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SA SERIES
FIBEROPTIC UNIT

User's 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. For the -48 V DC option, disconnect the -48 V DC and +RTN lines.

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.

For the -48 V DC option, the unit requires a 48 V DC supply at 2 A.

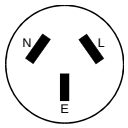
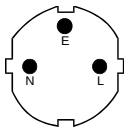
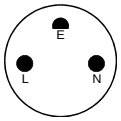
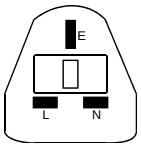
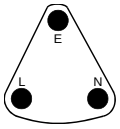
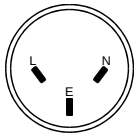
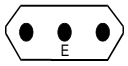
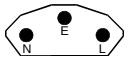
Fuse Type

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

Line Power Cord

The unit uses a three-wire power cord. When connected to an appropriate AC power receptacle, this cable grounds the instrument chassis. JDS Uniphase supplies the type of power cord appropriate for the destination country (Table 1).

Table 1: Power Plug Chart

Destination	Illustration	Part Number
Australia, China		A0102338
Austria, Belgium, Finland, France, The Netherlands, Germany, Spain, Portugal, Sweden		A0100741
Denmark		A0102681
Hong Kong, Ireland, United Kingdom		A0100740
India		A0102180
Israel		A0101407
Italy[1]		A0100742
North America, Central America, Columbia, Ecuador, Japan, Taiwan, Venezuela		A0100483
Switzerland		A0101406

1 This plug is not polarized.
N Neutral
E Earth
L Line

Laser Application



Warning

The unit is rated as a system for use with laser equipment. This means that the laser class of any unit connected to the SA unit applies to the SA unit. Follow appropriate laser safety procedures for that class.

Safety Instructions

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

Before Initializing and Operating the Unit

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

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

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

Operating the Unit



Warning

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

- If using a voltage-reducing autotransformer to power the unit, ensure that the common terminal connects to the earthed pole of the power source.
- Use only the type of power cord supplied with the unit.
- Connect the power cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord that is not equipped with this feature.
- Willfully interrupting the protective earth connection is prohibited.
- Never look into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible, and direct exposure can severely injure the human eye. For more information, see the user's manual of the laser source in use.
- Turning off the power to the device does not always block the externally supplied radiation to the connector at the output of the unit.
- Do not use the unit outdoors.
- To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.
- Do not operate the unit when its covers or panels have been removed.
- Do not interrupt the protective earth grounding. Any such action can lead to a potential shock hazard that can result in serious personal injury.
- Do not operate the unit if an interruption to the protective grounding is suspected. In this case, ensure that the unit remains inoperative.
- Use only the type of fuse specified by the manufacturer as appropriate for this unit. Do not use repaired fuses, and avoid any situations that can short-circuit the fuse.

	• 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 servicing. • 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. If the instructions are not followed, the safety of the product can be impaired. • 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 2). Observe all safety instructions that are associated with a symbol.

Table 2: 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

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.”

UL[1] Compliance

The unit complies with Underwriters Laboratories (UL) standard 3101.1, Electrical Equipment for Laboratory Use; Part 1: General Requirements.

[1] UL is a registered trademark of Underwriters Laboratories Inc.

General Information and Specifications

General Information

This user's manual for the SA Series Fiberoptic Unit contains complete operating instructions. The inspection report and a description of any customer-requested information are found in the **Customized Features and Test Data** section.

The SA unit (Figure 1) typically contains a combination of relay and precision stepper motor optical switches. Direct-drive lines can be pre-configured to operate in groups, providing individual switch control. The SA unit is designed to connect fiberoptic input channels to any of N output channels, in a wide variety of configurations. A unique, easy-to-use local and remote user interface provides simple control of the technology.



Figure 1: SA Unit (optional channel connectors not shown)

The performance, configuration, and flexibility of the SA unit are suitable for a wide range of applications, including fiberoptic component testing systems, remote fiber test systems in telecommunications, and research and development. Depending on the configuration, an example is rerouting a transmission signal, with the SA unit acting as the rerouter; the SA unit can be used for backup routing during power outages. Another example, again depending on the configuration, is using the SA unit to test power, losses, backreflection, or attenuation of a device under test (DUT).

The SA unit is equipped with an IEEE 488.1 parallel interface and an RS232C serial interface for remote control operation. The unit also can be operated using front-panel controls. An optional connector panel can be added to the front panel, whereby for the single-height chassis up to 32 FC/PC or up to 56 SC/PC connectors can be attached.

The SA unit can be ordered with a DC power supply option.

Key Features

- Custom optical configurations using combinations of relay switches, 1xN switches, and passive optical components
- User-friendly local and remote interfaces
- Compact design

Applications

- Component and remote fiber testing
- Research and development

Standard Accessories

- AC power cord
- User's manual

Optional Accessories

- Rack-mount kit
- Connector panel

Specifications

The optical specifications that describe the warranted characteristics of the unit are found in the **Customized Features and Test Data** section. Supplementary specifications describe the typical non-warranted performance of the unit (Table 3 and Table 4).

