SLD – 101

Highly Stable Light Source

**Operation Manual**

July 21, 2007

General Photonics Corp.
5228 Edison Ave.
Chino, CA 91710 USA

Ph: (909) 590-5473
Fax: (909) 902-5536

www.generalphotonics.com
WARRANTY

All of General Photonics’ products have been inspected and found to comply with our stringent quality assurance standards before shipping. If any damage occurs during shipment, please contact the carrier and inform us or our distributors as soon as possible.

Please do not, under any circumstances, attempt user repair of any General Photonics product. To avoid further damage, any repair of defective products must be performed by well-trained engineers.

General Photonics warrants that this product will be free from defects in materials or workmanship for a period of one year from the date of original shipment (listed on the certificate of quality or packing list enclosed with the original shipment). A product found to be defective during the warranty period will be repaired or replaced, at no charge, at General Photonics’ option.

If a problem is found, please contact General Photonics for assistance. If necessary, return the defective product, freight prepaid, clearly labeled with the RMA number, with as complete a description of the problem as possible. The repaired or replacement product will be returned, freight prepaid, as soon as possible.

The above warranty specifically excludes products that have been repaired or modified by non-manufacturer-authorized personnel, as well as damage caused by misuse, abuse, improper storage or handling, or acts of nature.

This warranty is in lieu of all other warranties, expressed or implied. General Photonics will not be liable for any indirect or consequential damages or losses resulting from the use of its products.
SAFETY CONSIDERATIONS

The following safety precautions must be observed during operation, service and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. General Photonics Corp. assumes no liability for customers’ failure to comply with these requirements.

- **Before operation, the user should inspect the instrument and review the manual carefully.**

- The instrument’s rear panel includes a chassis ground terminal for electrical safety.

- Make sure that the instrument is in a secured work environment (in terms of temperature, humidity, electrical power, hazard due to fire or shock, etc.) for proper operation.

- Standard laser safety procedure should be followed during operation.
IMPORTANT NOTICE ABOUT SLD-101

1. Make sure that special precautions have been taken for high power light sources.

2. When using external/internal modulation, make sure do not run at 100% modulation for long time, continuous running at such high driving current (normally maximum driving current) may reduce the life time of the light source.

3. Avoid any reflection in the optical path back into the light source (even there is an optical isolator integrated in the instrument), through either external optical isolator or angled connectors.

4. Avoid possible voltage surges for the main power supply (110V or 220V).

5. Keep the test report accompanied with the SLD-101, in case there is any problem with the instrument, use it as a reference for diagnosis.
# Table of Contents:

Section 1. Specifications: ................................................................. 6
Section 2. Overview: ............................................................... 7
Section 3. Feature Description: ...................................................... 8
  3.1 Optical Features: ............................................................... 8
  3.2 Electrical Features: ............................................................ 9
Section 4. Operation Instructions: ................................................ 12
  4.1 Unpacking ................................................................. 12
  4.2 Front Panel Operation ..................................................... 12
  4.3 Front panel operation troubleshooting ................................ 17
  4.4 Testing and Characterization ............................................ 17
  4.5 Remote control and programming: ................................... 18
    4.5.1 RS-232 operation ................................................... 18
      4.5.1.1 RS-232 connection ........................................ 18
      4.5.1.2 Remote operation and commands ................... 18
      4.5.1.3 RS-232 troubleshooting .................................. 21
    4.5.2 USB control ..................................................... 21
      4.5.2.1 Procedure for Installing USB VCP driver .......... 21
      4.5.2.2 VCP Uninstall Procedure .............................. 29
      4.5.2.3 SLD-101 USB Commands ............................... 30
      4.5.2.4 USB Troubleshooting: .................................... 30
    4.5.3 LabVIEW control programs ................................. 31
    4.5.4 ETHERNET control ............................................ 41
    4.5.5 GPIB control .................................................. 37
Section 5. Technical Support ...................................................... 43
Section 1. Specifications:

Physical Features:

Package Dimensions    Standard 2U half-19” rack mount size  
14” (L) × 8.5” (W) × 3.5” (H)
Output Fiber Type    PM or SM fiber
Fiber Connector Type    FC/PC, FC/APC, SC/PC or SC/APC  ¹
Weight       7 lb

System Characteristics:

Operating Wavelength 630-1600nm (depending on light source)
Output power (at pigtail) 0.2mW-20mW (for regular LD, SLED)  
100mW-1000mW (pump LD for ASE source)
Power stability  <0.01% variation (1-hour)  
<0.05% variation (long-term)
Power accuracy² ± 0.25 dB
PD monitoring stability³ <0.05%
Output current⁴ 0~2 A
Internal modulation⁵ 0-2 kHz, sine and square wave
External modulation⁵ 0-100 kHz sine and square wave
Temperature control⁶ +10º to 40º C
Temperature control accuracy  <0.05 ºC
Operating Temperature 0º to 50º °C
Storage Temperature -20 to 65ºC
Front panel display 2-line LCD display
Power Supply 100-120VAC, 50-60 Hz or  
200-240VAC, 50-60 Hz
PC Interface RS-232, USB, Ethernet, GPIB

