response messages (Table 13) are formatted as qn, where q is the switch status (A = normal, I = syntax error, C = calibration error) and n is the channel number.

* The command FE (Verify channel) requires approximately 1.5 seconds delay between issuing an FE and the next command. The time delay depends on the current position of the switch. The further the switch is from its home position, the more time needed to complete the FE command.

Table 13: Response Messages for SC Series Switch Commands

Status Byte Register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Message
0	0	0	0	0	0	0	BUSY
0	0	0	0	0	0	1	NORMAL
0	RQS	0	0	0	0	1	CAL ERROR
0	RQS	0	0	1	0	1	BAD DATA
0	RQS	0	0	1	1	1	UNIT FAILURE

SX Series Switch Command Set

The syntax and functions for the SX Series switch commands (SXxxxx-0xxx models) are provided in Table 14.

Table 14: SX Series Switch Command Set

Syntax	Function
An	Switch to channel n
Sn	Set driver n
Cn	Clear driver n
Bk	Configure drivers with binary code k
E	Enable unit to assert SRQ interrupt after completing each command
D	Disable SRQ interrupt except when an error occurs
R	Remote mode: lock out front panel keys; not implemented in SC-Switch (RS232C only)
L	Local mode: enable front panel keys; not implemented in SC-Switch (RS232C only)

Response messages (Table 15) are formatted as qn Rm, where q is the unit status (A = normal, C = command error, S = system error); n is the channel number (0 to N); R is the letter R; and m is the state of the external relay drivers (0 to 255).

Table 15: Response Messages for SX Series Switch Commands

Status Byte Register								
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Message
0	RQS	0	0	0	0	0	0	BUSY
0	RQS	0	0	0	0	0	1	NORMAL
0	RQS	1	0	0	0	0	1	BAD DATA
0	RQS	1	0	0	0	1	0	UNIT FAILURE

These bits are usually set to 0. Bit 6 (RQS) is set to 1 when the SC-Switch generates a service request interrupt.

Release Notes:

Version 3.14: When there is nothing in the output queue, earlier releases would generate a “NO DATA” response to a Read, Query, and Invalid Query commands. Version 3.14 and above will not return anything. This will result in the controller timing-out as per IEEE-488.2-1992 standard section 6.5.2.

China RoHS Addendum



“中国 RoHS”

《电子信息产品污染控制管理办法》(信息产业部, 第 39 号)

附录 (Additional Information required for the Chinese Market only)

本附录按照“中国 RoHS”的要求说明了有关电子信息产品环保使用期限的情况, 并列出了产品中含有的有毒、有害物质的种类和所在部件。本附录适用于产品主体和所有配件。

产品系列: SB and SC SERIES FIBEROPTIC PROGRAMMABLE SWITCHES
(Product Family)

环保使用期限:



本标识标注于产品主体之上, 表明该产品或其配件含有有毒、有害物质 (详情见下表)。

其中的数字代表在正常操作条件下至少在产品生产日期之后数年内该产品或其配件内含有的有毒、有害物质不会变异或泄漏。该期限不适用于诸如电池等易耗品。

有关正常操作条件, 请参见产品用户手册。

产品生产日期请参见产品的原始校准证书。

有毒、有害物质的类型和所在部件

元器件 (Component)	有毒、有害物质和元素					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(CR ⁶⁺)	多溴联苯(PBB)	多溴二苯醚(PBDE)
产品主体 SB, SC (Main Product)						
印刷电路板组件 (PCB Assemblies)	X	O	X	O	X	X
内部配线 (Internal wiring)	X	O	X	O	X	X
显示器 (Display)	X	X	O	O	O	O
电源 (Power Supply)	X	O	X	O	X	X
电工零件 (Electro-mechanical parts)	X	O	X	X	X	X
光模块 / 辅助模块 (Optical modules) / (Auxiliary modules)	O	O	X	O	O	O
金属外壳零件和紧固件 (Metal case parts and fixings)	O	O	O	X	O	O
塑料外壳零件 (Plastic case parts)	O	O	O	O	X	X
配件 (Accessories)						
外接电缆和适配器 (External cables and adapters)	X	O	O	O	X	X

O: 代表该部分中所有均质材料含有的该有毒、有害物质含量低于 SJ/T11363-2006 标准的限值。
X: 代表该部分中所有均质材料含有的该有毒、有害物质含量高于 SJ/T11363-2006 标准的限值。

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