

THORLABS

S7FC/S9FC Series Single-Channel Semiconductor and Booster Optical Amplifiers

Operating Manual



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Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.



SHOCK WARNING



High voltage inside. To avoid electrical shock, before powering unit, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock resulting in severe injury or even death. Do not operate without cover installed.



WARNING



This unit must not be operated in explosive environment.



WARNING



Avoid Exposure – Radiation Emitted from apertures.

The unit is supplied with a 115 V parallel blade line cord for North American use only. For all other applications use an IEC 320 compatible line cord fitted with a plug appropriate for your particular AC wall socket.

Make sure that the line voltage rating marked on the rear panel agrees with your local supply and that the appropriate fuses are installed. Changing of the mains fuse can be done by the user (see Setting the AC Line Voltage and Installing Fuses). With the exception of the mains fuses, there are no user serviceable parts in this product.

Do not operate in wet or damp conditions. Do not obstruct the air-ventilation slots in the housing!

This device can only be returned when packed into the complete original packaging, including all foam packing inserts. If necessary, ask for a replacement package.

Mobile telephones, cellular phones or other radio transmitters should not to be used within the range of three meters of this unit since the electromagnetic field intensity may exceed the maximum allowed disturbance values according to EN50082-1.

Chapter 3 Description

3.1. Optical Amplifiers

Semiconductor Optical Amplifiers (SOAs and BOAs) are similar in design to Fabry-Perot Laser Diodes. The difference between Fabry-Perot laser diodes and the SOA's and BOA's is that Fabry-Perot laser diodes have reflective coatings or mirrors on both end faces of the semiconductor chip, those mirrors are essential to create the light conditions for lasing to occur. While, SOAs and BOAs have an anti-reflection (AR) coatings or mirrors on both end faces of the semiconductor chip. The AR coatings limit the optical reflection into the chip so that lasing does not occur.

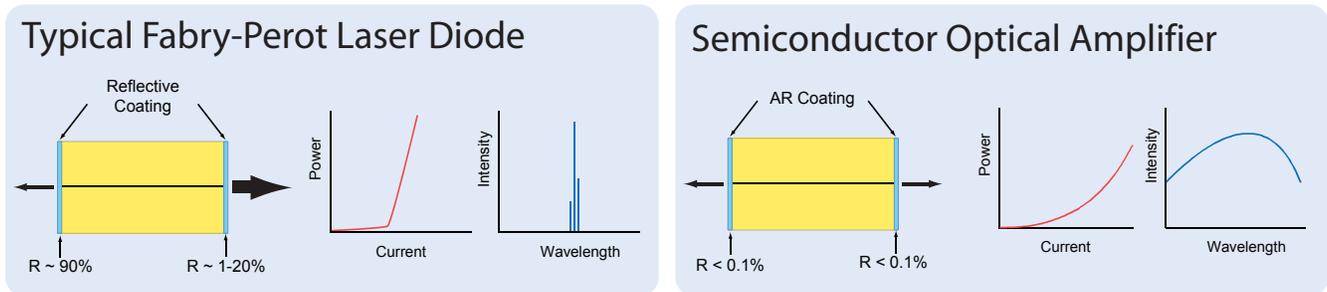


Figure 1 Fabry-Perot laser diode compared to SOA.

As is typical for all amplifiers, SOA/BOAs operate in two regimes: a linear, flat, constant gain regime and a non-linear, saturated output regime. When used to amplify a modulated signal, the linear regime is typically used to eliminate pattern-dependent distortion, multi-channel cross-talk and transient response issues common to EDFAs. The non-linear regime is used to take advantage of the highly non-linear attributes of the semiconductor gain medium (cross-gain modulation, cross phase modulation) to perform wavelength conversion, optical 3R regeneration, header recognition, and other high-speed optical signal processing functions.

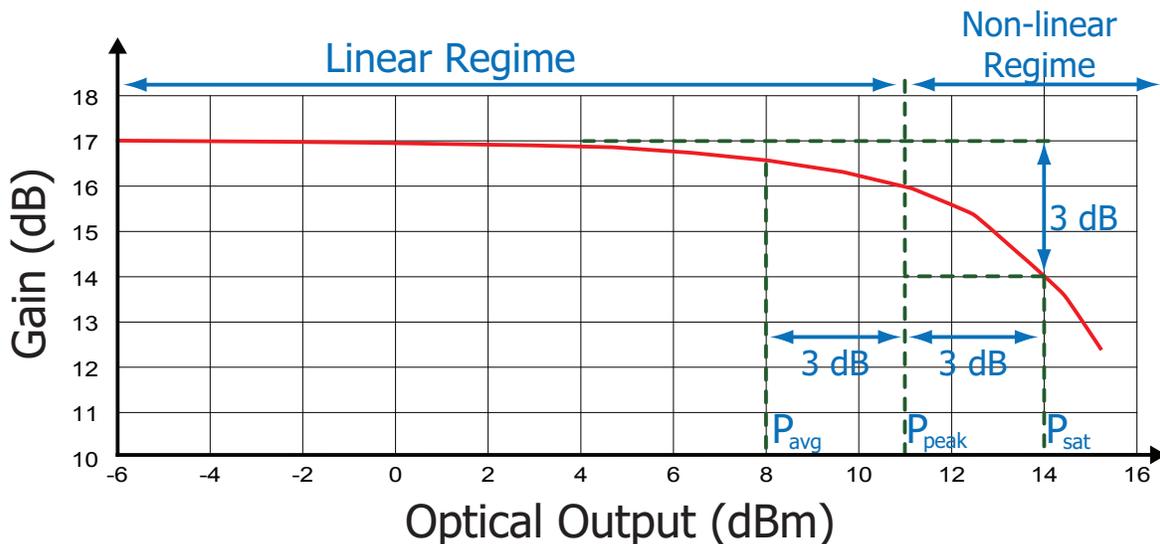


Figure 2 Chart showing linear and non-linear regions of SOA output.