Note:
1. Per user specification at the time of ordering, APC is recommended.
2. Compare to measured result using the calibrated optical power meter.
3. Depending on the light source, this option may not be available.
4. Specs are according to the electronic driver capability, may vary for different kinds of light source.
5. Modulation setting should be optimized for best performance, and functions may not be available for special light sources.
6. Output power has been calibrated over the full temperature range for the constant current mode.
Section 2. Overview:

General Photonics’ SLD-101 is an advanced laboratory light source specially designed for applications with high stability requirements such as OCT, sensors, and test and measurement applications. During operation, both the current and temperature are accurately controlled for optimal power and spectral stabilities. This instrument is available in many different configurations tailored to users’ specific needs. User selectable options include type of light source (SLED or DFB laser), output power range, operating wavelengths, and, in the case of the SLED, degree of polarization (DOP). The range of current available to drive the laser diode is 0 to 2A, but can be limited to match the requirements of the selected light source.

The SLD-101 has several different operation modes: constant current, constant power, internal modulation, and external modulation. In constant current mode, the drive current is maintained at a constant, user-selected value. The output power has been fully calibrated over the whole temperature range (+10º to 40º C). In constant power mode, the SLD-101 uses its internal feedback system to precisely maintain the output power at a constant, user-selected level. Depending on the light source, this option may not be available. In addition, the output power of the constant power mode has been calibrated under lab environment (25º C), while the readings under other temperatures are used for reference only. In internal modulation mode, the light output is modulated by an internally generated sine or square wave signal of user-selected frequency and depth. External modulation mode allows the user to input a modulation signal of up to 100 kHz from an external source such as a function generator. Note that these operation modes may not be available for different light sources.

The SLD-101 also offers precise control of the light source temperature through a powerful, compact analog PI (Proportional, Integral) control loop circuit optimized for use in ultrastable thermoelectric temperature control applications, which maintains precision temperature regulation using an adjustable sensor bias current and error amplifier circuit. The controlled temperature range is from 10ºC to 40ºC, with variation of <0.05ºC.

The SLD-101’s extreme stability and flexibility make it an ideal light source for a wide range of applications.
**Section 3. Feature Description:**

**3.1 Optical Features:**

The SLD-101 has one fiber connector on the front panel for the output optical beam. The output can be SM or PM depending on the option chosen when the instrument was ordered. The adapter is a universal connector interface (UCI), which features a male-type adapter top piece that can be removed for direct access to the ferrule end for routine cleaning and maintenance without removing the entire adapter from the panel. This feature helps avoid high insertion loss, high return loss and measurement instability caused by dirty or contaminated connectors. In addition, the SLD-101’s universal interchangeable adapter allows the end user to switch to ST, SC, or FC connectors without opening the instrument panel. *For the SLED light source under special wavelength range (e.g. 630-1300 nm), an angled (i.e. APC) connector is highly recommended and any back-reflection along the optical path of the experimental setup should be minimized for the safety of the source.* Although the instrument is shipped with a customer specified fiber adapter, other interchangeable inserts can be purchased from General Photonics. For additional information on different input fiber adapter inserts, please contact General Photonics.

External fiber connectors should be cleaned using industry standard cleaning methods before connection to the SLD-101. If this procedure is followed before each connection, the instrument’s internal connector ferrule should not need regular cleaning. However, high insertion loss or measurement instability that does not improve after cleaning the external connectors may indicate that the instrument’s internal connector ferrule needs to be cleaned. The connector ferrule is contained in a universal connector interface consisting of a front piece that connects to the external fiber connector, and a base piece that is mounted on the front panel of the instrument. To clean the connector ferrule, first, make sure that no external connector is connected to the universal connector interface. Then, using a Phillips screwdriver, remove the two small screws connecting the front and back parts of the adapter, and carefully pull the front flange straight out. (Note: never remove the adapter base from the front panel). The ferrule end should now be exposed. Clean the ferrule using standard cleaning procedures (compressed air or a fresh lint-free tissue and alcohol). Care must be taken to avoid scratching the ferrule surface. Finally, replace the front flange (position it so that the key notch faces up, and the small alignment pin lines up with the hole in the base piece, before pushing it in) and the screws. It is generally recommended that the user prepare a patch cord fiber to avoid inside connector wear.
3.2 Electrical Features:

The SLD-101 system uses the standard wall electricity supply. The line voltage is factory-set at 110 VAC or 220 VAC per customer specification. Due to high voltage, the following safety precautions must be exercised during operation.

- The ground pin on the power supply cord must be connected to earth ground of the wall receptacle.
- Never touch the boards inside the package without proper insulation.
- The SLD-101 is not user serviceable and can be serviced only by factory-authorized personnel.

The front panel of the SLD-101 is shown in Figure 2. The power switch (Power), light source enable key, liquid crystal display (LCD), external modulation BNC connector, push button control pad, and output optical connector are mounted on the front panel. The AC power plug, fuse, and RS-232, USB, Ethernet, and GPIB interface connectors are mounted on the back panel, as shown in Figure 3.

