KSC101
K-Cube Solenoid Controller

KINESIS User Guide



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Chapter 1 Safety

1.1 Safety Information

For the continuing safety of the operators of this equipment, and the protection of the equipment itself, the operator should take note of the **Warnings, Cautions** and **Notes** throughout this handbook and, where visible, on the product itself.

The following safety symbols may be used throughout the handbook and on the equipment itself.



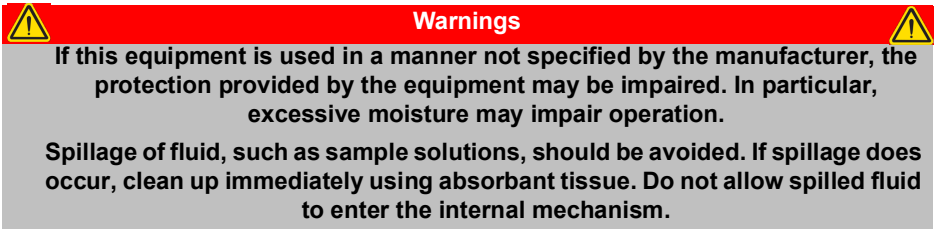




Note

Clarification of an instruction or additional information.

1.2 General Warnings



Chapter 2 Overview and Setup

2.1 Introduction

The K-Cube Solenoid Controller (KSC101) is a new very compact single channel controller for easy manual and automated control of solenoid operated shutters, and other such devices. Designed to operate 15 V solenoid actuated devices, this mini controller is fully featured, possessing an embedded DSP processor to provide a multitude of flexible operating modes.

Embedded software functionality allow this unit to be used to control solenoid devices manually (using panel buttons), automatically with DSP timed operation, or via external trigger signals for operation with third party equipment. A trigger out connection allows multiple K-Cube controllers to be connected together for multi-channel 'synchronized' operation.

For convenience the footprint of this unit has been kept to a minimum, measuring only 60 mm x 60 mm x 47 mm (2.4" x 2.4" x 1.8") and with the facility to directly mount to the optical table. The manual controls for this unit are conveniently located on the upper surface such as the 'Mode' and 'Enable' buttons. The Mode button allows the various operating modes to be selected easily and the Enable button is used to initiate manual or automatic operation of the solenoid controller output. There is also a safety key switch and interlock plug fitted to this compact unit for use in laser safety applications.



Fig. 2.1 K-Cube Solenoid Controller

USB connectivity provides easy 'Plug and Play' PC controlled operation - multiple units can be connected to a single PC via standard USB hub technology or by using the new K-Cube Controller Hub (see Section 2.2) for multi-axis motion control applications. Coupling this with the very user friendly Kinesis software (supplied) allows the user to very quickly get up and running with complex operating sequences in a short space of time. Custom control applications and sequences are also possible using the extensive programming environment also supplied. This programming library is compatible with many development tools such as LabView, Visual Basic, Visual C++, C++ Builder, LabWindows/CVI, Matlab and Delphi.

In the remainder of this handbook, operation of the unit is described for both top panel and PC operation. Tutorial sections (Chapter 4 and Chapter 5) provide a good initial understanding on using the unit and reference section (Chapter 6) covers all operating modes and parameters in detail.

2.2 Power Options

A single way wall plug KPS201* supply for powering a single K-Cube Driver is available.

* The previous-generation KPS101 power supply is also compatible and can be used to power a single K-Cube Driver.

For multiple cube systems, a 3-channel (KEH3) or 6-channel (KEH6) K-Cube Controller Hub are offered. Previous generation 3- and 6-channel controllers (KCH301 and KCH601, respectively) may also be used, but are no longer available for individual purchase. These products have been designed specifically with multiple K-Cube operation in mind in order to simplify issues such as cable management, power supply routing, multiple USB device communications and different optical table mounting scenarios.

The K-Cube Controller Hub comprises a slim base-plate type carrier with electrical connections located on the upper surface to accept the K-Cubes.

Internally the Controller Hub contains a fully compliant USB 2.0 hub circuit to provide communications for all K-Cubes – a single USB connection to the Controller Hub is all that is required for PC control. The Controller Hub also provides power distribution for the K-Cubes, requiring only a single power connection.

2.3 PC Software Overview

2.3.1 Introduction

The K-Cube range of controllers share many of the benefits of the Thorlabs range of motor controllers. These include USB connectivity (allowing multiple units to be used together on a single PC), fully featured Graphical User Interface (GUI) panels, and extensive software function libraries for custom application development.