Table 3: Operating Specifications

Parameter	Specification
Local control	• Step-up, step-down channel selection • IEEE 488.1 address selection • Return-to-local function
Remote control	• GPIB interface: IEEE 488.1 1987 capability SH1, AH1, T6, L4, SR1, PP0, DC1, C0, E1 • RS232C interface: setting 8 bits, 9600 baud, 1 stop bit, no parity
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[1] or -48 V DC at 2 A
Power consumption	100 VA maximum
Physical	
Dimensions (W x H x D) benchtop single height with rack mount double height with rack mount	 44 x 13.3 x 38 cm 48 x 13.3 x 38 cm 48 x 26.6 x 43 cm
Weight	9.07 kg (20 lbs) maximum, 3U 13.16 kg (35 lbs) maximum, 6U
Environmental	
Operating temperature	0 to 55 °C
Storage temperature	-40 to 70 °C
Humidity	95% RH from 0 to 40 °C
Altitude	2000 m maximum

[1] Main supply voltage fluctuation must not exceed ±10% of nominal voltage.

Getting Started

The SA Series Fiberoptic Unit consists of the switching unit and an AC power cord or a DC power supply.

Before Initializing and Operating the Unit

☑ Inspect the unit for any signs of damage.

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

Initial Inspection



Warning

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

Check that the unit and contents are complete:

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

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

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

4. For the AC version, connect the unit to a power source, using the AC power cord provided. For the -48 V DC option, connect the unit to a DC power source providing 48 V DC at 2 A.

5. Set the power switch to **I** (on). All key lamps and status LEDs light during the power-up sequence. The model number and the firmware version are displayed. If optional expansion hardware is installed, the number of expansion cards also are displayed. If no malfunction is detected during power-up, all lamps and LEDs turn off, and the default unit display is shown.

6. Set the power switch to **O** (off) and unplug the AC power cord or DC power supply from the power source and from the SA unit.

7. Keep the packaging.

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

Operating Environment

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

Temperature

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

Humidity

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

Ventilation

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



Warning

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

Storing and Shipping

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

Claims and Repackaging

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

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

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

Returning Shipments to JDS Uniphase

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

Ship return material in the original shipping container and packing material. If these are not available, typical 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, as 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.

Cleaning Connectors



Caution

- Connecting damaged or dirty fibers to the unit can damage the connectors on the unit.
- Never force an optical connector. Some connectors have a ceramic ferrule that can easily be broken.

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 at http://www.techspray.com/1671.htm)
- Lint-free pipe cleaners (for example, from 3M[2]) or lint-free swab
- Lint-free towels (for example, 10 x 10 cm or 4 x 4 in HydroSorb III wipers, available at 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 2).

[2] 3M is a trademark of 3M.

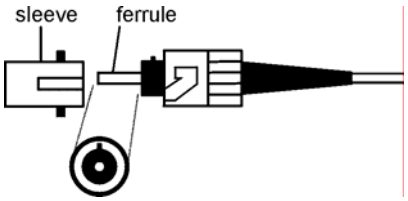


Figure 2: Connector Cleaning (connector type can vary)

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 Unit

To install the SA unit:

1. Place the unit in its intended operating location. The rack-mounting flanges fully support the weight of the unit. Avoid blocking the ventilation holes at the back and at the bottom of the unit.

2. Route the fiber cables in such a way as to avoid creating bends that have a radius of less than 2.5 cm. For example, do not lay cables across sharp corners, and do not tie bundles of cables together tightly. Do not pull the fibers exiting through the rear-panel strain relief; excessive force can damage the optics.

3. Reattach the AC power cord or -48 V DC supply, as appropriate, and reinitialize the unit. See the **Powering Up the Unit** section for more information on the power-up sequence.

Setting up for Remote Control

The unit can be operated from its front panel or remotely by GPIB or RS232 interface.

Setting up for GPIB Operation

To set up the unit for use remotely by GPIB interface:

1. Connect your computer to the SA unit using a cable; connect the cable to the IEEE 488 (GPIB) port at the back of the SA unit.

2. Verify that the GPIB address is set to 7. To do this, press and release the GPIB ADDR key on the front panel of the SA unit. When the address is set to 7, the display reads GPIB ADDRESS ✶7.

3. At the computer that controls the GPIB interface, 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 SA unit. Similarly, the unit appends the same characters to all messages it returns.

4. To activate the default switches mode (with no field active), press the Select key.

5. Send a sample command to the SA unit. For example, use an Output statement (or equivalent) to send the command **Switch 1 1 2** at GPIB address 7. The output channel setting of switch number 1, input channel 1, changes to 2 (unless input channel 1 is already set to output channel 2). Most programming languages automatically append the terminating characters to the message.

6. Send a sample query command, for example, **SWNUM?**. Use an Input statement to receive the message from GPIB address 7. The correct response to this query is a decimal integer corresponding to the number of controllable switches contained within the SA chassis.