The SLD-101 includes RS-232, USB, Ethernet, and GPIB interfaces for external computer operation of the system. RS-232 and USB cables are provided for connection to a personal computer. A basic LabVIEW™ (National Instruments, www.ni.com) control program is also provided. The remote control command list and instructions, USB driver installation instructions, and LabVIEW™ control program descriptions are listed in section 4.5.
Figure 2. Front panel layout.

Front panel description:

- LCD display: displays operation mode and parameters
- POWER: power on/off switch
- LIGHT: light source enable/disable key
- EXTERNAL MOD: BNC connector for external modulation signal input
- LIGHT OUTPUT: universal connector interface adapter for optical fiber output
- Keypad: push buttons for operation status control
  - MODE: Select operation mode or parameter setup
  - ENTER: Confirm or select displayed setting
  - ▲◄►▼: Arrow keys: set parameters or move between setting options.
Figure 3. Rear panel

Rear panel description:

USB: USB interface port
RS-232: serial communication port
Ethernet: Ethernet interface port
GPIB: GPIB interface port
Line: external AC supply input connector, 110 V or 220 V
BNC: not used in SLD-101
接地: electrical ground connection
Section 4. Operation Instructions:

Warning:

- Never look into the light source fiber connector when the light source is turned on. THE OUTPUT LIGHT FROM A HIGH POWER LASER IS HARMFUL TO HUMAN EYES. Please follow industry standard procedures when operating a high power laser source.

- The SLD-101 is designed for indoor use only. Avoid water condensation or liquid spills during SLD-101 storage and operation.

- The SLD-101 is designed with highly precise circuits and expensive light source chips, therefore, important precautions should be taken during operation, for example, make sure to reduce the driving current/output power to zero before turning off the instrument.

4.1 Unpacking

Inspect SLD-101 for any physical damage due to shipping and transportation. Contact carrier if any damage is found. Check the packing list to see if any parts or accessories are missing.

4.2 Front Panel Operation

Setup procedure is described below:

1. Make sure local AC voltage matches the AC voltage requirement of the SLD-101 system. If not, do not proceed. Contact General Photonics immediately.
   - i. The base model uses 100-120 VAC, 50/60Hz
   - ii. The SLD-101 can also be configured to use 200-240 VAC, 50/60Hz by user request at the time it is ordered.

2. Connect power cord and plug it into wall receptacle. Make sure the ground pin of the power cord is connected to earth ground.

3. Connect the output fiber to the output connector of the SLD-101. It is important to clean the fiber connector using industry standard procedures and to make sure that the connection is good. Make sure that the optical power source is off during connector cleaning.

4. If using external modulation, connect the source to the external modulation connector on the front panel of the SLD-101.

5. Turn on power supply, select operational mode and parameters (see next section) and turn light enable key.
When the instrument is first powered on, it will go through an initialization process. During this time, the LCD will display the following initialization screen:

When initialization is complete, the LCD displays:

The default operational mode is constant current mode, with operation temperature set at 25°C. At this point, the user can use the arrow keys to change the current and temperature values, followed by the ENTER key to confirm the setting. The MODE key can be used to select other operational modes.

**Mode selection (*: Some modes may be disabled for certain light sources):**

Press the MODE key to bring up the operational mode and basic parameter selection screens. The SLD-101 has 7 options available under its mode selection screens, with 2 options listed on each screen. When the MODE key is pressed, one of these screens will appear, with the current operation mode highlighted. The default operation mode is constant current, so the first time the MODE key is pressed after power up, the first screen will appear, with Mode 1 highlighted. Use the UP and DOWN arrows to move between options, and the ENTER key to select the highlighted option. The mode selection screens are shown below.
OPTION 1: Constant Current Mode

In constant current mode operation, both the diode temperature and current are maintained at a constant, user-selected value. This allows for extremely stable optical power output. When Option 1 is first selected, the LCD displays:

```
Iset = xx.xx mA
I: xx.xx mA P:xx.xxmW
```

This is the initial current setting screen. The top line shows the current setting, and the bottom line shows the actual current and power values at the time the MODE key was pressed. Use the arrow keys to set the desired drive current value. The LEFT and RIGHT arrows move the cursor between digits, and the UP and DOWN arrows increment and decrement the active digit. Once the value is set, the ENTER key implements the setting. The constant current mode operation screen is essentially the same as the setup screen:

```
Iset = xx.xx mA
I: xx.xx mA P:xx.xxmW
```

The first line still shows the set current value, but the bottom line now shows the actual, real-time drive current and output optical power values. Pressing any of the arrow keys from this screen will return the instrument to current setup, as described above. Pressing ENTER from the operation screen switches the display to a temperature setting screen:

```
Tset = 25.0 °C
T : 25.0 °C
```

The temperature setting is displayed in the top line, and can be changed with the arrow keys, while the bottom line displays the actual temperature reading. Pressing ENTER from this screen implements the temperature setting displayed in line 1 and returns the display to the constant current mode operation screen.