For a CW input signal, the amount of power that can be produced by the amplifier is determined by the saturation output power (P_{sat}) parameter. P_{sat} is defined as the output power at which the small-signal gain has been compressed by 3 dB. The maximum amount of CW power that can be extracted is approximately 3 dB higher than the saturation power.

BOAs and SOAs are single-pass, traveling-wave amplifiers that perform well with both monochromatic and multi-wavelength signals. Since BOAs only amplify one state of polarization, they are best suited for applications where the input polarization of the light is known. For applications where the input polarization is unknown or fluctuates, a Semiconductor Optical Amplifier (SOA) is required. However, the gain, noise, bandwidth, and saturation power specifications of a BOA are superior to that of a SOA because of the design features that make the SOA polarization insensitive.

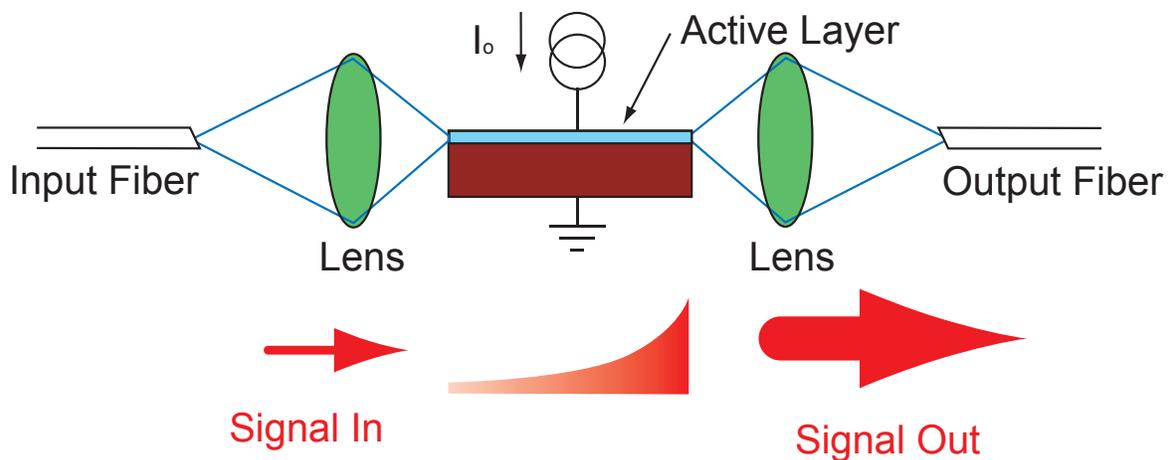


Figure 3 Internal diagram of optical amplifier chip.

3.2. S7FC Series SOA

The Semiconductor Optical Amplifier (SOA) is a polarization insensitive optical amplifier; therefore, all polarization states are amplified. These devices are an ideal in-line amplifier. C-Band SOAs are available in a standard 14-pin butterfly package with SMF pigtailed that are terminated with FC/APC connectors. Advanced epitaxial wafer growth and opto-electronic packaging techniques enable a high output saturation power, low noise figure, and large gain across a broad spectral bandwidth. These devices come in an industry-standard 14-pin butterfly package with either single mode fiber or polarization maintaining pigtailed. These come without isolators, but we are able to provide units with polarization-insensitive isolators at the input, output, or both.

3.3. S9FC Series BOA

The BOA consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure. As seen in the schematic above, the input and output of the amplifier is coupled to the reliable ridge waveguide on the optical amplifier chip. C-Band BOAs are available in a standard 14-pin butterfly package with either SMF or PMF pigtailed that are terminated with FC/APC connectors. Optional polarization-maintaining isolators at the input, output or both input/output are also available, but please contact Tech Support for help in ordering such a device. We also offer BOAs that have been hand-picked and determined to have superior specifications to the design specifications of the device. These premium devices are known as our XL series. While the normal product line is specified with typical values, the XL line is specified with minimum values. These devices typically feature larger bandwidths and greater gain. Alternatively, an unpackaged C-Band BOA chip is available on a submount or heat sink.

3.4. S7FC/S9FC Description

The Thorlabs Semiconductor Optical Amplifier (S7FC/S9FC) provides easy coupling and simple control of Polarization Insensitive (SOA) and Polarization Maintaining (BOA) devices. Each system is equipped with a dual fiber input and output amplifier connection available in standard TQE 1050 to 1625 nm wavelengths. Please visit our website for a full list of currently available options.