This controller is fully compatible with Thorlabs' Kinesis® and XA software applications. This manual describes use of the controller with Thorlabs' Kinesis software suite that provides a flexible and powerful PC based control system both for users of the equipment, and software programmers aiming to automate its operation. For information about operation using Thorlabs' XA software, refer to the XA User Guide.

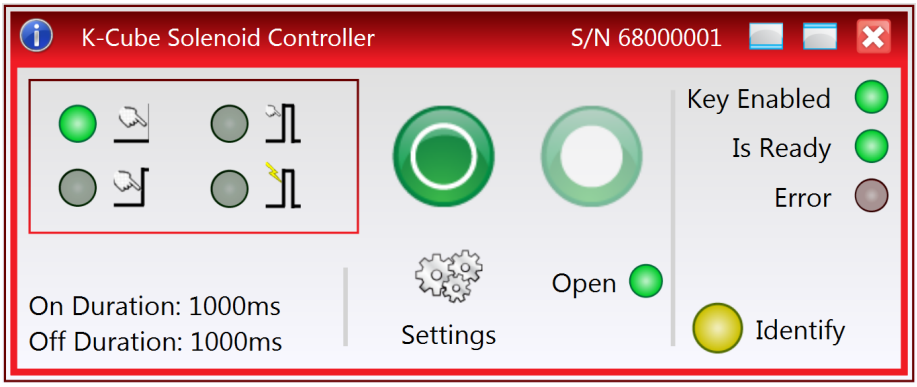
The User Interface allows full control of all settings and operating modes enabling complete 'out-of-box' operation without the need to develop any further custom software. It provides all of the necessary system software services such as generation of GUI panels, communications handling for multiple USB units, and logging of all system activity to assist in hardware trouble shooting. The Kinesis server is also used by software developers to allow the creation of advanced automated positioning applications very rapidly and with great ease. The Kinesis server is described in more detail in Section 2.3.2

2.3.2 Kinesis Server

Kinesis controls are re-usable compiled software components that supply both a graphical user interface and a programmable interface. Many such Controls are available for Windows applications development, providing a large range of re-usable functionality. For example, there are Controls available that can be used to manipulate image files, connect to the internet or simply provide user interface components such as buttons and list boxes.

With the Kinesis system .Net Controls are deployed to allow direct control over (and also reflect the status of) the range of electronic controller units, including the Stepper Driver K-Cube. Software applications that use .Net Controls are often referred to as 'client applications'. A .Net Control is a language independent software component. Consequently the controls can be incorporated into a wide range of software development environments for use by client application developers. Development environments supported include Visual Basic, Labview, Visual C++, C++ Builder, HPVEE, Matlab, VB.NET, C#.NET and, via VBA, Microsoft Office applications such as Excel and Word.

Consider the .Net Control supplied for the K-Cube solenoid driver unit.



This Control provides a complete user graphical instrument panel to allow the unit to be manually operated, as well as a complete set of software functions that allow all parameters to be set and solenoid operations to be automated by a client application. The instrument panel reflects the current operating state of the controller unit to which it is associated (e.g. such as solenoid state). Updates to the panel take place automatically when a user (client) application is making software calls into the same Control.

The Kinesis Controls collection provides a rich set of graphical user panels and programmable interfaces allowing users and client application developers to interact seamlessly with the Kinesis hardware. Each of the Kinesis controllers has an associated .Net Control and these are described fully in the handbooks associated with the controllers.

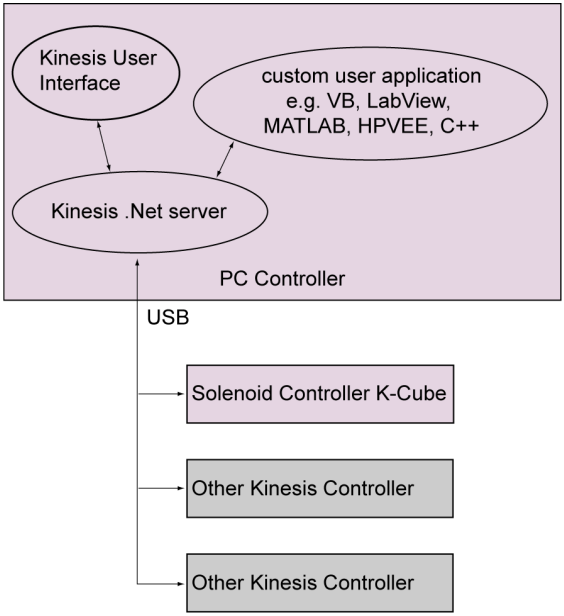


Fig. 2.2 System Architecture Diagram

Refer to the main Kinesis Software online help file, for a complete programmers guide and reference material on using the Kinesis Controls collection. This is available either by pressing the F1 key when running the Kinesis server, or via the Start menu, Start\Programs\Thorlabs\Kinesis\Kinesis Help.