Setting up for RS232C Operation

To set up the unit for use remotely by RS232C interface:

1. Connect your computer to the SA unit using a cable; connect the cable to the RS232C port at the back of the SA unit.

2. Using the computer, initialize the serial port to 9600 baud, eight bit ASCII character code, one stop bit, and no parity. Use the following MS-DOS[3] Qbasic program as an example.

```
OPEN "COM2;9600,N,8,1" FOR RANDOM AS #1
PRINT #1, "SWITCH 1 1 2"
PRINT #1, "SWNUM?"
INPUT #1,A$
PRINT A$
END
```

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

Front Panel

Figure 3 shows the front of the SA unit.

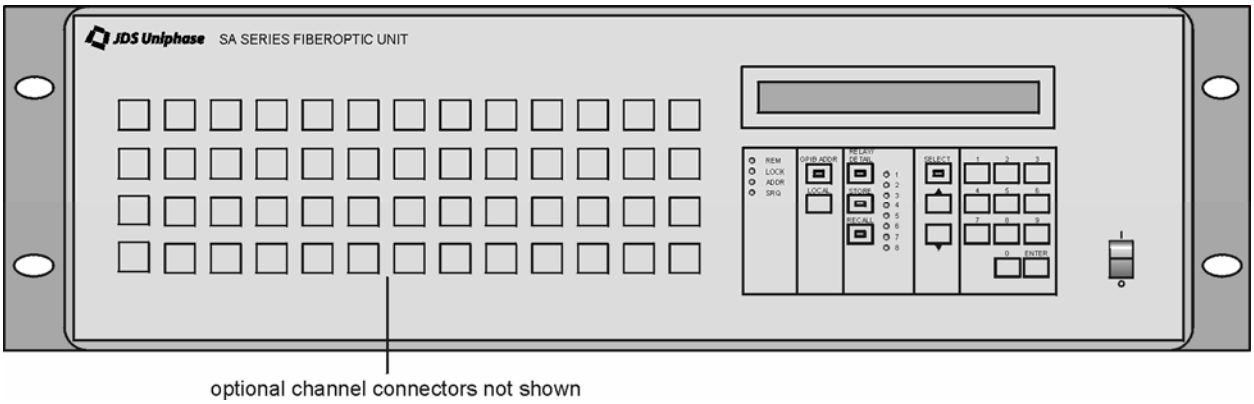


Figure 3: Front of Unit

Operating Keys and Status LEDs

Figure 4 shows the keys in detail.

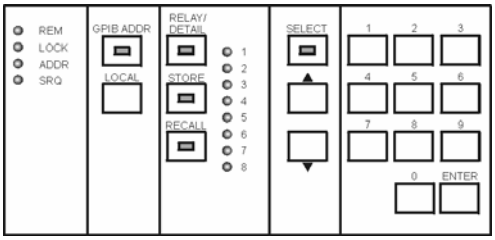


Figure 4: Detail of Front Panel

I / O	Power on/off switch.
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 SA unit is in Local Lockout mode. This mode prevents the Local key from returning the SA unit to Local mode.
ADDR	Indicates that the GPIB interface is in talk state (for example, sending data using the GPIB interface).
SRQ	Indicates that the interrupt logic of the SA unit has generated a service request interrupt on the GPIB interface.
✹ (1 to 8)	Indicates the state of direct-driver lines (active when LED is lit).

(table continued)

GPIB ADDR	Sets the SA unit to GPIB Address mode.
LOCAL	Returns the SA unit to Local mode from Remote mode, unless the unit is in Local Lockout mode.
RELAY/DETAIL	Sets the SA unit to Detailed Switch Information mode if expansion hardware is installed, otherwise allows direct-drive Relay Control.
STORE	Stores the currently displayed switch or driver in non-volatile memory.
RECALL	Recalls a previously stored switch or driver pattern in non-volatile memory.
SELECT	Sets the SA unit to Switch Control. Subsequently selects numeric input fields: switch, input channel (if applicable), or output channel.
	Channel increment key.
	Channel decrement key.
☐ (0 to 9)	Numeric entry key pad.
ENTER	Terminates an entry, for example, channel number or GPIB address.

Rear Panel

Figure 5 shows the back of the unit for AC power. Figure 6 shows the back of the unit for the -48 V DC option.