The SOA/BOA operates from an independent, high precision, low-noise, constant-current source and temperature control unit. An intuitive LCD interface allows the user to view and set the parameters for the SOA/BOA. The user can adjust the SOA/BOA current and temperature control independently. The display indicates the part number, output wavelength of the amplifier and the actual temperature the SOA/BOA is set to.

This device includes a microcontroller to fully control the SOA/BOA's optical power, temperature, and monitor the system for fault conditions. The S7FC/S9FC source includes a USB connection that allows remote adjustment of power, temperature, and enabling. On the rear panel, an analog input is available to modulate the SOA/BOA with an external signal. This is added to the internal set point. To prevent damage, the microcontroller will disable the output if the analog input plus the internal set point exceeds the SOA/BOA limits.

For added safety, the system was fully designed to meet 3B laser class requirements. There is an interlock located on the rear panel that must be shorted in order for any SOA/BOA output to be enabled. This can easily be configured to be triggered by doors to disable the SOA/BOA in unsafe conditions. The power switch is a key-lock system to prevent accidental or unwanted use. An enable button must be set to activate the unit with a green LED indicator to easily determine its current state. There is a 3-second delay before the SOA/BOA turns on, and the user is warned by the rapidly blinking LED.

The S7FC/S9FC includes a universal power supply allowing operation over 100 to 240 VAC without the need for selecting the line voltage. The fuse access is conveniently located on the rear panel. This unit is supplied with a US line cord as well as a standard European line cord.

Chapter 4 Setup

4.1. Setting the AC Line Voltage and Installing Fuses

Your S7FC/S9FC Series SOA/BOA amplifier has been shipped from Thorlabs configured for 100 to 240 VAC operation. There is no line switch adjustment to be made. However it may be necessary to replace an open fuse. To do this you must perform the following procedure.

- Remove the AC power cord if it is connected to the unit.
- Locate the fuse tray directly below the AC power cord connection on the rear panel of the unit.
- Carefully use a flat blade screwdriver to open the fuse tray.
- Remove the existing fuse and install the appropriate 500 mA fuse. The replacement fuse must be a 5 mm x 20 mm, 250 VAC Type T Fuses (IEC 60127-2/III, low breaking capacity, slow blow)
- Push the fuse tray back into place making sure that it snaps and seats correctly.
- Connect the appropriate power cord into the AC receptacle and plug the unit in.

4.2. Initial Set-up

- Locate the unit on a dry, level working surface.
- Make sure the POWER key switch on the front of the unit is in the OFF position (key perpendicular to working surface).
- Plug the female end of the AC line cord provided into the AC Input Receptacle on the rear of the unit. Plug the male end into a properly grounded AC socket.
- Install the interlock “shorting device” into the interlock connector located on the rear panel. This is installed from the factory. See page 11 for details.
- Connect a FC/APC Fiber Optic cable light source to the SOA/BOA APERTURE IN and a Fiber Optic cable to the SOA/BOA APERTURE OUT on the front panel of the unit.

