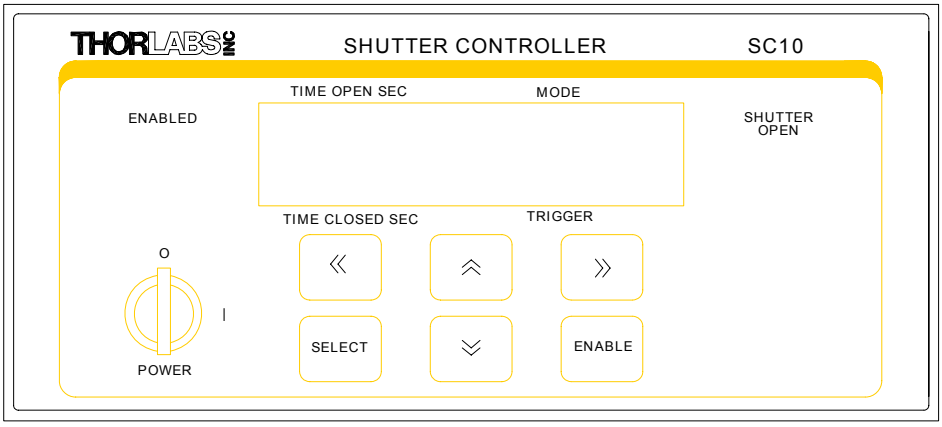
SC10

Shutter Controller

Operating Manual



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The Thorlabs SC10 is a digital shutter controller designed to control the Thorlabs SH05 Shutter. The SC10 also has the ability to operate as a stand-alone digital delay generator with 1 millisecond resolution and 0.1 millisecond accuracy.

Features:

- Automated computer control capability
- .0001 second accuracy
- On/Off times from 1 millisecond to 999.999 milliseconds
- Input and output triggers
- Interlock and alarm functions
- Automatic open shutter detection
- Automatic, Single, Manual, Repeat (n), and External Gate operation

Description:

The SC10 provides a direct interface to the SH05 shutter, providing the drive levels required to operate the shutter with millisecond accuracy. In addition the SC10 also provides a TTL output trigger to control other devices used in concert with the SHO5. Both outputs are under direct control of the user interface. The SC10

provides three unique user interfaces; control from the front panel, control from a PC, and control from a TTL direct interface.

The front control panel allows the user to directly program and monitor the shutter open/close times. In addition modes such as run continuous (auto), single shot, and repeat are also entered via the front panel interface. The repeat mode allows the user to repeat the displayed open/close sequence from 1 to 99 times.

The unit can be triggered from a TTL input. The TTL input may also be configured as external gate where the control of the SH05 output will follow the TTL input.

The unit may also be controlled and operated from a remote RS232 interface. All of the provisioning and control can be programmed using a command line editor, or from the stand alone PC application software supplied with the unit. The unit also comes with LabWindows/CVI® and LabVIEW® drivers.

When integrated with the SH05, shutter the unit detects the presence of the unit and provides an alarming/monitor feature to insure the status of the shutter agrees with the output of the controller. When the SH05 is present the output trigger follows the actual state of the SH05, this can be used for triggering other devices or for monitoring the performance of the shutter. When the controller is used without a shutter the TTL output signal represents the precise programmed output of the controller.

A key lock and an interlock function are also provided on the SC10.

The SC10 provides drive/output pulses that have 0.001Second resolution and 0.0001 Second accuracy for both the ON (OPEN) and OFF (CLOSE) time. Though the controller has this accuracy the resulting operation of a shutter differs due the mechanical and electrical properties of the shutter. **See the SH05 specification sheet**.