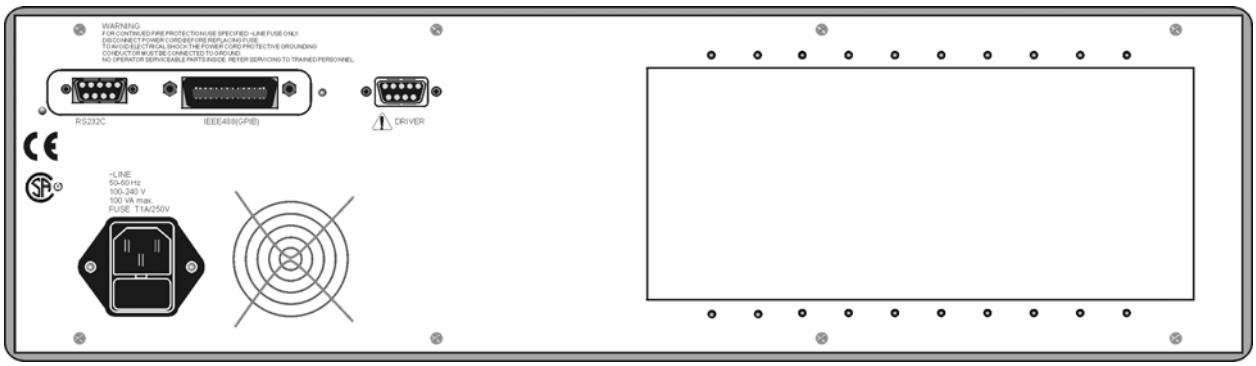


Figure 5: Back of Unit for AC Power

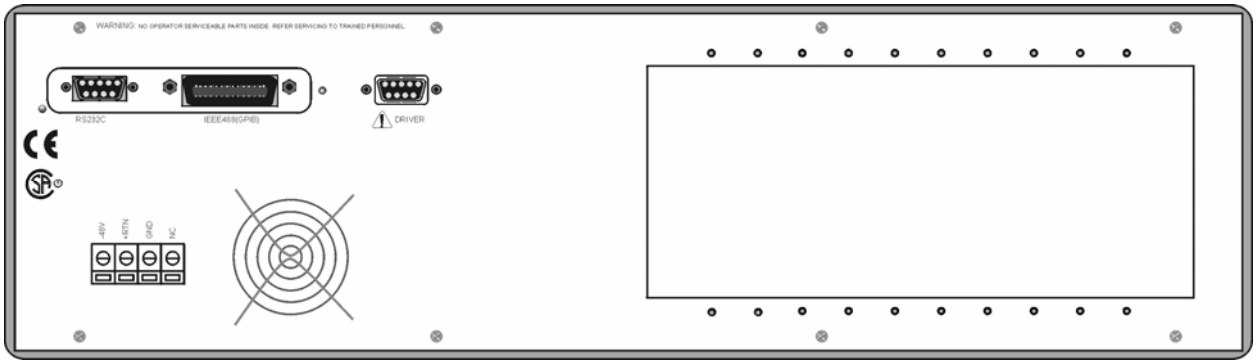


Figure 6: Back of Unit for DC Power

External Switch Module Connections

External Switch Module without TTL Input Controls

Figure 7 shows the setup for a switch without transistor-transistor logic (TTL).

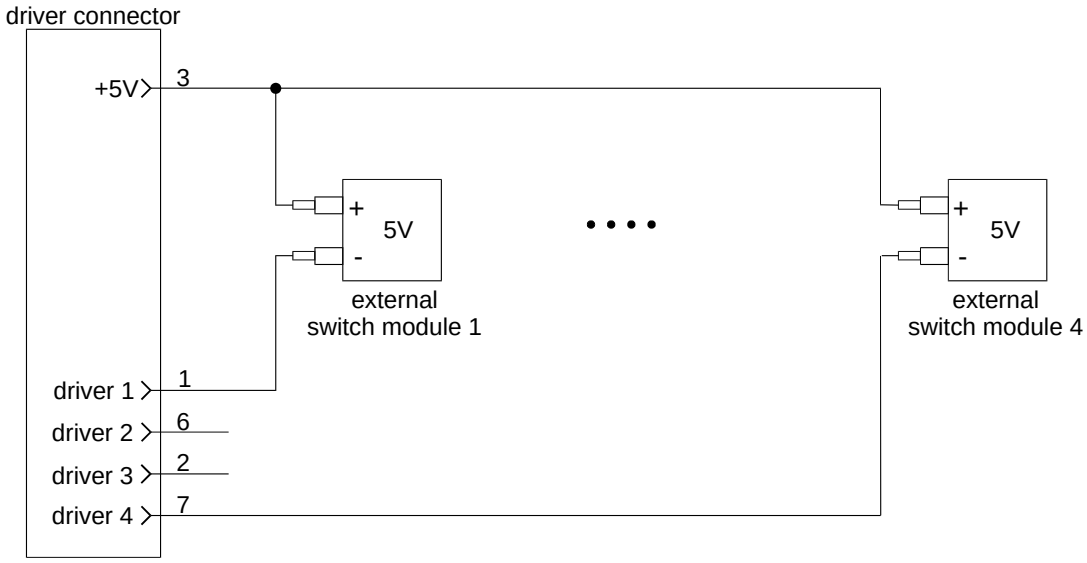


Figure 7: Switch without TTL

External Switch Module with TTL Input Controls

Figure 8 shows the setup for a switch with TTL.