OPTION 2: Constant Power Mode

Constant power mode allows the user to set the output optical power level directly rather than by setting a current level. As with constant current mode, the diode temperature is maintained at a constant, user-selected level; however, in constant power mode, a feedback circuit controls the drive current to maintain the output power, especially the power at 25°C has been calibrated with an accurate reading (others are for reference only and may not be accurate). On entering constant power mode, the LCD shows the initial power setting screen:

```
Pset = xx.xx mW
P : xx.xx mW I:xx.xxmA
```

```
The top line displays the power setting, while the bottom line displays the optical output power and diode drive current at the time the MODE key was pressed. Use the arrow keys to set the desired optical output power level. The LEFT and RIGHT arrows move the cursor between digits, and the UP and DOWN arrows increment and decrement the active digit. Once the value is set, the ENTER key implements the setting, and the main operation screen is displayed:

```
Pset = xx.xx  mW
P : xx.xx mW  I:xx.xmA
```

The top line is the power setting, and the bottom line is the actual optical output power and drive current. Pressing any of the arrow keys from this screen will return the instrument to power setup, as described above. Pressing ENTER from this screen will toggle the display to the temperature setting screen:

```
Tset = 25.0 °C
T : 25.0 °C
```

As in Mode 1, the temperature can be set from this screen with the arrow keys and confirmed with the ENTER key. If no settings are changed, the ENTER key toggles between this screen and the constant power mode operation screen.

**OPTION 3: External Modulation Mode**

In External Modulation Mode, the SLD-101’s optical output is directly controlled by an external signal input from the BNC connector on the front panel. There will be no light output if external modulation is selected but no signal is input. The external signal can have a frequency between 0 and 100 KHz, with a voltage range (e.g. 0~2V), and a voltage offset range (e.g. 1~2V). 2V corresponds to the maximum input current for any particular light source, so the maximum input voltage should not exceed 2V. The combination of amplitude and offset for the modulation signal should be selected accordingly. For the best modulation output, recommended voltage and offset values are provided for different light sources (refer to the test report). Severe damage may happen to the SLD-101 if the wrong modulation is performed for long period since the 100% modulation is operated at the maximum driving current.

After the external signal is connected to the BNC connector, press the ENTER key to apply the modulation to the output. The LCD will display:

```
Under EXT Modulation
```
OPTION 4: Internal Modulation Mode

In internal modulation mode, the diode drive current is modulated from a base level of approximately $0.5*I_{\text{max}}$ by an internally generated sine or square wave of user-selected frequency and depth. The frequency range is 0 to 2 kHz (for internal sine wave modulation, the frequency range is 0 to 200Hz), and the modulation depth can be varied between 0 and 100%. A modulation depth of 0% corresponds to CW operation at the base level, and 100% corresponds to a periodic drive signal with amplitude $I_{\text{max}}$ and mean level equal to the base level.

On entering internal modulation mode, the LCD will display:

```
1. Sine wave MOD
2. Square wave MOD
```

Use the UP and DOWN arrows to select sine or square wave, and ENTER to confirm the selection. The LCD will display:

```
Set Freq = 100 Hz
Set Depth = xxx%
```

Use the arrow keys to set the desired frequency, and ENTER to confirm the setting. Then use the arrow keys to set the depth, and ENTER to confirm the setting. The instrument will apply the modulation signal, and the LCD will display the internal modulation operation screen:

```
Under Sine MOD
F: 100 Hz   D: 100%
```

OPTION 5: Set Temperature

Option 5 is not an operation mode; it allows the user to set the diode operation temperature. The temperature range is 10-40°C. On selection of option 5, the LCD will display:

```
Tset = xx.x °C
T : xxx °C
```

The top line shows the current temperature setting, while the bottom line shows the current temperature reading. Use the arrow keys to change the temperature setting in the top line, and the ENTER key to apply the setting. After ENTER is pressed, the SLD-101 will continue operation under its current operation mode, but with the new diode temperature setting. The LCD will return to the corresponding operational mode screen.
NOTE: The diode temperature setting can be changed from three points: (1) constant current mode; (2) constant power mode; (3) set temperature.

**OPTION 6: Light Source Info**

Option 6 displays the principal specifications of the SLD-101’s internal light source, as shown below:

<table>
<thead>
<tr>
<th>Type: LD</th>
<th>Imax: 90mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>λ: 1550 nm</td>
<td>Pmax: 10mW</td>
</tr>
</tbody>
</table>

The content includes: the type of light source, center wavelength, maximum drive current and maximum optical output power.

**OPTION 7: Set GPIB Address**

Option 7 allows the user to set the instrument’s GPIB address. When option 7 is selected, the LCD displays the current GPIB address information, as shown below:

GPIB ADDR: 11

Use the UP and DOWN arrow keys to change the GPIB address (range is 1-30), then press ENTER to confirm the setting.

**4.3 Front panel operation troubleshooting**

1. No light output: Make sure that the light enable key is in the “on” position.
2. Unstable light output: Make sure that the SLD-101 has been allowed to warm up for 0.5-2 minutes when first powered on, or has been allowed 0.5-2 minutes to stabilize if the operating temperature setting has been changed.
3. Optical output power lower than expected: Make sure that the output fiber connector type matches the SLD-101’s output fiber connector, and that all connectors and adapters are clean.

**4.4 Testing and Characterization:**

The SLD-101 can be serviced only by manufacturer-authorized personnel. There are no user serviceable components in this system.

The performance of the SLD-101 can be evaluated using standard power meters and spectrum analyzers.
4.5 Remote control and programming:

4.5.1 RS-232 operation

4.5.1.1 RS-232 connection

The RS-232 serial interface port allows the user to remotely control the SLD-101. Any program that supports RS-232 communication protocols can be used to send ASCII commands to the SLD-101 to remotely access the system. The accompanying LabVIEW program shows a programming example.

The RS-232 connector on the rear panel of the SLD-101 is a DB9 male connector. Use a straight connection RS-232 cable to connect the SLD-101 to the RS-232 port of a computer. To ensure proper communication, use a serial cable with direct pin-to-pin connected wires (see Fig. 4) at both ends of the cable.

![RS-232 connector pin assignment on SLD-101 back panel.](image)

4.5.1.2 Remote operation and commands

General Photonics provides a test program for remote control of the SLD-101. The control software is included with the SLD-101 package. Installation and application procedures for the control software are described later in this section.

If users write their own control programs, the following steps and commands are recommended for remote operation of the SLD-101 using the RS-232 communication port.

2. Turn the power switch on.
3. Open the correct remote port.
4. Referring to Table 1, the user can send a command string to the SLD-101 through the RS-232 port. There are many programming languages that support serial communications, including Visual Basic, LabVIEW, and C.
RS-232 command notes:
1. RS-232 port uses asynchronous framing, 8 data bits, no parity bit, and 1 stop bit.
2. RS-232 baud rate: 9600 bps.
3. Only one command is allowed in each command string.

Table 1 Remote control commands

Note: The commands and responses listed in tables 1 and 2 are the same for all communication protocols: RS-232, USB, Ethernet, and GPIB.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Response: (Command acknowledgement, error code, or requested data) All responses start with “*” and end with “#”</th>
</tr>
</thead>
<tbody>
<tr>
<td>*IDN?</td>
<td>Queries the instrument part number</td>
<td>*IDN GP-SLD-101#</td>
</tr>
<tr>
<td>*VER?</td>
<td>Queries the Firmware Version</td>
<td>*VER 2.2# (version dependent)</td>
</tr>
<tr>
<td>*ERR?</td>
<td>Status request. Returns E00 if state is OK</td>
<td>*Err# (version dependent)</td>
</tr>
<tr>
<td></td>
<td>Otherwise, returns an error code number.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(see table 2)</td>
<td></td>
</tr>
<tr>
<td>*TMP nn.f#</td>
<td>Set diode operation temperature, in °C.</td>
<td>Range for nn.f is 10.0 to 40.0°C.</td>
</tr>
<tr>
<td></td>
<td>Ex.: *TMP 25.0# set temp to 25.0°C.</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*TMP?</td>
<td>Request operation temperature</td>
<td>Ex.:*TMP 25.00#</td>
</tr>
<tr>
<td>*IND ON/OFF#</td>
<td>Enable/disable command indicators when</td>
<td>For example: When indicators are ON, response to a current request might be: *CUR 20.66#. When OFF, response is *20.66#</td>
</tr>
<tr>
<td></td>
<td>requesting data.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex.: *ADR 9#</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*ADR nn#</td>
<td>Set the GPIB address.</td>
<td>Range for nn is 1 to 30</td>
</tr>
<tr>
<td></td>
<td>Ex.:*ADR 9#</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*ADR?</td>
<td>Query the GPIB address</td>
<td>Ex.:*ADR 9#</td>
</tr>
<tr>
<td>*SIM:FRQ?</td>
<td>Request frequency of internal sine wave</td>
<td>Ex.:*FRQ 100#</td>
</tr>
<tr>
<td></td>
<td>modulation, in Hz</td>
<td></td>
</tr>
<tr>
<td>*SQM:FRQ?</td>
<td>Request frequency of internal square wave</td>
<td>Ex.:*FRQ 100#</td>
</tr>
<tr>
<td></td>
<td>modulation, in Hz</td>
<td></td>
</tr>
<tr>
<td>*SIM:DEP?</td>
<td>Request depth of internal sine wave modulation,</td>
<td>Ex.:*DEP 100#</td>