SC10 Specifications:

Performance

Parameter	Min	Max	Tol	Unit
TIME OPEN (Output pulse high)	.001	999.999	+/- 0.0001	Seconds
TIME CLOSED (Output pulse low)	.001	999.999	+/- 0.0001	Seconds

Electrical

Parameter	Min	Max	Typical	Unit
Power Input 50-60Hz @ 110mA	100	250		VAC
Trigger Out	2.2 500 ohm load	5.0 Open circuit		Volts
Trigger In (10K input impedance)	2.0	5.0		Volts
Shutter Output Drive pulse- 5mS (SHO5 Jack) into 28 ohms			24	Volts DC
Shutter Output Hold voltage (SHO5 Jack) into 28 Ohms			10	Volts DC
RS232 input	9.6K	115K		BAUD


Attention:

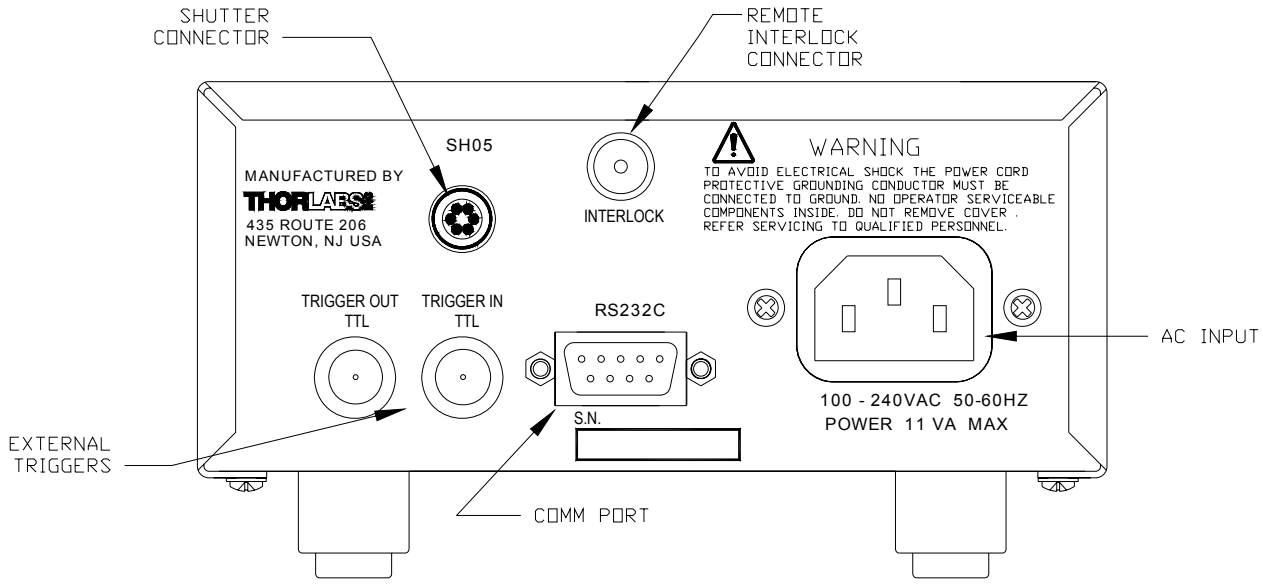
AC Input: 100 to 250 VAC 50-60Hz @ 110mA

NOTE: Unit is supplied with a 115V 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.