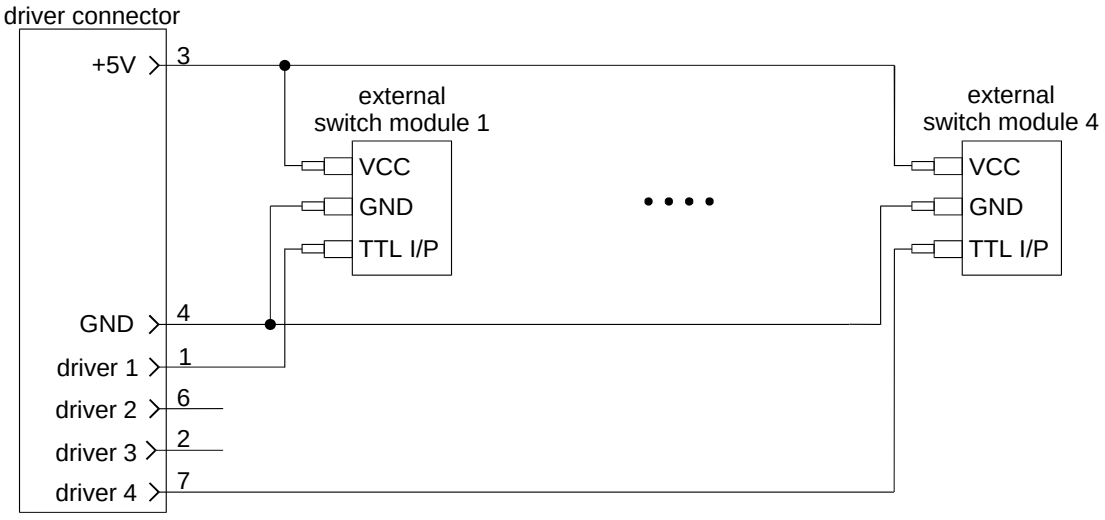


Figure 8: Switch with TTL

Sample Driver Application: Electrical Equivalent of Driver

Figure 9 shows a sample driver configuration.

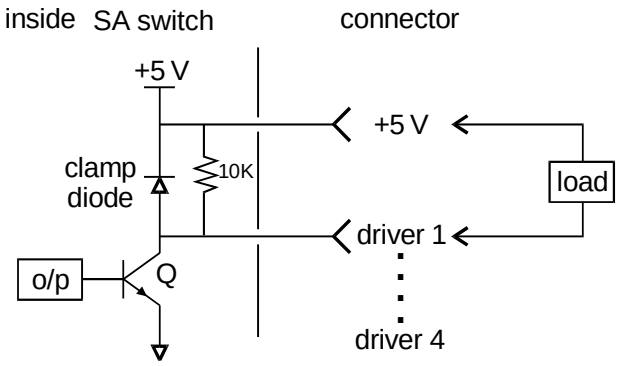


Figure 9: Sample Driver Configuration

	Caution Do not exceed 100 mA per driver.

Powering Up the Unit

To power up the unit:

1. Connect the unit to the AC power source, with the AC power cord provided.

2. Set the power switch to **I** (on). All key lamps and status LEDs light during the power-up sequence. The LCD displays the unit designation (SA), the firmware version, and the number of expansion boards (Figure 10).

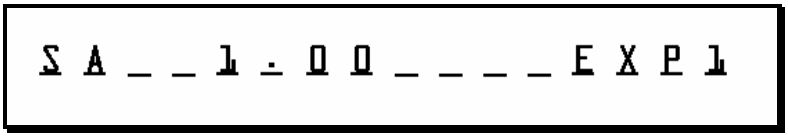


Figure 10: LCD Display for Power On/Reset, with Expansion Hardware

When no expansion boards are installed, no indicator is displayed at the start-up (Figure 11).

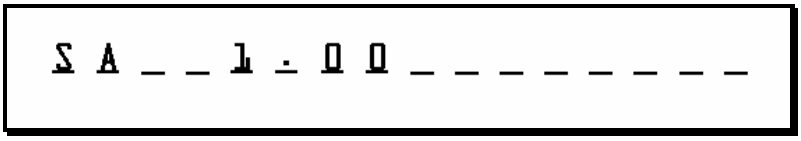


Figure 11: LCD Display for Power On/Reset, without Expansion Hardware

The switch number and channel connection status are shown in a generic format on the LCD, referred to as the default unit display (Figure 12).

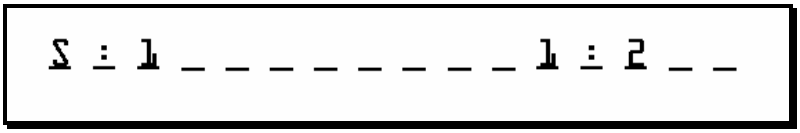


Figure 12: Default LCD Display

The field “S : 1” indicates the actual switch number, field “1” indicates the current input channel number, and field “2” indicates the current output channel number.

If you have not already done so, you can set the SA unit for remote control by GPIB or RS232 interface (see the **Setting up for Remote Control** section).

Selecting Switches, Input Channels, or Output Channels

While the default unit display is active (see Figure 12) the Select key is lit on the front panel of the unit. Pressing and releasing the Select key causes the switch field to become active. Pressing and releasing the Select key a second time causes the input channel field to be activated. Pressing and releasing the Select key again causes the output channel field to be activated. Pressing and releasing the Select key again causes all fields to be deactivated. An active field is indicated on the LCD by the characters within that field blinking continuously.