2.3.3 Software Upgrades

Thorlabs operate a policy of continuous product development and may issue software upgrades as necessary.

Chapter 3 Getting Started

3.1 Install The Software

Note

When operating via a PC, direct user interaction with the solenoid controller is accomplished through intuitive graphical user interface panels (GUIs), which expose all key operating parameters and modes. The multitasking software architecture ensures that the graphical control panels always remain live, showing all current hardware activity.

Caution

Some PCs may have been configured to restrict the users ability to load software, and on these systems the software may not install/run. If you are in any doubt about your rights to install/run software, please consult your system administrator before attempting to install.

If you experience any problems when installing software, contact Thorlabs on +44 (0)1353 654440 and ask for Technical Support.

DO NOT CONNECT THE CONTROLLER TO YOUR PC YET

1) Go to Services/Downloads at www.thorlabs.com and download the software.
2) Run the .exe file and follow the on-screen instructions.
3) Follow the on-screen instructions.

3.2 Mechanical Installation

3.2.1 Environmental Conditions

Warning

Operation outside the following environmental limits may adversely affect operator safety.

Location	Indoor use only
Maximum altitude	2000 m
Temperature range	5 °C to 40 °C
Maximum Humidity	Less than 80% RH (non-condensing) at 31°C

To ensure reliable operation the unit should not be exposed to corrosive agents or excessive moisture, heat or dust.

If the unit has been stored at a low temperature or in an environment of high humidity, it must be allowed to reach ambient conditions before being powered up.

3.2.2 Mounting Options

The K-Cube Solenoid Controller is shipped with a baseplate, for use when fitting the unit to a breadboard, optical table or similar surface - see Section 3.2.3

For multiple cube systems, a 3-channel (KEH3) or 6-channel (KEH6) K-Cube Controller Hub are offered. Previous generation 3- and 6-channel controllers (KCH301 and KCH601, respectively) may also be used, but are no longer available for individual purchase. See Section 2.2 for further details. Full instructions on the fitting and use of the controller hub are contained in the handbook available at www.thorlabs.com.

Caution

When siting the unit, it should be positioned so as not to impede the operation of the control panel.
Ensure that proper airflow is maintained to the unit.

3.2.3 Using the Baseplate

The baseplate is supplied with magnets for quick positioning on an optical worksurface. For more secure positioning, it can be bolted to the worksurface before the K-Cube is fitted, as shown below. The K-cube is then located on two dowels in the baseplate and secured by two clips.