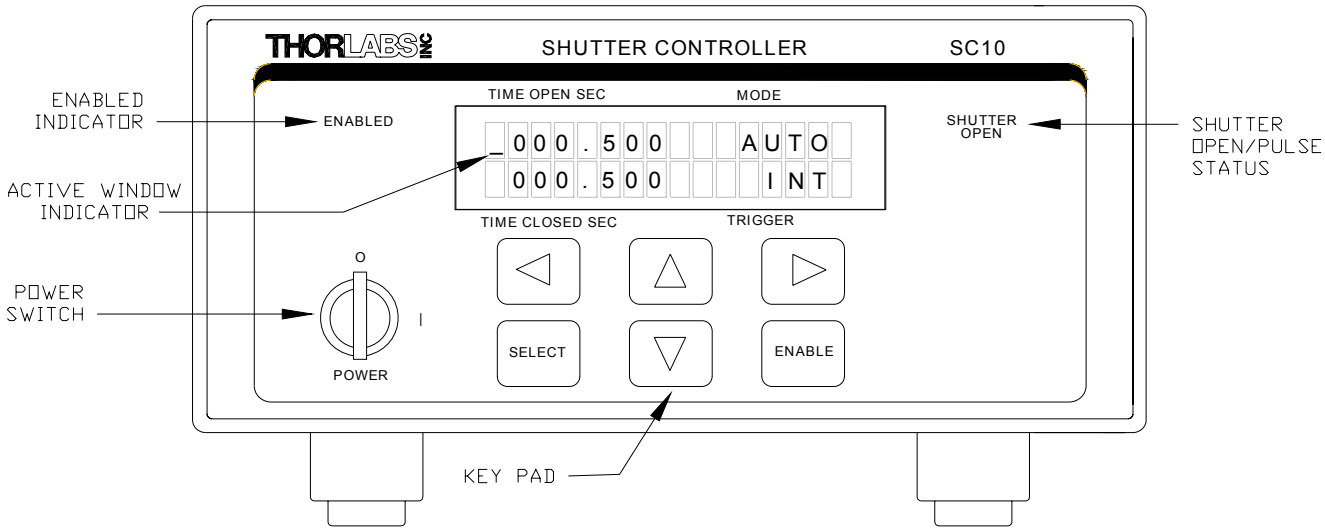
Communications: RS232C - Connection made via standard DB9 cable included with unit.

Physical Characteristics and Interface:

Parameter	Description
Trigger Jacks	BNC Female
RS232	DB9F
SH05 Jack	HRS, HR10-7R-6S
Interlock jack	2.5mm mono-phono
AC Input jack	IEC320
Size Length: Width: Height: Weight:	 11.5" (292mm) 5.3" (135mm) 3.0" (76mm) 5 lbs.



SC10 REAR PANEL



SC10 FRONT PANEL

Front Panel Keys and Indictors:

SELECT - Selects the window or function to be operated on. The Main LCD display screen contains four display windows, each is located in a quadrant of the display. The windows are **TIME OPEN**, **TIME CLOSED, MODE**, and **TRIGGER**. The **SELECT** key is used to move between the four windows (quadrants) of the display. The active quadrant is indicated by the "_" (underscore) in the quadrant. When the underscore "_" is present in the quadrant the contents of the quadrant may be modified using the ◄►▲▼keys.

ENABLE - Enables operation the controller as per the programmed parameters. When the unit is enabled the "ENABLED" indicator will illuminate. Pressing the **ENABLE** key while the unit is enabled will disable the unit.

▲ - Increments either numerically (digits) or steps up through the options in the active window.

▼ - Decrements either numerically (digits) or steps down through the options in the active window.

◄ - Moves the curser left in the active display.

► - Moves the curser right in the active display.

ENABLED - Illuminates when the unit is active or waiting for a trigger event to executing the programmed parameters.

SHUTTER OPEN - Illuminates when the shutter is open or the output pulse is "active high".

OPERATION

Initial Set-up

- Locate the unit on a dry, level working surface.
- Make sure the **POWER** switch on the front of the unit is in the OFF position (0).
- 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.
- Connect the SH05 cable to the connector on the rear of the unit.

Turning ON the Unit

- Turn the Power Key lock switch clockwise to the ON position (|). The LCD screen will display a brief message stating the model number and the firmware revision. After approximately 2 seconds this message will scroll off of the screen and the "Main" LCD screen will appear.
- The unit defaults to the " MANUAL" mode on the initial power-up. Subsequent power-up conditions will default to the set parameters when unit was last enabled.
- Make sure that the Remote Interlock input is "closed". See "Remote Interlock" below.
- In the MANUAL mode the **ENABLE** keypad on the front panel will open and close the shutter. The "SHUTTER OPEN" indicator will track the shutter status.