Those fields that have only one possible parameter (for example, a unit with a single input channel) cannot be selected. In this case, the particular field is skipped when the Select key is pressed, and the next valid field is activated. While any field is active, it can be modified in the following manner:

1. Press and release the Select key until the desired field is activated, as described.

2. Enter a number using the numeric keypad (one to three digits).

3. Press the Enter key. (Numeric entry is automatically accepted if the maximum number of digits is entered. In this case, the Enter key need not be pressed. For example, if the SA chassis contains less than 10 switches, only a single digit can be entered in the switch field.)

   Or,

3. Press the or key to change the field sequentially.

Output channel 0 is an open circuit (for example, the selected switch is in an unconnected state). This condition is shown on the LCD as “OFF”.

Saving and Recalling Switch or Relay Driver States

The SA unit has 10 non-volatile memory locations available for storing and recalling SA unit data.

If expansion hardware is installed in the SA unit chassis, the state of the currently displayed switch is stored in the manner described in the next section.

If expansion hardware is not installed in the SA unit chassis, the current state of the eight direct-drive relay lines is stored and recalled as follows:

1. Select the desired switch or place the direct-drive relay lines in the desired pattern.

2. Press the Store key.

3. Enter a number (0 to 9) using the key pad to assign the stored switch state.

4. To recall the switch state, press the Recall key, followed by the assigned number.

Displaying Switch Details or Controlling Direct Drivers

If expansion hardware is installed (see the **Customized Features and Test Data**), detailed information about particular switches can be displayed in “detail mode” operation. The LCD display shows the switch number currently selected, the physical type of switch (for example, SC, SB, or SN), and the input/output channel configuration. An example is shown in Figure 13.

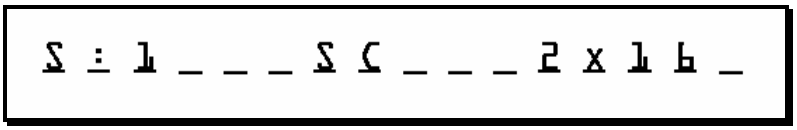


Figure 13: Detailed Motor Display with Expansion Hardware

To display switch details:

1. Press the Relay/Detail key. The currently selected switch is displayed.

2. Scroll through the installed switches using the or key. Numeric entry is not possible.

When the expansion hardware is not present, the Relay/Detail key places the unit in driver control mode and does not display detailed switch information. In driver control mode, the SA unit has four drivers (1, 2, 3, and 4) for driving the external switch modules and four drivers (5, 6, 7, and 8) for driving internal switch modules. The LCD indicates that relay control is active (Figure 14).



Figure 14: Relay Control Display without Expansion Hardware

To activate or deactivate direct-driver lines:

1. Press the Relay/Detail key. The Relay Control message is displayed.

2. Toggle the desired direct-driver line on or off by pressing and releasing the corresponding key on the numeric keypad.

The status LED of the corresponding driver is lit when the driver line is active.

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. Scroll to the required address using the or key, or enter the address via the numeric keypad. Valid GPIB addresses are numbers in the range 1 to 30.

3. Press the Enter key to activate the new address or to leave the GPIB address unchanged, then press a mode key (for example, Relay/Detail or Select). Address entry is confirmed by the appearance of an asterisk.

Calibrating the Unit

No calibration is required.

Maintaining the Unit

Clean the connector ends with a lint-free tissue and alcohol before every mating, as outlined in 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.

2. Pull the panel out carefully, extending it no more than 10 cm (4 in) from the body of the unit.

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, and reinstall the connectors into the bulkheads.

5. Reinstall the connector panel, guiding the fiber back to ensure that it does not bend sharply.



Caution

Do not extend the connector panel more than 10 cm (4 in) from the body of the SA unit.

Programming Guide

The following programming instructions for the SA unit are intended for users who are familiar with the GPIB interface and how to send or receive messages over the bus. 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 SA unit is equipped with a GPIB parallel interface and an RS232C serial interface. The unit accepts the same device-dependent commands (commands that control the instrument) over either interface.

GPIB Pin Assignment

Figure 15 shows the GPIB pin assignment.

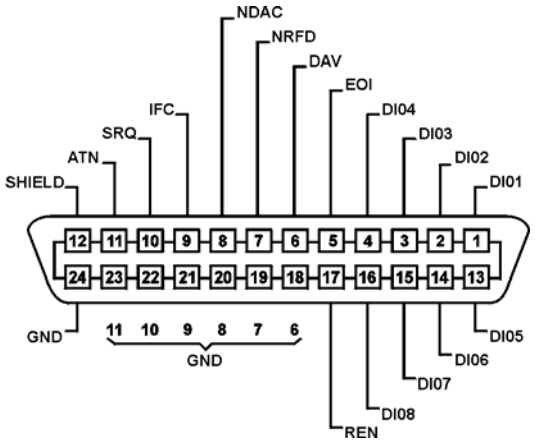


Figure 15: GPIB Pin Assignment

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

The GPIB interface functions are outlined in Table 5.

Table 5: 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

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. Scroll to the required address using the ▲ or ▼ key, or enter the address using 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/Detail, or Select).

RS232C Pin Assignment

Figure 16 shows the RS232 pin assignment, which is not applicable if expansion hardware is installed.