</tr>
<tr>
<td></td>
<td>in %</td>
<td></td>
</tr>
<tr>
<td>*SQM:DEP?</td>
<td>Request depth of internal square wave</td>
<td>Ex.:*DEP 100#</td>
</tr>
<tr>
<td></td>
<td>modulation, in %</td>
<td></td>
</tr>
<tr>
<td>*SIM:FRQ nnn#</td>
<td>Set Internal sine wave modulation, with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequency nnn Hz</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SIM:DEP nnn#</td>
<td>Set Internal sine wave modulation, with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequency of Internal square wave modulation</td>
<td>See table 2.</td>
</tr>
<tr>
<td></td>
<td>See table 2.</td>
<td></td>
</tr>
<tr>
<td>*SIM:DEP nnn#</td>
<td>Set Internal sine wave modulation, with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>depth of nnn%</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SQM:FRQ nn#</td>
<td>Set frequency of Internal square wave</td>
<td></td>
</tr>
<tr>
<td></td>
<td>modulation</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SQM:DEP nn#</td>
<td>Set depth of Internal square wave modulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See table 2.</td>
<td></td>
</tr>
</tbody>
</table>
**Measurement data requests and optical parameter setting**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>*POW?</td>
<td>Request output power value, using the optimal unit.</td>
<td>*POW 2.55#</td>
</tr>
<tr>
<td>*POW:UNT?</td>
<td>Request power unit: µW/mW</td>
<td>Ex.: *UNT mW#</td>
</tr>
<tr>
<td>*POW:UNT uW/mW#</td>
<td>Set power unit</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*CUR?</td>
<td>Request current value of drive current, in mA.</td>
<td><em>CUR 20.66</em></td>
</tr>
<tr>
<td>*IMA?</td>
<td>Request maximum drive current for SLD’s internal light source, in mA</td>
<td>*IMA 90#</td>
</tr>
<tr>
<td>*PMA?</td>
<td>Request maximum output power of SLD, in mW</td>
<td>*PMA 15#</td>
</tr>
<tr>
<td>*TYP?</td>
<td>Request the type of light source: SLD/LD/ASE</td>
<td>*TYP LD#</td>
</tr>
<tr>
<td>*WAV?</td>
<td>Request output light wavelength</td>
<td>*WAV 1550#</td>
</tr>
</tbody>
</table>

**Mode commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>*MOD?</td>
<td>Request current operation mode</td>
<td>Ex.: *MOD CCM# (CCM/CPM/EXM/SIM/SQM)</td>
</tr>
<tr>
<td>*CCM nn.ff#</td>
<td>For constant current mode, set current to nn.ffmA</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*CPM nn.ff#</td>
<td>For constant power mode, set power to nn.ffmW</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*EXM#</td>
<td>For constant power mode, set power to nn.ffmW</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SIM:ENA ON#</td>
<td>Start the internal sine modulation process</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SIM:ENA OFF#</td>
<td>Stop the internal sine modulation process</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SQM:ENA ON#</td>
<td>Start the internal square modulation process</td>
<td>See table 2.</td>
</tr>
<tr>
<td>*SQM:ENA OFF#</td>
<td>Stop the internal square modulation process</td>
<td>See table 2.</td>
</tr>
</tbody>
</table>

**Table 2 Command Response Codes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E00</td>
<td>No error (Correct command received)</td>
</tr>
<tr>
<td>E01</td>
<td>Undefined Command</td>
</tr>
<tr>
<td>E02</td>
<td>Missing parameter</td>
</tr>
<tr>
<td>E03</td>
<td>Invalid syntax in command string</td>
</tr>
<tr>
<td>E04</td>
<td>String of characters too long (&gt;buffer limit)</td>
</tr>
<tr>
<td>E05</td>
<td>Parameter has too many digits after the decimal point</td>
</tr>
<tr>
<td>E06</td>
<td>Parameter outside the allowed range</td>
</tr>
</tbody>
</table>
4.5.1.3 RS-232 troubleshooting

If a problem occurs during RS-232 control, please check the following:

1. Cable should be straight-wired: Select a straight-wired (pin-to-to pin wired) cable;
2. Verify active Comm Port (COM1, COM2, etc.);
3. Verify Comm Port settings: 8 data bits, 1 stop bit, no parity bits;
4. Check baud rate: must be 9600 bps;
5. Check commands: command should begin with “*” and end with “#” or “?”.

4.5.2 USB control

Connect the instrument to the control computer using the provided USB cable.

4.5.2.1 Procedure for Installing USB VCP driver

1. Copy VCP driver from CD-ROM to your computer.
2. Turn on power supply and plug in USB cable; this should bring up the “Found New Hardware Wizard”:

   ![Found New Hardware Wizard]

   Welcome to the Found New Hardware Wizard

   This wizard helps you install a device driver for a hardware device.

   To continue, click Next.

3. Click “Next”:
4. Click “Next”:

5. Check “Specify a location”, then click “Next”: 
6. Use “Browse” to locate the file directory where the VCP driver is. Click “OK” to proceed to the next screen:

7. Click “Next”: 
8. Click “Finish”. This completes the first part of the installation, during which the USB to serial converter is installed. The second part consists of the installation of the serial port driver. This should follow automatically once the converter installation is completed:
9. Click “Next”:

10. Click “Next”: 
11. Use “Browse” to locate the file directory where the VCP driver is. Click “OK” to proceed to the next screen:

12. Click “Next”: 
13. Click “Finish”.

Depending on the system software and the location of the driver, the sequence of screens between the “found new hardware” screen and the “completion” screen may be slightly different, but in all cases, the result will be the installation first of the USB serial converter and then the USB serial port.

Once the installation of the serial port driver has been completed, confirm that the installation has been successful by looking under “Device Manager” on the “System Properties” screen: select Control Panel → System Properties → Hardware → Device Manager, then Select View → Device by type. The resulting screens are shown below. The device should have installed as a USB Serial Port (COMx) attached to USB High Speed Serial Converter. Note the port number that the device is using; it will need to be entered in the control program.