Main Display

- The front panel contains six keypads that can be used for various functions and navigating through the display.
- The Main display screen contains four display windows, each is located in a quadrant of the display. The windows are **MODE**, **TRIGGER**, **TIME OPEN**, and **TIME CLOSED**. The keypads will modify (edit) the active quadrant which is indicated by a "_" next to the quadrant. The **SELECT** key is used to move between quadrants.

MODE

When the active window indicator is in the **MODE** quadrant (upper right) the ▲ ▼ keys will sequence through the modes **SINGLE, AUTO**, **MANUAL**, **X GATE**, and **REP**.

SINGLE – In the single event mode the shutter will open and close at the occurrence of each trigger using the parameters displayed in the (open/close) time windows.

AUTO – In the automatic mode the shutter will continually open and close after a single event using the parameters displayed in the (open/close) time windows.

MANUAL- In manual mode, the displays in the other quadrants will blank and the **ENABLE** key will toggle the operation of the shutter.

X GATE - In the external gate mode the other displays will blank and the control of the shutter will follow the signal on the input trigger BNC connector on the rear panel. The shutter will be open when the signal is active high (TTL). The shutter will be closed when active low (TTL).

REP – In the repeat mode the open/close time sequence will be executed the number of times shown next to the REP display. The unit may be programmed to repeat the cycle anywhere between 1 and 99 times. While the active display is in the REP mode the number of events may be modified by using the ◄ key to place the curser under the number displayed and using the ▲▼ keys to increment or decrement the number. The repeat sequence begins with activation of a trigger.

TRIGGER

When the active window indicator is in **TRIGGER** quadrant (lower right) the ▲ ▼ keys will sequence through the trigger options **INT**, **EXT**.

INT - In the internal mode pressing the **ENABLE** key activates or enables the operation of the shutter as per the selected mode and timing parameters. While the shutter controller is executing a sequence (actively running) the "ENABLED" indicator will illuminate on the front panel. In all modes of operation pressing **ENABLE** key while the unit is "enabled" will disable the shutter.

EXT – In the external trigger mode a rising edge on INPUT TRIGGER BNC input will start execution of the parameters programmed on the unit. The unit will respond to the external trigger after the **ENABLE** key is pressed. When enabled the "ENABLED" indicator will illuminate on the front panel. In all modes of operation pressing **ENABLE** key while the unit is "enabled" will disable the shutter.

TIME OPEN (ON)

When the active window indicator is in **TIME OPEN** quadrant (upper left) the ▲ ▼ keys will increment and decrement the indicated digit. The ◄► keys will move between digits. This indicates how long the shutter will be open (when the shutter is not connected it indicates the "high" time of the TTL output trigger).

TIME CLOSED (OFF)

When the active window indicator is in **TIME CLOSED** quadrant (lower left) the ▲ ▼ keys will increment and decrement the indicated digit. The ◄► keys will move between digits. This indicates how long the shutter will be closed (when the shutter is not connected it indicates the "low" time of the TTL output trigger).

NOTE: If active window indicator is in the **TIME CLOSED** quadrant when the shutter is enabled, timing will begin with the programmed **TIME CLOSED**.

INTERLOCK and ALARM

Using the Safety Interlock - Connections and Operation

The SC10 is equipped with a Remote Interlock connector located on the rear panel (Refer to Figure 1). In order to enable the controller, 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 and an SH05 is connected, the shutter will automatically close. And the display will flash "**INTERLOCK OPEN**". If the switch returns to a closed condition the shutter 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 your remote interlock switch. Next, remove the shorting device by unscrewing it from the input and install the connector into the Interlock input.

The Interlock input only accepts a **2.5mm mono phono jack**. This connector is readily available at most electronics stores (Radio Shack, Digikey, Mouser, Allied to name a few).