Chapter 5 Operation

5.1. Front and Back Panel Overview

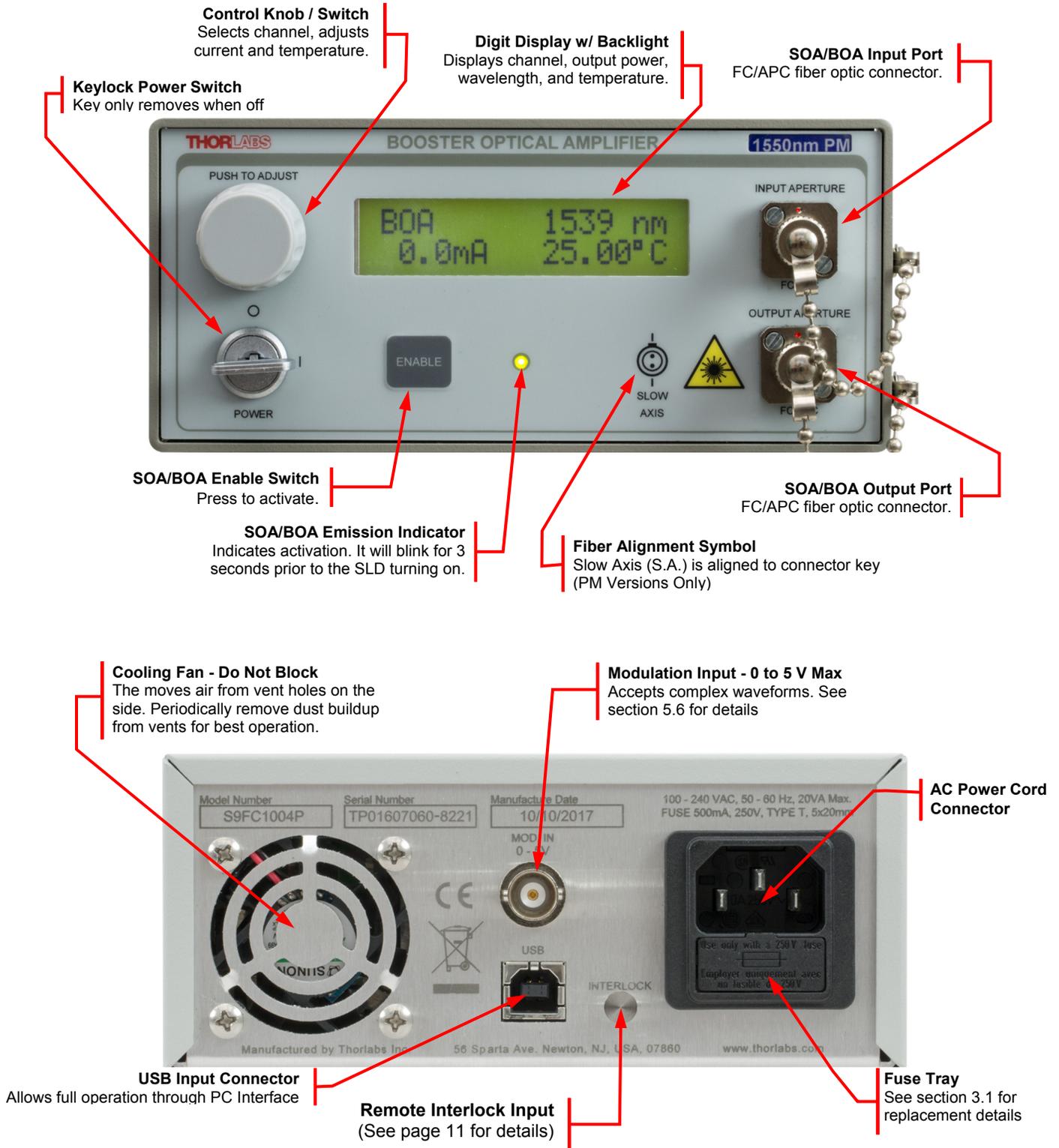


Figure 4 Front and Rear Panels SOA and BOA Sources

5.2. Turning On the Amplifier

- Turn the POWER key switch clockwise. The LCD display will scroll “Thorlabs” across the screen, followed by the software revision number.
- Make sure the Interlock Input is short-circuited; see page 11 for detailed instructions.
- Press and release the ENABLE switch to activate the SOA/BOA. There will be an approximately 3 second delay before the SOA/BOA powers up. During this time the ENABLE indicator will light up and blink rapidly.
- Thermo-electric cooler readings will be activated when the unit turns on. Allow one to two minutes for the temperature to settle.

5.3. Viewing Information

The S7FC/S9FC uses a single four quadrant LCD to display and access information. At any time, display variables can be adjusted by simply rotating the control knob located to the left of the display. The following information will be available:

- Top left – Indicates device type. (BOA or SOA)
- Top Right – Indicates the wavelength of the SOA/BOA internal to the S7FC/S9FC. This is set at the factory when the (SOA/BOA)s are installed.
- Bottom Left – Indicates the operating current level of the SOA/BOA in (mA).
- Bottom Right – Indicates the actual temperature the SOA, or BOA, is stabilized to and is displayed in °C. The system defaults to a temperature of 25.00 °C until changed by the user. The temperature control is always active and may require 5 to 10 minutes to fully stabilize.

5.4. Adjusting the SOA/BOA Output Power & Temperature

Note: The adjustment knob utilizes an intelligent speed control. Adjusting the knob slowly will increment values at the maximum resolution while adjusting fast will make larger movements. This allows both a fine and course control.

Note: The SLD threshold current is a user settable command parameter. It is included to allow certain users the ability to filter out the non-linear sections of the SOA/BOA power curve. The threshold current is defaulted to 1mA on initial power up. Threshold current for a SOA/BOA is not the same as the threshold current of a laser diode since the SOA/BOA does not have a true threshold point. Operating the SOA/BOA as an optical switch will require operating in the standby mode with the analog input switching from 0V to the desired gain voltage.

- The bottom left location will start blinking when the control knob is pressed. Adjust the control knob until the desired current is achieved. The current/power will adjust real-time. The first time default setting will be current full off. Adjusting the knob clockwise will immediately set the current to the SOA threshold and then incrementally to the max operating current. Adjusting the knob counter clockwise will incrementally decrease the signal until it hits the threshold, and then immediately to SOA off. On power down, the current setting will be remembered.
- Note that there is a timeout on the display, after which the display will revert back to the viewing mode. This is to prevent accidental adjustment of the power.

- Press the knob again to switch to temperature adjustment. The set point temperature will be displayed and will be blinking; for example, 25.00 °C. Adjust the control knob to increase or decrease the temperature set point. The temperature default is 25.00 °C but can be adjusted over a range of 20.00 to 30.00 °C with a resolution of 0.01 °C.
- Note, as above there is a timeout where the display will revert to the viewing display and lock out adjustment to the temperature.
- Pressing the control knob again will exit the adjustment mode and revert back to the viewing mode, locking in the selected parameters. This can also be achieved by allowing the display to time out at any point in the process. Depending on the magnitude of the change in temperature set point, it will take anywhere from a few seconds to a few minutes for the system to settle into the new operating temperature.