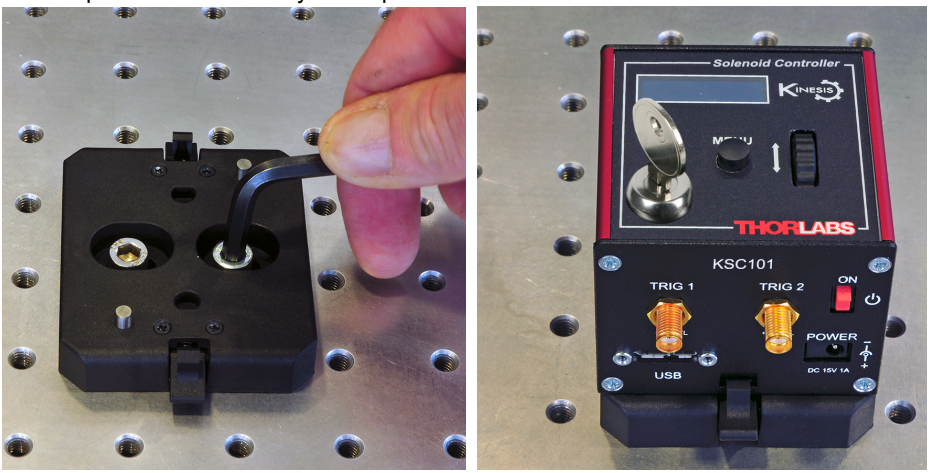


Fig. 3.1 Using The Baseplate

3.3 Electrical Installation

3.3.1 Rear Panel

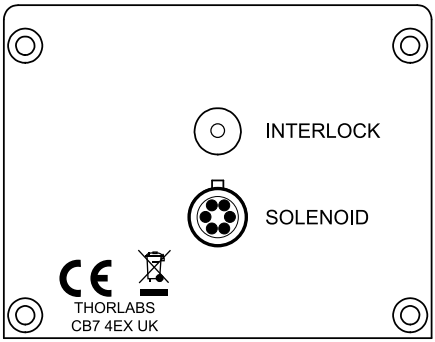


Fig. 3.2 Rear Panel Connections

The solenoid is connected via the 6-way Hirose connector, which is compatible with all Thorlabs solenoid-actuated shutters (refer to Appendix A for details of pin outs).

The unit also features an Interlock connector, for use in laser safety applications - see Section 3.4.2

Caution

Do Not connect/disconnect the interlock jackplug with power applied to the unit.

3.3.2 Front Panel

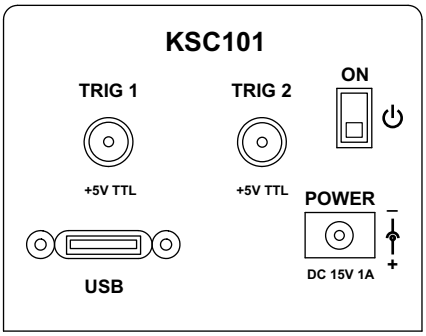


Fig. 3.3 Front Panel Power Supply Connections

Shock Warning

The unit must be connected only to a DC supply of 15V, 1A regulated. Connection to a supply of a different rating may cause damage to the unit and could result in injury to the operator.

POWER - A Standard 3.5 mm front panel jack connector for connecting the unit to a regulated DC power supply of 15 V, 1 A - 2.66 A.

A single way wall plug KPS201* supply for powering a single Driver K-Cube is available.

*The previous-generation KPS101 power supply is also compatible.

USB - USB port for system communications.

Note

The USB cable length should be no more than 3 metres unless a powered USB hub is being used.

ON - Power ON/Standby switch. When in the ON position, the unit is fully powered up. When the switch is turned to the Standby position, the unit initiates a controlled power down sequence, saving all user-adjustable parameters to non-volatile memory before turning off the power. For the first few seconds, the shutdown can be cancelled by turning the switch on again, in which case the unit will save the parameters but will remain powered up. In a powered down (Standby) state, the logic circuits are powered off and the unit will draw only a small quiescent current. The switch should always be used to power down the unit.

TRIG 1 and TRIG 2 - SMA connectors for use with external trigger input and output signals (5V TTL levels). TRIG1 is set to trigger IN and TRIG2 to trigger OUT.

3.4 Connect The Hardware

1) Perform the mechanical installation as detailed in Section 3.2
2) Install the Kinesis Software.

Caution

During items (3) to (6) the instructions should be followed in the order stated. Problems may occur if the process is not performed in the correct sequence.

3) Connect the Controller unit to your PC.
   (**Note**. The USB cable should be no more than 3 metres in length. Communication lengths in excess of 3 metres can be achieved by using a powered USB hub)
4) Connect the solenoid to the Controller unit - see Section 3.3.1.

Caution

During item (5) ensure the power switch on the top panel of the unit is switched off before connecting power to the K-Cube. Always power up the K-Cube unit by its ON switch. DO NOT connect the K-Cube unit to a 'live' external power supply. Doing so (i.e. "hot plugging") carries the risk of PERMANENT damage to the unit. Similarly, to power down the unit, turn the power switch off before disconnecting the power supply.

5) Connect the Controller unit to the power supply - see Section 3.3
6) Connect the INTERLOCK jack plug - seeSection 3.4.2
7) Connect the PSU to the main supply.
8) Turn ON the key switch.
9) Switch 'ON' the unit using the switch on the front panel.

The unit takes about 5 seconds from power application until warm up is finished, during which time the following screens are displayed.