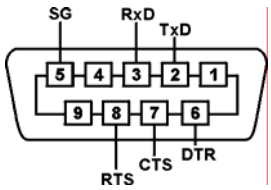


Figure 16: RS232 Pin Assignment

The RS232C interface specifications are outlined in Table 6.

Table 6: RS232C Interface Functions

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 9600 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.

Figure 17 shows the RS232 pin assignment of the drivers.

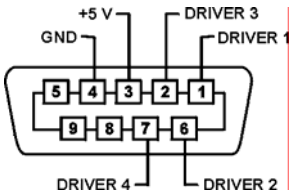


Figure 17: RS232 Driver Pin Assignment



Caution

Do not exceed 100 mA per driver.

Operation and Query Commands

Most operation and query commands control instrument functions and are interface independent.

Command Parser Rules

- A command consists of a mnemonic (for example, a switch) 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 and 10.0 are recognized as the same value.
- Commands can be sent in uppercase or lowercase characters.
- A command is transmitted in a message, and messages can contain more than one command. For example, **SWITCH 1 1 3;SWNUM? <CR> <LF>** contains two commands.

- All GPIB messages must end with the terminating sequence <CR> <LF>.
- All RS232C commands must be terminated with a single <CR> character.
- The input buffer of the SA unit can hold as many as 100 characters. If the buffer becomes full, the unit holds the handshaking line on the GPIB interface until space is available. Similarly, over the RS232C interface the SA unit 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 SA unit delays accepting new characters sent over the GPIB interface while the switch mechanism is moving, but no data are lost. The SA unit is always ready to accept characters over the RS232C interface.
- A query command is used to extract status information from the SA unit. For example, **SRE? <CR> <LF>** returns the contents of the status register (see the **Status Reporting and Service Request Control** section).
- Multiple-command messages can contain only one query command. A query must be the last command in the message, for example, **SWITCH 2 1 1; XDRS? <CR> <LF>**.

Operation Commands

RESET	**Reset**

Returns the SA unit to the power-up state, for example, channel 0, relay drivers off. All motors and non-latching relay switches are returned to the reset position. The state of the latching switches is not modified.

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 register.

CLR	**Clear Device**

Clears the SRQ mask register.

SWITCH I J K **Set Optical Connection**

Sets the optical connection of the selected switch.

- I = switch number
- J = input channel number
- K = output channel number

CLOSE I **Modify Stepper Motor Optical Setting**

Connects input channel 1 to the output channel specified by I on the first motor (if any).

- I = output channel number to be connected to input channel 1

GPIB I **Set the GPIB Address (RS232 Interface Only)**

Modifies the GPIB address.

- I = GPIB address (0 to 30)

Query Commands

SWITCH ? A **Query Optical Connection**

Returns the connection status of the switch specified by A: current input, current output.

- A = switch number

CLOSE? **Optical Switch Path**

Returns the current output channel number connected to input channel 1 of the first motor (if any). CLOSE? MAX returns the maximum output channel (if any) of the first motor.

SWNUM? **Number of Switches**

Returns integer equal to total number of switches within the unit.

CONFIG? **Query Switch Configuration**

Returns a data stream containing a number of packets equal to the number of switches within the unit, with each packet separated by a semicolon (;) delimiter. Each data packet contains: an integer representation of the switch number; two characters representing the switch designation; an integer describing the output channel currently connected to input channel one; an integer defining the board or motor address of the switch; two integers defining the numbers of the first and last relay lines used by this switch (if motor, these are 0); an integer defining the number of input channels; and an integer defining the number of output channels.

LRN? **Learn**

Returns a string containing the commands that, if sent, reset the currently selected switch to its current state, for example, **SWITCH I J K;SRE L**, where I represents the switch number, J represents the input channel number, K represents the output channel number, and L 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 verification operation on all installed stepper motor type switches. 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

ERR? **Error Number**

Returns the last error number that occurred. Returns 0 if the error queue is empty.

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 0 if the error queue is empty. This command removes the error number from the error queue, once it is read.

- -350 = queue overflow
- -330 = self-test failed
- 301 = command error
- 303 = invalid command
- 200 = parameter error
- 0 = no error

IDN? **Identifier**

Returns a string that identifies the manufacturer, the SA unit model number, and the firmware level, for example, JDS Uniphase, SA unit, v1.1.

XCARD? I **Expansion Card Installation**

Returns expansion card installation status. XCARD? returns 1 if the specified expansion card is installed, 0 if the specified card is not installed.

- I = expansion card number (1 to 8)

Commands when No Hardware is Installed

The following commands are available only if expansion hardware is not installed in the SA unit.

XDR I J **Direct Drive Line Control**

Sets the specified direct-drive relay line ON or OFF.

- I = driver number (1 to 8)
- J = state (1 = ON, 0 = OFF)

XDRS I **Direct Drive Line Group Control**

Sets all eight direct-drive relay lines ON or OFF 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
- I = sum of the weights of the drivers to be activated; when I = 255, all driver lines are active

XDR? I **Direct Drive Line Query**

Returns the current state of the specified direct-drive relay line (1 = ON, 0 = OFF).