5.5. Turning the SOA/BOA Off

- **Standby Mode** – By adjusting the control knob fully counter clockwise the current/power will adjust down to the threshold current and then to off, or standby mode. The threshold current is a user settable point at which the internal SOA/BOA diode can be set to operate within a desirable range. For convenience the system is set up to adjust from the threshold to the max current. In addition, when adjusting below the threshold, the current will be set to almost 0 mA. Since the system utilizes a constant current control, there will always be a minimum current to maintain the current control loop. The output emission is typically very low, or nonexistent. The SOA/BOA is still enabled and operating at the minimum possible current. This can be useful while using the external modulation. The full 5 V can be applied without compensating for the internal set point. However, the external signal will need to provide a DC offset to bias the SOA/BOA above the threshold current for best results. Input signals will see clipping on their lower edges below threshold.
- **Disable/Enable Mode** - The SOA output should be turned off by pressing and releasing the ENABLE switch. The SOA temperature will be maintained even when the SOA is disabled.
- **Power Down** - When completely powering down an enabled unit, first press and release the ENABLE switch and then turn the POWER key switch counterclockwise, which will turn OFF the entire unit. Anytime the unit is turned OFF and then turned back ON, the SOA will be disabled until the ENABLE switch is pressed.

5.6. Modulating the SOA Output

The MOD IN input can be used to modulate the SOA/BOA output, or set the SOA/BOA output remotely using a 5 V power source. The 5 V maximum inputs correspond to the maximum calibrated power, which operate using a constant current drive technique. The resulting actual output power is dependent on the set current and operating temperature. In addition, in order to eliminate a dead zone in the power control knob, the output of the unit is offset to the threshold current of the coupled SOA/BOA amplifier. Adjusting the knob below threshold will immediately set the current to almost 0 mA, or Standby mode as described in section 4.5. Therefore, there are two modes of modulation available. First setting the control to “Standby” allows the analog modulation to utilize the full 0 to 5 V input range. The drawback is that a minimum voltage will be required to operate above the threshold current but allows more flexibility by the user. The second mode is to adjust the control knob so that the SOA is at threshold or above. The analog modulation voltage will be limited to less than 5 V, but a DC offset will not be required. This should be kept in mind when using the modulation input since it will limit the actual input voltage range.

- Connect a signal generator or 0 to 5 V power source to the unit using a BNC type connector.
- Connect a complimentary FC/APC Fiber Optic light source to the SOA/BOA APERTURE IN of the unit.
- Set the PWR ADJ knob on the front panel to its full counter clockwise setting for standby mode, or increase slightly to the threshold current mode.
- Press the ENABLE switch to turn on the SOA, wait for the safety delay to time out.
- **For Threshold Offset** - Apply the appropriate signal to the MOD IN input. If too much voltage is applied internal current limiting will prevent damage to the SOA/BOA and the device will be immediately disabled. If an internal threshold is set the acceptable drive voltage range will be less than 5V. To calibrate your input apply a DC voltage to the MOD IN and slowly increase until the system disables. This will be the max voltage allowable.
- **For Standby Operation** – Apply an appropriate signal between 0 and 5 V to the MOD IN input. Determine the DC offset by increasing the voltage slowly until a large power jump is seen on the output. An easier method is to apply a 1 Vpp sinusoid and adjust the DC offset until the sinusoid appears and then the bottom edge is no longer clipping. This method requires applying the SOA output to a photodetector and monitoring with an oscilloscope. Next maximize the amplitude so that the peak is 5V or less as desired.

Chapter 6 Making the Safety Interlock Connections

The S5FC series SLD sources are equipped with a remote interlock connector located on the rear panel, see Figure 2. All units have this feature regardless of their FDA and IEC classifications. In order to enable the S5FC source, a short circuit must be applied across the terminals of the Remote Interlock connector. In practice this connection is made available to allow the user to connect a remote actuated switch to the connector (i.e. an open door indicator). The switch (which must be normally open) has to be closed in order for the unit to be enabled. Once the switch is in an open state the S5FC source will automatically shut down. If the switch returns to a closed condition the S5FC source must be re-enabled at the unit by pressing the ENABLE switch.

All units shipped from Thorlabs are configured with a shorting device installed in the Interlock connector. If you are not going to use this feature then you can leave the shorting device installed and the unit will operate normally as described in the procedures above.

If you wish to make use of the Interlock feature you will need to acquire the appropriate connector mate and wire it to your remote interlock switch. Next, remove the shorting device by pulling it out with a pair of needle nose pliers and install the connector into the interlock input.

The interlock input only accepts a 2.5 mm mono phono jack. This connector is readily available at most electronics stores.

The electrical specifications for the interlock input are shown in the following table.

Specification	Value
Type of Mating Connector	2.5 mm Mono Phono Jack
Open Circuit Voltage	Internal Pull Up to 5 VDC
Short Circuit Current	10.0 mA DC
Interlock Switch Requirements	Must be N.O. Dry Contacts Under no circumstances should any external voltages be applied to the Interlock input

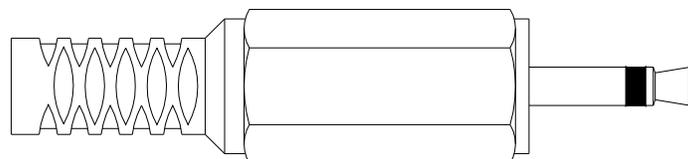


Figure 5 Remote Interlock Connector

Chapter 7 Remote Communications

7.1. Installing the USB Drivers

Prior to running the command line interface, the USB drivers must be installed. The S7FC/S9FC must not be connected to the PC while installing the drivers. Insert the CD that was supplied with your unit into your PC. From the dialog box that is displayed, select the Install Drivers button. If the dialog box is not displayed, browse to the CD and run CD_Started.exe. Follow the onscreen prompts to install the driver. After the driver is installed, attach the S7FC/S9FC to the PC and power it on. Your PC will then detect the new hardware and will prompt you when the installation is complete.