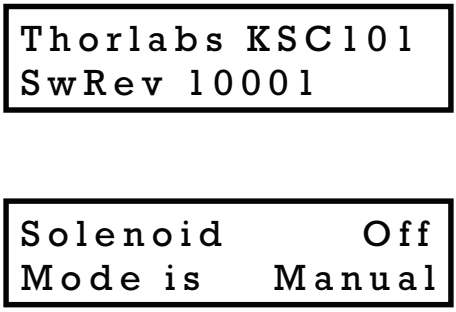


Fig. 3.4 KSC101 Start Up Screens

10) Windows® should detect the new hardware. Wait while Windows® installs the drivers for the new hardware.

Note

If any problems are encountered during the connection and power up process, power cycle the unit, which should clear the error.

3.4.1 Using an External Trigger

To use the external trigger, the unit must be set to *Triggered* mode - see Section 4.4.2

The K-Cube solenoid controllers have two bidirectional trigger ports (TRIG1 and TRIG2) that can be used to read an external logic signal or output a logic level to control external equipment. By default, TRIG 1 is configured as an input and TRIG 2 as an output. The active logic state can be selected High or Low to suit the requirements of the application. In this way, the shutter can be opened and closed in relation to the duty cycle of the trigger input signal.

Electrically the ports output 5 Volt logic signals and are designed to be driven from a 5 Volt logic. The unit must be primed (i.e. the top panel wheel has been moved up) before the unit can respond to the external trigger.

Warning

In external triggering mode, the shutter is opened and closed under control of an external logic signal, connected to the SMA input marked "TRIG IN" on the rear panel.

The 'TRIG IN' SMA defaults to logic LOW, when the external input is open circuit (disconnected). However, the way in which the unit responds when the 'TRIG IN' connector is open circuit differs depending on whether the trigger is set to Active High or Active Low. This is particularly important in applications where a shutter is used to enable or disable a laser light source.

When set to Active Low, the shutter will open immediately if the top panel wheel is moved up.

When set to Active High, the trigger is disabled when the external input is open circuit (disconnected).
The top panel wheel must be moved up for the shutter opening to be enabled, so a disconnected input in itself cannot cause the shutter to open. However, understanding this feature of the KSC101 is particularly important for customers using the KSC101 cube in an application where the shutter opening due to a disconnected EXT TRIG input can have safety implications.

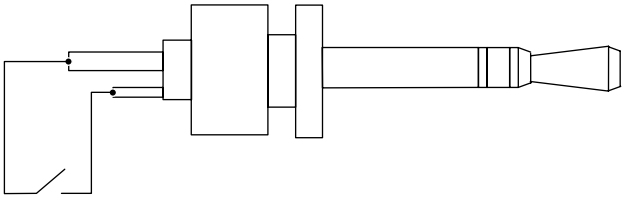
3.4.2 Using the Safety Interlock

To comply with laser safety regulations, the Solenoid Controller K-Cube is fitted with a remote INTERLOCK connector located on the rear panel (see Fig. 3.2). A short circuit must be applied across the terminals of this connector before the unit can be enabled.

Caution

If it is controlled externally, the INTERLOCK contact is taking the solenoid drive current. This current is dependent upon the solenoid being driven but could as high as 2A peak.

An INTERLOCK jack plug is supplied with the unit to close this connection. Alternatively, the contact can be controlled externally; the user can use a custom 3.5mm jackplug connected to a remote actuated (normally open) switch (e.g. an open door indicator), which must be closed before the unit can operate. See Fig. 3.5 for wiring details.



Switched short circuit between
tip and center connection

Fig. 3.5 Remote Actuated Interlock Wiring.

Caution

Do Not connect/disconnect the interlock jackplug with power applied to the unit.

If the unit is being operated in a trigger mode, the interlock controls the output of the master unit in the normal way. However, if the interlock is removed from the master unit, the slave unit will still function unless its interlock is also removed.

3.5 Verifying Software Operation

3.5.1 Initial Setup

1) Install the Kinesis software as detailed in Section 3.1
2) Connect the Controller to the solenoid (see Section 3.3.1) and the PC, then switch ON. Wait several seconds for the system to settle.
3) Run the Kinesis utility and check that the Graphical User Interface (GUI) panel appears and is active.