The electrical specifications for the Interlock input are as follows:

Type of Mating Connector: 2.5mm mono phono jack
Open Circuit Voltage: +5VDC with respect to Chassis ground
Short Circuit Current: 0.5mADC
Connector Polarity: Tip is +5V, Barrel is ground
Interlock Switch Requirements: Must be N.O. dry contacts (under no circumstances should any external voltages be applied to the Interlock input)

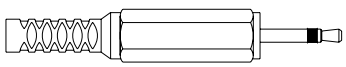


Figure 2 - Remote Interlock Connector

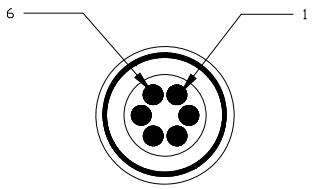
ALARM

The SC10 has an Alarm feature when used in conjunction with an SH05 shutter. In the event that the shutter does not close within 30 ms of the deactivation voltage (Shutter Closed State) the display will indicate an "ALARM" condition. This feature is only active when the SH05 shutter is connected.

SH05 Interface

The interface to the SH05 Shutter is via a 6 pin HRS female connector. The pin descriptions are as follows:

Pin	Description
1	To Opto cathode -GND
2	To Shutter Coil - 24V pulse 10V steady state (.4A max)
3	To-Shutter Coil - GND (on) Open Ckt (off)
4	To- Opto Anode (12V limited to 20mA)
5	To- Opto Emitter- GND
6	To- Opto Collector (2.5V)



SHO5 Connector Rear Panel

Operating From a Computer:

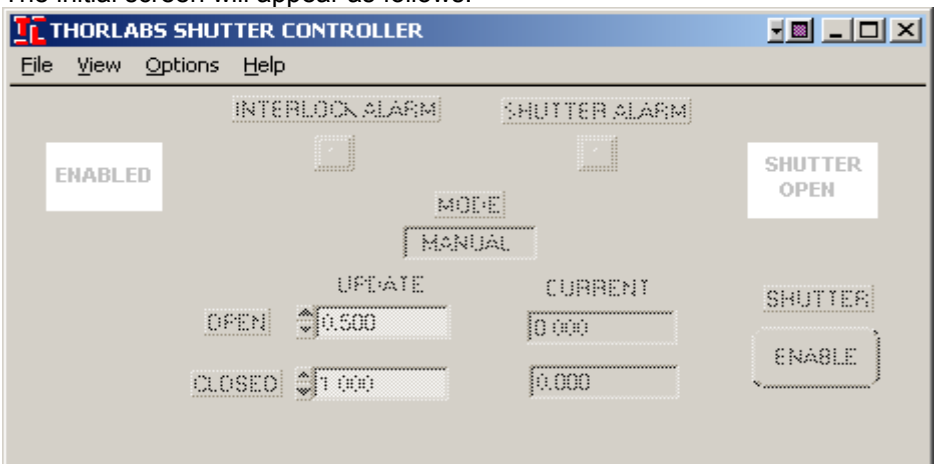
Overview

- The SC10 Shutter Controller is fully operational from a remote computer via and RS232 interface.
- Connection from the computer to the SC10 is made with a standard DB9 cable (supplied).
- The SC10 can be controlled using the SC10 Application Software provided with the unit.
- It can also be controlled directly using a command line interface and any Terminal Communications software such as HyperTerminal.
- And finally it can be configured and operated using National Instrument's LabView® or Lab Windows® using the drivers supplied with the unit.