7.2. Command Line Interface

Once the USB drivers have been installed, the unit connected to the PC, and the power turned on, configure the terminal emulator as follows:

- Baud Rate = 115.2 KBits Per Second
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = None

If the connection is correct you will see the following after pressing the “Enter” key.

```
Command error CMD_NOT_DEFINED
```

Followed immediately by the prompt:

```
>
```

The basic structure of the interface is a keyword followed by either an equals sign “=” or a question mark “?”. The “=” or “?” will determine if the string is a command or a query. All strings (commands and queries) must be terminated by a carriage return (CR) or pressing the ENTER key on the computer.

The command structure is as follows:

```
Keyword = argument (CR)
```

Where “keyword” defines the function and “argument” is a numerical value followed by a carriage return (CR). See listing below.

The query structure is as follows:

```
Keyword? (CR)
```

The “keyword” defines the function and the question mark (?) indicates a query. The string is terminated with a carriage return (CR). See listing below.

There are a few exceptions to this which are noted below, also noted are unique shortcut keys.

The prompt symbol “>” will appear on power up and after a command is accepted by the system indicating it is ready to receive another command line.

7.3. Keywords (Commands and Queries)

The following list shows all of the available commands and queries, and summarizes their functions:

Command	Syntax*	Description
Get Commands	?	List the available commands
Get ID	id?	Returns the model number and firmware version.
Get Target Temp	target?	Returns the set temperature (°C).
Set Temp	target= <i>n</i>	Sets the set temperature (<i>n</i>) (°C).
Get Actual Temp	temp?	Returns the actual temperature (°C).
Get Power	power?	Returns the power (mW)
Get Current	current?	Returns the current.
Set current	current= <i>n</i>	Sets the current (<i>n</i>).
Get Enable	enable?	Returns the current state of the Enable button.
Set Enable	enable= <i>n</i>	Sets the state of the Enable button (0: disabled, 1: enabled).
Get Step	step?	Returns the increment used to adjust the temperature and current when the arrow keys are pressed.
Set Step	step= <i>n</i>	Sets the increment (<i>n</i>) used to adjust the temperature and current when the arrow keys are pressed.
Get Specs	specs?	Returns the specifications.
* All commands and queries are in lower case letters.		

If the keyword, format, or argument is incorrect or out of range, the unit will return an error string. The function is determined by the value set with the mode command in the above table.

In addition to the above commands there is also special functionality added to the arrow keys of the computer’s keyboard.

- Up Arrow Key – Increments the current by *n*.
- Down Arrow Key – Decrements the current by *n*.
- Right Arrow Key – Increments the temperature by *n*.
- Left Arrow Key – Decrements the Temperature by *n*.

Where *n* is set by the command “Set Step”.

Chapter 8 Troubleshooting

The following table describes some typical problems that may be encountered while using the S7FC/S9FC and possible solutions to these problems.

Problem	Solution
Unit does not turn on when switching the power switch to the ON position.	<ol style="list-style-type: none"> 1. Make sure AC line cord is fully inserted into the AC Input receptacle and plugged into an outlet providing 100 to 240 VAC. 2. Fuse(s) may be open. Refer to Page 6 for information on replacing open fuses. If the problem persists, please return the unit to Thorlabs for evaluation.
Unit does not enable the Source when pressing the ENABLE keypad.	<ol style="list-style-type: none"> 1. Make sure that the AC Line Cord is properly plugged in and Key Switch is turned to "ON" position. 2. Check to make sure the interlock "shorting device" is installed on the rear panel. See Page 11 for details.
Unit is enabled but there is no Output.	<ol style="list-style-type: none"> 1. Check to make sure you are using the correct type of Fiber Patch Cord for the particular wavelength. 2. Disconnect the Fiber Patch Cord and check to see if there is Light Output from the FC/APC Connector. Caution: Do Not Directly Look into the Fiber Key Slot. Use a Viewing Card to safely determine Light output.
Unit is enabled but there is no Output. (Analog Modulation)	<ol style="list-style-type: none"> 1. Check the output of the modulating source and confirm the Output is "On". 2. If using Analog Modulation make sure the S7FC/S9FC is not operating in the dead zone. One may need to operate above the Threshold Current to see output. For further details refer to Page 10. For information regarding Threshold Current Limits refer to SOA/BOA documentation provided with the unit.
I can't connect to the S7FC/S9FC over the USB com port.	<ol style="list-style-type: none"> 1. Make sure that the com port is configured correctly for the unit. Refer to page 11 for the correct com port settings. 2. The incorrect com port is selected on your terminal program or S5FC application. 3. USB driver was not installed. See Page 12.