The USB driver can drive more than one instrument, but the correct port number must be set in the control programs for each of the instruments.
In this example, the USB device is connected to COM3.
4.5.2.2. VCP Uninstall Procedure:

Unplug device. Run “Add/Remove Programs” from Control Panel:
4.5.2.3. SLD-101 USB Commands

Control programs are provided on the accompanying CD. The user interfaces are universal for RS-232, GPIB and USB. (Ethernet control uses separate programs- see section 4.5.4.) For users who prefer to write their own control programs, the command list (table 1 in section 4.5.1.2) is universal for RS-232, Ethernet, GPIB and USB.

4.5.2.4. USB Troubleshooting:

Sometimes, for unknown reasons, the USB Serial Port cannot be found in Device Manager. To troubleshoot this issue, run “Add/Remove Programs” from the Control Panel, click FTDI USB Serial Converter Drivers, and then click the Change/Remove button. A warning window will tell you that you have to unplug the USB cable if you want to remove the drives. Unplug USB cable, then press “Continue” button. Restore computer, then run VCP installation procedure again.
4.5.3 LabVIEW control programs

LabView control programs are provided for computer control of the SLD-101 through different control interfaces. Before running these programs, the user should determine whether the LabView developing environment is installed in the control computer. If the LabView environment (version 8.2 or above) is present, either the source code (vi) or the executable versions of the remote control programs can be used without installing further drivers. To control the SLD-101 through the USB port, the USB drivers need to be installed (see section 4.5.2)

Note: For simple control of the instrument, it is often easier to use the executable versions of the program than the source code. However, the executable versions will not run properly while LabView is running. If using the executable versions of the program on a computer with LabView installed, the user should quit LabView before running them.

If LabVIEW is not installed on the control computer, the user should set up the LabVIEW Run-Time engine by running the programs under “\LVRunTimeEng_8.2” (on the CD-ROM), and install the driver program for VISA (used for RS-232, distributed by National Instruments) by running the program named “Visa400runtime.exe” (under the root directory). To use the USB programs, the USB drivers also need to be installed (see section 4.5.2). For further details on Ethernet and GPIB control, see sections 4.5.4 and 4.5.5, respectively. Once the necessary drivers and other setup parameters are in place, the executable programs in the application directory can be run.

After the necessary drivers are installed, the programs (executable and/or source code) should be copied to the hard drive and run from there.
Several LabView control programs are provided. To locate a particular program:

A. Under “LabView_SourceCode” directory:
   - SLD_REMOTE.vi – Source code for SLD control program for RS-232, USB, or GPIB;
   - SLD ETHERNET.vi – Source code for SLD control program for ETHERNET (see section 4.5.4)
   - GP_SET ETHERNET.vi – Source code for ETHERNET setup (see section 4.5.4)
   - GP_GPIB_ADDRESS.vi – Source code for querying/changing GPIB address (see section 4.5.5)

B. Under “LabView_Application” directory
   - Executable programs with the same names and functions as those contained in the “LabView_SourceCode” folder.

Note: Always close the control program (and LabView as well if using the VI version of the control program) before turning off the instrument.

The control programs “SLD_REMOTE.vi” (source code) or “SLD_REMOTE.exe” (executable) are compatible with RS-232, USB and GPIB interfaces. The program will auto-sense which interface is being used and display the appropriate port configuration option. The control program interface is otherwise identical for RS-232, USB and GPIB control.

**Constant Current Mode**

![Figure 5 Constant Current Mode](image-url)
Before the SLD-101 can be remote-controlled, the port configuration must be set. Make sure that the program is stopped (stop sign for source code version or “STOP Program” button for executable program) before setting port number.

Port: Displays the selected port for the RS-232, USB or GPIB connection. If the selected port and the actual connection do not match, the program will not function correctly. Set the correct port number here. The port number can be determined from the Device Manager (see section 4.5.2) or from the Measurement & Automation program from National Instruments. Note that the port number cannot be set while the program is executing (trying to make a measurement). Stop the program first and choose the correct port if necessary.

Notes: (a) ASRL1:INSTR is the same as COM1 for RS-232.
    (b) GPIB:XX:INSTR means the GPIB port with an address of XX.

The constant current mode screen allows the user to set the drive current value to be maintained by typing it in the box and then clicking “OK”. The “STOP” button stops this process.

**Constant Power Mode**

The constant power mode control screen is shown below:

![Constant Power Mode Screen](image)

Figure 6 Constant Power Mode

The constant power mode screen allows the user to set the output optical power value to be maintained by typing it in the box and then clicking “OK”. The “STOP” button stops this process.
External Modulation

This screen is used to set the SLD-101 to external modulation mode. Connect the external modulation signal to the BNC connector on the front panel of the instrument. (The external signal can have a frequency between 0 and 100 KHz, with a voltage range of 0~2V, and a voltage offset range of 1~2V.) Then click the “START” button to enable external modulation.

The “STOP” button disables external modulation.
Internal Modulation