Application Software operation

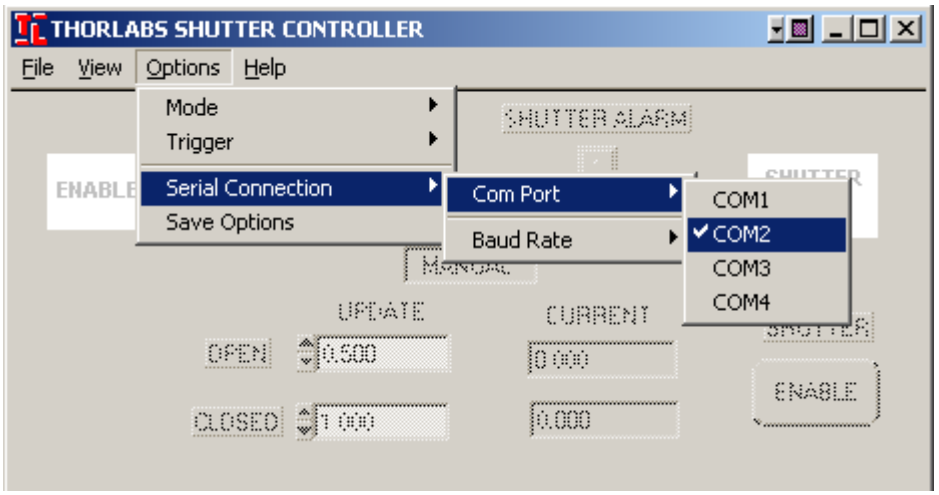
The SC10 comes with a CD-ROM containing application software to control the unit from a PC. After installing the software (see software installation), apply power to the unit. Connect a 9 pin (DSUB) serial cable between the SC10 and the PC. To execute the SC10 standalone application select "Programs->Thorlabs->SC10" from the Start menu.

The initial screen will appear as follows:



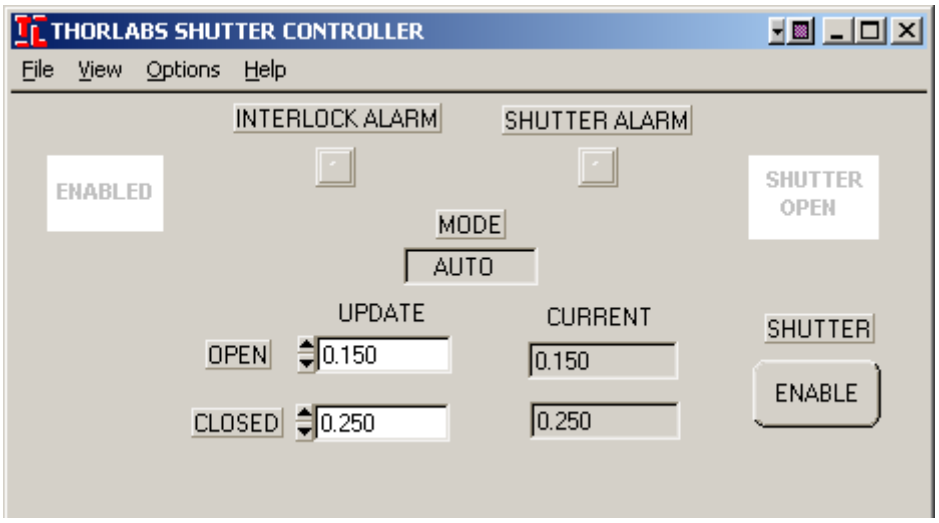
Establishing communications with SC10

To communicate with the SC10 you must first establish a connection with the SC10 and the PC, the COM port and BAUD rate for the PC connection are set in the “Options->Serial Connection” menu. Note the SC10 defaults to 9.6K Baud and can only be changed using the command line interface (see “command line interface”). The SC10 Application software defaults to COM1 at 9.6K BAUD. The SC10 supports 2-BAUD rates 9.6K and 115.2K.



After insuring the proper COM port and BAUD rate, click on the “Open Connection” under the “File” menu.
The unit is now ready to operate from either the application software or from the front panel controls on the unit. The “Save Options” menu item will save the selected options for future sessions.

The shutter timing can be changed in any of the following ways: using the increment decrement arrows or by entering a time in seconds in the “OPEN CLOSED “ windows. When typing, a carriage is required to update the SC10. The grey boxes on the right of the display indicate the active value.



The MODE and TRIGGER parameters can be changed in the Options menu. The operating MODE of the SC10 is displayed in the center of the window. The ENABLE button acts identically to the one on the front panel.

The PC window also contains active displays to indicate the status of the shutter.