Chapter 9 General Maintenance

Aside from the AC input fuse, there are no user serviceable parts in this product. If you suspect something has failed on the unit, please contact your local Thorlabs Technical Support Office for advice on returning the unit for evaluation.

9.1. Cleaning

The outside surface of the unit can be cleaned using a soft, slightly damp cloth. Avoid using any solvents on or near the unit.

9.2. Connector Cleaning

It is necessary to clean the fiber patch cable and the connector tip inside the bulkhead connector every time you make the connection for both safety reasons and fiber care. Failure to do so may result in a damaged fiber connector on your user provided patch cord, the internal fiber connector, or both by burning the fiber end faces if the contaminants are over the fiber core.



WARNING



DO NOT connect a fiber patch cord to the laser's FC/PC bulkhead connector without cleaning the fiber tips first. DO NOT connect a fiber patch cord to the unit while the laser is enabled. Failure to follow these precautions may result in permanent damage to the unit.

Thorlabs recommends using our FCC-7020 (pictured below) to clean the fiber tip of your FC/PC patch cord. To clean your connector:

1. Open the door on top of the FCC-7020
2. Pull the white tape out until the perforations clear the window
3. Place the tip of the connector flat against the white tape on either the right or left side – it does not matter.
4. Drag the connector down the white tap front
5. Then repeat steps 3 – 4 on the opposite side.

Take care not to twist the connector while cleaning.

The instructions on how to use the FBC1 is located on the web on its product page, on the “Cleaning with FBC1” Tab.

You can find the complete line of Thorlabs’ fiber optic cleaning products on the web at www.thorlabs.com.



FCC-7020
Fiber Cleaning Cloth Spool



FBC1
Bulkhead and
Connector Cleaner

Chapter 10 Specifications

General Specifications	
AC Input	100-240 VAC, 50 - 60 Hz
Input Power	25 VA Max
Fuse Ratings	500 mA
Fuse Type	IEC60127-2/III (250 V, Slow Blow Type 'T')
Fuse Size	5 mm x 20 mm
Dimensions (W x H x D)	5.8" x 11.4" x 2.6" (147 mm x 290 mm x 66 mm)
Weight	5 lbs (9.1 lbs Shipped Weight)
Operating Temperature	10 to 40 °C
Storage Temperature	0 to 50 °C
Connections and Controls	
Interface Control	Optical Encoder with Pushbutton
Enable Select	Keypad Switch Enable with LED indication
Power On	Key Switch
Fiber Ports	FC/APC, 2.0 mm Narrow Key (Aligned to Slow Axis for PM Versions)
Display	LCD, 16x2 Alphanumeric Characters
Input Power Connection	IEC Connector
Modulation Input Connector	BNC (Referenced to Chassis)
Interlock	100 mil header (see Part 5)
Communications	
Communications Port	USB 2.0
Com Connection	USB Type B connector
Required Cable	2 m USB Type A to Type B Cable (Replacement Part Number USB-A-79)
Performance Specifications	
Display Power Accuracy	±10%
Current Set Point Resolution	0.1 mA
Temperature Adjust Range	20.00 to 30.00 °C
Temp Set Point Resolution	±0.01 °C
Noise	<0.5% Typical (Source Dependent)
Analog Modulation Input	0 - 5 V = 0 - Full Power
Analog Modulation Bandwidth	250 kHz for Full Depth of Modulation
Rise Time / Fall Time	1.4 µsec / 1.6 µsec (For a Square-Wave Modulation Input)

The specifications in the following tables are given for operation at 25 °C.

Polarization Insensitive Semiconductor Optical Amplifiers (SOAs)

Item #	S7FC1013S		
	Min	Typ	Max
Wavelength (nm)	1528	1550	1562
Operating Current (mA)	-	500	750
Saturation Output Power at -3 dB (dBm)	12	14	-
Optical 3 dB Bandwidth (nm)	70	74	-
Signal Gain @ P _{in} = -20 dBm (dB)	10	13	-
RMS Gain Ripple (dB)	-	0.1	0.5
Noise Figure (dB)	-	8	9.5
Polarization Dependent Gain (dB)	-	1.0	1.8

Polarization Sensitive Booster Optical Amplifiers (BOAs)

Item #	S9FC1137P		
	Min	Typ	Max
Wavelength (nm)	1030	1050	1070
Operating Current (mA)	-	-	300
Saturation Output Power at -3 dB (dBm)	6	9	-
Optical 3 dB Bandwidth (nm)	40	50	-
Signal Gain @ P _{in} = -20 dBm (dB)	17	21	-
RMS Gain Ripple (dB)	-	-	0.5
Noise Figure (dB)	-	11	14

Item #	S9FC1132P			S9FC1004P		
	Min	Typ	Max	Min	Typ	Max
Wavelength (nm)	1290	1300	1315	1530	1550	1570
Operating Current (mA)	-	700	750	-	600	750
Saturation Output Power at -3 dB (dBm)	15	17	-	13	15	-
Optical 3 dB Bandwidth (nm)	80	87	-	90	100	-
Signal Gain @ P _{in} = -20 dBm (dB)	27	30	-	25	28	-
RMS Gain Ripple (dB)	-	0.2	0.3	-	0.1	0.2
Noise Figure (dB)	-	7.0	9.0	-	7.0	9.0

The specifications in the following table are given for operation at 25 °C.