This screen is used to apply an internally generated modulation signal to the SLD-101’s optical output. Select the desired waveform (sine or square) from the pull-down menu on the left side of the screen. Then click the “START” button to enable modulation.

To change the frequency or depth of the modulation signal, either type the desired value into the box or use the wheel to set the value, then click “set” to send the information to the instrument.

The “STOP” button stops this process.
Diode Temperature

This screen is used to set the diode operation temperature. The range is 10-40°C. Either type the desired value in the box or use the up and down arrows to set the value, then click “OK” to send the information to the instrument.

The thermometer scale on the right side of the screen shows the actual temperature in real time.

Figure 9. Diode temperature setting screen
Light Source Information

This screen displays the principal specifications of the internal light source for a specific SLD-101 unit. The parameters displayed are light source type, center wavelength, maximum drive current, and maximum optical power output.

4.5.4 Ethernet control

The SLD-101 includes a small server. The following steps describe how to use it.

1. Connect Instrument
   There are two connection configurations for Ethernet control:

   a) Connect the instrument directly to the PC, as shown in figure 11.
   b) Connect the instrument with a DHCP server (router or exchange server), as shown in figure 12.
2. There are two ways of assigning the instrument an IP address:

   a) Static IP: the administrator assigns the instrument a fixed IP address.
   b) Dynamic IP: the DHCP server assigns the instrument an available address when requested.

3. Set Ethernet configuration and get IP address:
   Open the LabVIEW program \textit{(GP\_SET\_ETHERNET.vi or GP\_SET\_ETHERNET.exe)} to set the Ethernet configuration.

   \textbf{NOTE: This program was designed for an RS-232 interface, so the instrument should be connected to the computer via RS-232 before running it. Please see the instructions at the beginning of section 4.5.3 for preparations to run an RS-232 LabView program. The program interface is shown below.}

   a) To use a static IP configuration, click the “fixed IP mode” tab, as shown in figure 13. Set the 5 parameters shown in figure 14. They can be obtained from your network administrator. The default values are those shown in Fig. 15. Once the parameters are set, click the “Set” button to confirm.
b) To use dynamic IP address assignment, click the “DHCP MODE” tab, as shown in figure 14. Click the “OK” button to confirm. Note: this is the default mode.
After IP address configuration, select the “GET IP ADDRESS” tab to determine the IP address of the instrument, as shown in figure 16. Write down the IP address; it will be needed to access the SLD-101’s server.

![GP ETHERNET SETUP](image)

Figure 15 Get IP Address

4. Ethernet control of the SLD-101:
Open the LabVIEW program (*SLD_ETHERNET.vi or SLD_ETHERNET.exe, see section 4.5.3*) to control the instrument. The program interface is shown in figure 16. Input the IP address obtained in the previous step (see Fig. 15). If the *GP-SET-ETHERNET.vi* program’s static IP configuration was used, the Port number is the one set from that screen (see Fig. 13). The default value is 23.
From this point, the program interface is very similar to the RS-232, USB, and GPIB versions of the control program, with the same “CONSTANT CURRENT MODE”, “CONSTANT POWER MODE”, “EXT MODULATION”, “INT MODULATION”, “SET TEMPERATURE”, and “LIGHT SOURCE INFO” tabs. See section 4.5.3 for a more detailed description of the control program interface, some parameters are added for references though.

### 4.5.5 GPIB control

#### Setting the GPIB address

To set or find the GPIB address of SLD-101:

1) Front panel: Press the MODE button and select option 7. The LCD will display the current GPIB address;
2) Use arrow keys and ENTER key to change the GPIB address.

Note: The SLD-101’s GPIB address is stored in nonvolatile memory, so when the instrument is powered down and then powered up again, the active GPIB address will be the last one set.
Alternatively, the GPIB address can be changed by remote control either by sending individual control commands through one of the control interfaces (table 1 in section 4.5.1) or by using the LabView programs “GP_GPIB_ADDRESS.vi” or “GP_GPIB_ADDRESS.exe” to read or set the GPIB address through the RS-232 or USB port, as shown in figure 17.

![GPIB ADDRESS SETTING](image)

Figure 17 Retrieve or change the GPIB address via LabView program

**GPIB Control**

Connect the instrument to the computer with a GPIB cable. After determining/setting the SLD-101’s GPIB address, select the corresponding port number in the corresponding box of the LabView control program (see section 4.5.3) and run the control program.

In addition to using the provided control programs, individual commands can be sent through the GPIB port. Enter the GPIB address in the communication program being used. The instrument will then be ready to receive commands. The command list is given in Table 1 at the beginning of section 4.5.1.

To ensure proper communication, use a GPIB cable that is fully compatible with the IEEE 488.1 standard. All GPIB/IEEE 488 interface connections must be made before turning on the instruments.
Section 5. Technical Support

General Photonics is committed to high quality standards and customer satisfaction. For any questions regarding the quality and use of the SLD-101, or future suggestions, please contact General Photonics Corporation at (909)-590-5473 (telephone) or (909)-902-5536 (fax), or by e-mail at info@generalphotonics.com. General Photonics will respond to all customer questions within 24 hours during regular business hours. General Photonics can also be contacted by mail at:

General Photonics
5228 Edison Avenue
Chino, California 91710
USA