Command Line Interface

The SC10 may also be controlled using a command line language through the serial port. This is offered to enable operation through a terminal interface or for those who have a desire to control the unit through a scripting program. The command language is described below. Prior to running the command line interface the unit should be powered and a 9 pin (DSUB) serial cable should be connected between the SC10 and the host. The terminal emulator should be set as follows:

- Baud Rate = 9.6K Bits 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 a 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 SC10 indicating it is ready to receive another command line.

Keywords (Commands and Queries)

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

baud=0	Set Baud-	Sets the SC10 serial baud rate to 9.6K.
baud=1		Sets the SC10 serial baud rate to 115K.
baud?	Get Baud-	Returns “0” for 9.6K or “1” for 115K.
***idn?**	Get ID-	Returns the model number and firmware revision.
mode=(n)	Set mode-	Where (n) equals an associated mode. mode=1 – Sets the unit to Manual Mode mode=2 – Sets the unit to Auto Mode

		mode=3 – Sets the unit to Single Mode mode=4 – Sets the unit to Repeat Mode mode=5 – Sets the unit to the external gate Mode
mode?	Get mode-	Returns the mode value (1 through 5).
ens	Enable Toggle-	Enables/Disables the shutter
ens?	Get state	Returns “0’” if the shutter is disabled and “1’ if enabled.
open =(xxxxxx)	Open shutter-	Sets the shutter open time where xxxxxx is a time in mS.
open?		Returns the shutter open time in mS
shut =(xxxxxx)	Close shutter-	Sets the shutter close time where xxxxxx is a time in mS.
shut?		Returns the shutter close time in mS
trig=0	Set trigger mode-	Internal trigger mode.
trig=1		External trigger mode.
trig?	Get trigger mode-	Returns the trigger mode.
rep=(n)	Repeat-	When in the repeat mode (n) equals the repeat count, a value of 1-99
rep?		Return the repeat count, a value of 1-99
save	Save settings-	This will save the current baud rate as the default on power up.
xto= 0	Set Ex Trigger mode	This sets the output trigger to follow the shutter output when the SH05 is connected to the SC10 controller.
xto=1		Forces the trigger output to follow the controller output when an SH05 is equipped.
xto?	Get Ex Trigger mode	Returns the external trigger mode

All commands and queries are in lower case letters.

If the keyword, format, or argument are incorrect or out of range the unit will return an error string.

Software Installation

Insert the SC10 CD into the CD ROM drive. The program should automatically start installing. The install begins by opening install instructions to assist you with the automated installation.

NOTE: This program requires National Instrument’s VISA and IVI Runtime Software. If you have any National Instrument products installed on your computer there is a good chance that these programs already reside on your machine. These programs are included on the SC10 Application Software CD-ROM. If these programs are already on your system, then cancel the National Instruments Install Wizard for the installed products.

Minimum PC requirements
The application program requires a minimum of a Pentium ® class machine running Windows®98, 2000, NT or XP.

Service

There are no serviceable parts inside of the SC10 controller. All service should be performed by a factory authorized service technician. Contact Thorlabs if service is required.

WEEE

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 13th 2005
- marked correspondingly with the crossed out “wheelie bin” logo (see fig. 1)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

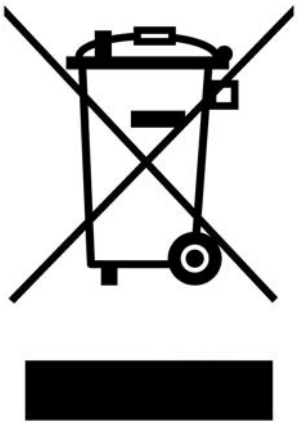
As the WEEE directive applies to self contained operational electrical and electronic products, this “end of life” take back service does not refer to other Thorlabs products, such as

- 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.

Waste treatment on 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.

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 live products will thereby avoid negative impacts on the environment.



Crossed out “wheelie bin” symbol