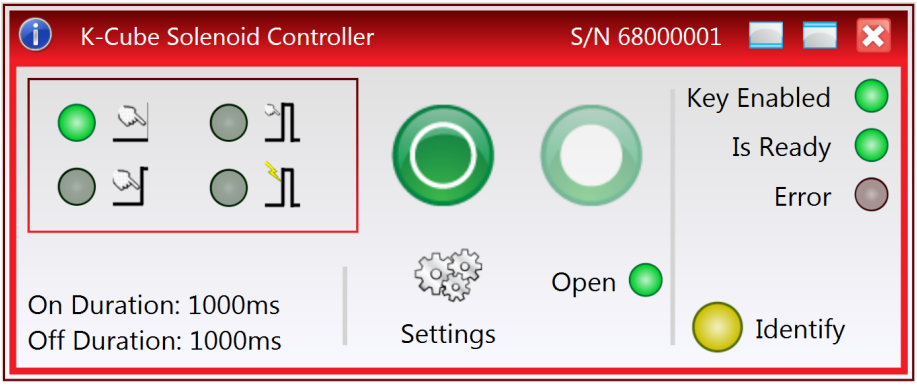


Fig. 3.6 Solenoid Controller GUI Panel

4) Click the 'Identify' button. The LED display on the control panel of the associated controller flashes. This is useful in multi-channel systems for identifying which channel is associated with which GUI.
5) Click the 'Mode' button until the 'Manual' LED is lit, then Click the ON and OFF Output buttons and check that the solenoid connected to the Solenoid Controller K-Cube responds.

Follow the tutorial steps described in Chapter 4 for further verification of operation.

Chapter 4 Standalone Operation

4.1 Introduction

The K-Cube Solenoid Controller (KSC101) is a compact single channel controller for easy manual and automated control of solenoid operated shutters, and other such devices. Designed to operate 15 V solenoid actuated devices, this mini controller is fully featured, possessing an embedded DSP processor to provide a multitude of flexible operating modes.

Embedded software functionality allows this unit to be used to control solenoid devices manually (using panel buttons), automatically with DSP timed operation, or via external trigger signals for operation with third party equipment. A trigger out connection allows multiple K-Cube controllers to be connected together for multi-channel 'synchronized' operation.

The following brief overview explains how the top panel controls can be used.

4.2 Control Panel

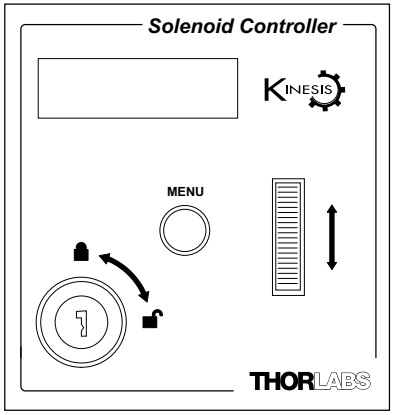


Fig. 4.1 Top Panel Controls and Indicators

Wheel - Used to open and close the solenoid when in manual or single operating modes - see Section 4.3

Digital Display - The display shows the menu options and settings, accessed via the menu button - see Section 4.4 When the Ident button on the associated GUI panel is clicked, the display will flash for a short period.

MENU - used to access the settings menu - see Section 4.4

Keyswitch - A key-operated enable switch.

4.2.1 Digital Display - Operating Mode

During normal operation, the digital display shows the current state of the solenoid, On or Off, together with the operating mode - see Section 4.3.

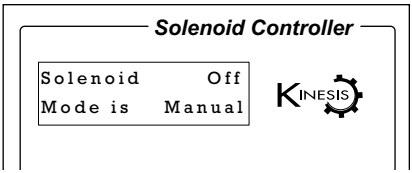


Fig. 4.2 Digital Display - Normal Operation

4.3 Operating Modes

Manual - In this mode, operation of the solenoid is via the top panel wheel. Move the wheel up to open the solenoid (ON) and down to close (OFF).

Single - In this mode, the solenoid will open each time the top panel wheel is moved up. The ON time is entered in the 'Settings' menu - see Section 4.4 If the top panel wheel is moved down, the solenoid will close (turn OFF) and the time entered in the ON Time parameter is ignored.

Auto - In this mode, the solenoid will open and close continuously after the top panel wheel is moved up. The ON and OFF times, and the number of cycles performed, are those entered in the 'Settings' menu - see Section 4.4

Trigger - The K-Cube solenoid controllers have two bidirectional trigger ports (TRIG1 and TRIG2) that can be used to read an external logic signal or output a logic level to control external equipment. By default, TRIG 1 is configured as an input and TRIG 2 as an output. The active logic state can be selected High or Low to suit the requirements of the application.

In Trigger mode, an ON pulse on the front panel TRIG BNC input will open the shutter, which will remain open until an OFF signal is detected. In this way, the shutter can be opened and closed in relation to the duty cycle of the trigger input signal.