Item #	S9FC1080P			S9FC1082P		
	Min	Typ	Max	Min	Typ	Max
Wavelength (nm)	1570	1590	1610	1600	1625	1650
Operating Current (mA)	-	600	750	-	600	750
Saturation Output Power at -3 dB (dBm)	12	15	-	10	13	-
Optical 3 dB Bandwidth (nm)	80	90	-	70	80	-
Signal Gain @ $P_{in} = -20$ dBm (dB)	20	25	-	14	18	-
RMS Gain Ripple (dB)	-	0.05	0.2	-	0.05	0.3
Noise Figure (dB)	-	7.0	9.0	-	7.0	9.0

Chapter 11 Mechanical Drawing

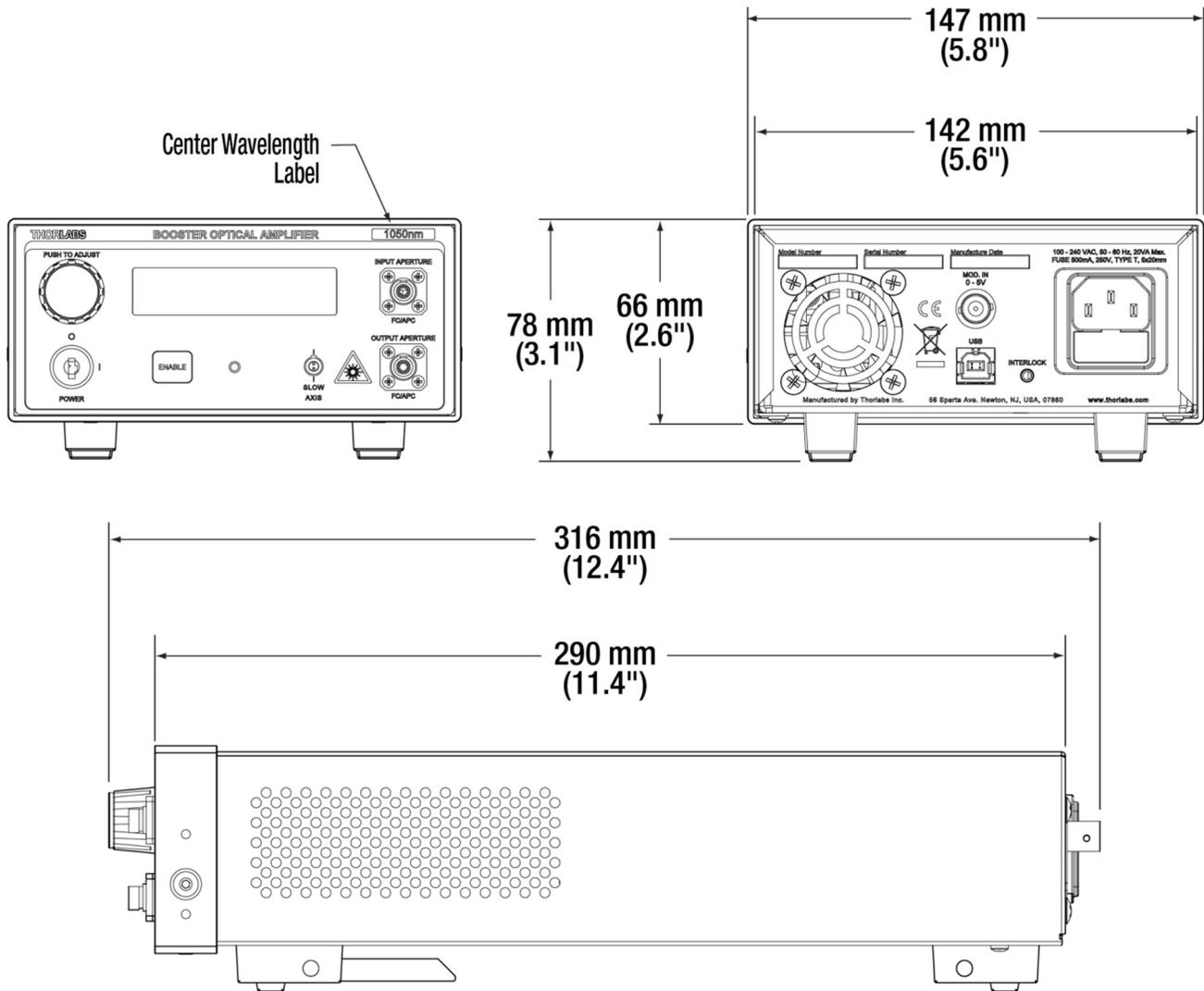
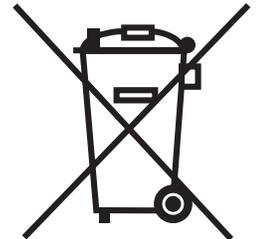


Figure 6 Mechanical Drawing

Chapter 12 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC



Wheelie Bin

- Still complete, not disassembled and not contaminated

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

12.1. Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

12.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 1' Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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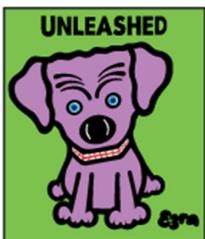
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