- I = driver number (1 to 8)

XDRS? **Direct Drive Line Group Query**

Returns the current state of all specified direct-drive relay lines (1 = ON, 0 = OFF).

Status Reporting and Service Request Control

The SA unit maintains three eight-bit registers that are used for status reporting and for 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. 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, the **CNB?** query returns 4.

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 SA unit. When an event occurs, the status logic of the SA unit sets the corresponding bit to 1. This register can be read at any time because the bits stay set until the register is read at least once.

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 SA unit 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 SA unit.

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 unmasks specific events in the status register that generate service request interrupts on the GPIB interface. 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; an SRQ is generated and bit 6 in the status register is set when the corresponding bit changes from 0 to 1.

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 SA unit 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 bit set, but then the logic of the SA unit automatically clears the register. As a result, subsequent **STB?** queries return 0.

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

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

GPIB Programming Examples

This section provides programming examples for controlling the SA unit over the GPIB interface. The samples were written in MS-DOS Qbasic and run on a personal computer equipped with a National Instruments[4] GPIB interface board, with National Instruments Universal Language Interface drivers loaded. The commands that control the GPIB are very similar to Hewlett Packard[5] HP Basic commands. Most other controller board manufacturers provide basic output and input statements for communicating messages to a GPIB instrument.

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

Before using any of these samples, 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.

Sending Commands

This sample sets the SA unit 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"SWITCH 1 1 1; STB?"
PRINT #1, "OUTPUT 07;SWITCH 1 1 1;STB?"
PRINT #1, "ENTER 07"
' sample queries
PRINT #1, "OUTPUT 07;SWNUM?"
PRINT #1, "ENTER 07"
INPUT #2, a
PRINT "switch ",a
PRINT #1, "OUTPUT 07;ERR?"
PRINT #1, "ENTER 07"
INPUT #2, a
PRINT "error  number= ",a
END
```

[4] National Instruments is a trademark of National Instruments.
[5] Hewlett Packard is a registered trademark of Hewlett-Packard Co.

Serial Polling the Status Register

This sample 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;SWITCH 1 1 1"     ' change channel
sr = 0                                 ' initialize sr variable to enter the while loop
WHILE ((sr AND 4 ) =0)                 ' loop until settled bit is true
  PRINT #1, "SPOLL 07"                 ' serial poll SA
  INPUT #2, sr
WEND
PRINT sr                               ' print final value of sr
END
```

Generating a Service Request Interrupt

This sample tests the service request interrupt function. It unmasks the settled bit in the SRQ mask register and selects a channel. An interrupt is generated when the SA unit 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;SWITCH 1 1 1"      ' 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 SA
  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 sample 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 SA unit to a same state.
' Like this...
PRINT#1, "OUTPUT 07;"LEARN$
' SA settings are now restored
END
```

RS232C Programming Examples

This section provides programming examples for controlling the SA unit over the RS232C interface. The samples 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 SA unit.

The RS232C commands that appear in this section do not always show the terminating character <CR>; however, it is implied.

The RS232C interface cannot receive an SRQ interrupt.

Sending Commands

```
OPEN "COM2:9600,N,8,1" FOR RANDOM AS #3
A = 10
PRINT#3, "SWITCH 1 1 1 ";A
END
```

Querying Status

This sample queries and displays the current channel setting.

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

Reading the Status Register

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

The following sample changes the channel setting and reads the status register continuously until the output has settled.

```
OPEN "COM2:9600,N,8,1" FOR RANDOM AS #3
PRINT#3, "CSB"                          ' clear status register
PRINT#3, "SWITCH 1 1 2"
DO                                      ' loop until motor settles
        PRINT#3, "STB?"
        INPUT#3, SR1
LOOP UNTIL (SR1 AND 4)
PRINT SR1
END
```

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 EN 45014

Manufacturer's Name JDS Uniphase Corporation

Manufacturer's Address 570 West Hunt Club Road
Nepean (Ottawa), Ontario
K2G 5W8 Canada
613 727-1303
www.jdsuniphase.com

Declares that the products:

Product Name SA, SA-ZTC, and SC product families

Product Option This declaration covers all options of the named products.

Conform to the following product specifications:

Safety IEC 1010-1:1990+A1/EN 61010-1:1993
CAN/CSA-C22.2 No. 1010.1-92
UL Std. No. 3101.1

EMC CISPR 22:1995/EN55022:1995
EN61000-4-2:1995/EN50082-1:1997 4kV CD, 8kV AD
EN61000-4-3:1995/EN50082-1:1997 3V/m, 80-1000 MHz
EN61000-4-4:1995/EN50082-1:1997 EFT class 2
EN61000-4-5:1995/EN50082-1:1997 1 kV Sig. Lines, 2 kV Power Lines
EN61000-4-6:1996/EN50082-1:1997 Cond. Immunity 3V RMAS, 150kHz-80 MHz
EN61000-4-11:1994/EN50082-1:1997 Voltage Dips and Interruptions

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

Nepean, Ontario CANADA
Date: 4 February 2000



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