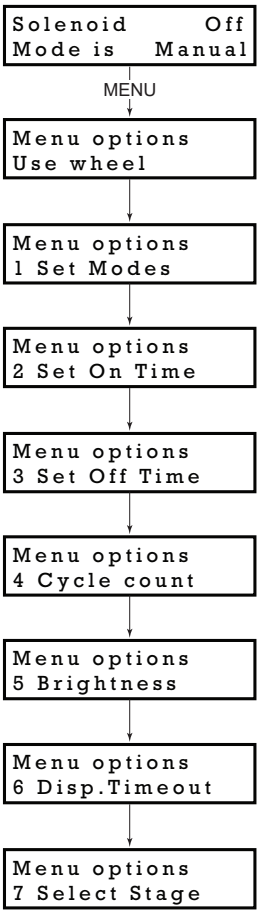
The unit must be primed (i.e. the top panel wheel moved up) before the unit can respond to the external trigger.

In all modes of operation, moving the wheel down while the solenoid is enabled will turn the solenoid OFF.

Caution

The last used MODE setting is remembered automatically between power cycles and the unit powers up automatically in the last used operating mode.

4.4 Settings Menu



4.4.1 Overview

Press the MENU button

Use the wheel to scroll through the menu options
Press the MENU button to enter a particular option

Set the operating mode - see Section 4.4.2

Set the time that the solenoid is On - see Section 4.4.3

Set the time that the solenoid is Off - see Section 4.4.4

Set the number of cycles - see Section 4.4.5

Set the display brightness - see Section 4.4.6

Set the display timeout period - see Section 4.4.7

Select the solenoid type - see Section 4.4.8

4.4.2 Menu Option - Set Modes

This option is used to move to an absolute position.

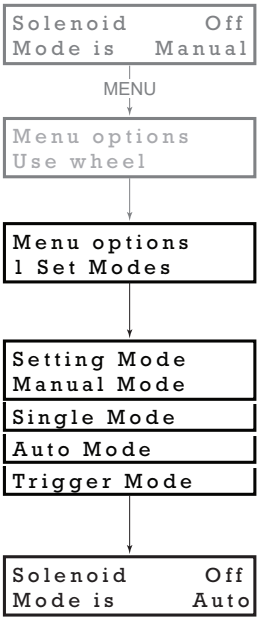
Press the MENU button, then use the wheel to scroll through the menu options.

Press the MENU button to enter the Set Modes option.

Use the wheel to adjust the mode as required.

See Section 4.3 for details of each operating mode.

Press the MENU button to store the selection and return to the operating display.



4.4.3 Menu Option - Set ON Time

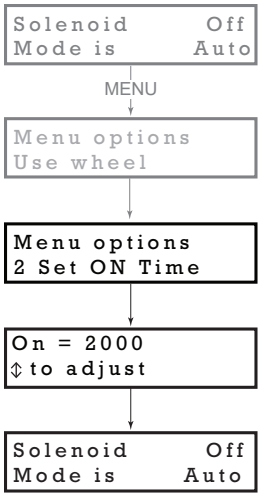
This mode is used to set the time the solenoid is ON, (i.e. the shutter/ solenoid is open) when operating in Single or Auto mode.

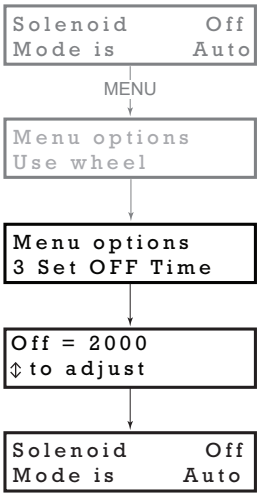
Press the MENU button, then use the wheel to scroll through the menu options.

Press the MENU button to enter the ON Time option.

Use the wheel to adjust the time which the solenoid is ON (activated). The range is 100ms to 100s in 1 ms steps.

Press the MENU button to save the setting and return to the operating display.





4.4.4 Menu Option - Set OFF Time

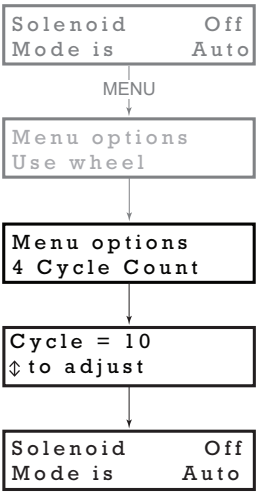
This mode is used to set the time the solenoid is OFF, (i.e. the shutter/ solenoid is closed) when operating in Auto mode.

Press the MENU button, then use the wheel to scroll through the menu options.

Press the MENU button to enter the OFF Time option.

Use the wheel to adjust the time which the solenoid is OFF (deactivated). The range is 100ms to 100s in 1 ms steps.

Press the MENU button to save the setting and return to the operating display.



4.4.5 Menu Option - Cycle Count

This mode is used to set the number of OPEN/CLOSE cycles, when operating in Auto mode.

Press the MENU button, then use the wheel to scroll through the menu options.

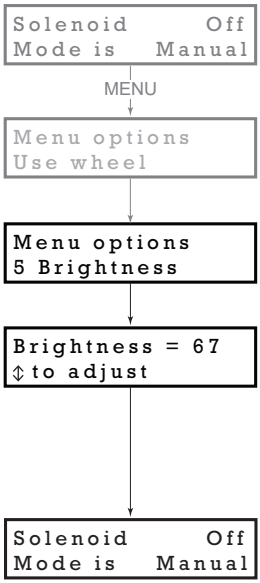
Press the MENU button to enter the Cycle Count option.

Use the wheel to adjust the number of Open/Close cycles (0 to 1,000,000) to perform when the unit is operating in 'Auto' mode. If set to '0' the unit cycles indefinitely

Press the MENU button to save the setting and return to the operating display.

4.4.6 Menu Option - Brightness

In certain applications, it may be necessary to adjust the brightness of the LED display. The brightness is set as a value from 0 (Off) to 100 (brightest). The display can be turned off completely by entering a setting of zero, however, pressing the MENU button on the top panel will temporarily illuminate the display at its lowest brightness setting to allow adjustments. When the display returns to its default position display mode, it will turn off again.



Press the MENU button, then use the wheel to scroll through the menu options.

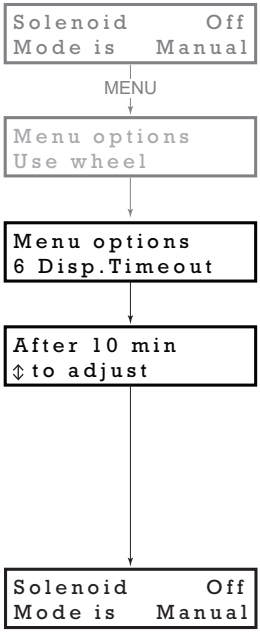
Press the MENU button to enter the Brightness option.

Use the wheel to adjust the brightness, then press the MENU button to store the selection and return to the main display.

4.4.7 Menu Option - Disp.Timeout

'Burn In' of the display can occur if it remains static for a long time. To prevent this, the display is automatically dimmed after a specified time interval.

Press the MENU button, then use the wheel to scroll through the menu options.



Press the MENU button to enter the Disp.Timeout option.

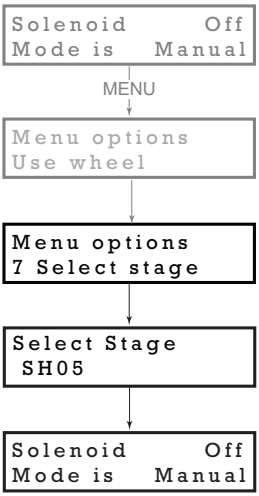
The time out interval is specified in minutes in the range 1 to 480. The adjustment is done in steps of 1 minute if the timeout is between 1 to 10 minutes, 10 minute steps between 10 minutes and 1 hour, and 30 minute steps above, up to a maximum of 480 minutes. After 480 minutes there is an option for Never.

The dim level can only be adjusted via the Settings panel - see Section 6.3.2

Press the MENU button to store the selection and return to the main display.

4.4.8 Menu Option - Select Stage

For correct operation the solenoid type being driven must be selected to enable default operating parameters to be loaded. At this time, the only solenoid devices available are the SH05 and SH1. Both of these devices are driven by the SH05 option which is loaded on start up as default. Other solenoid devices will be available in the future.



Press the MENU button, then use the wheel to scroll through the menu options.

Press the MENU button to enter the Select stage option.

Use the wheel to scroll to the required option.

Press MENU to store the selection and return to the main display.

4.5 Operation From The Top Panel

The following brief tutorial guides the user through a typical series of operations.

4.5.1 Preparation

1) Connect a solenoid actuated device (e.g. a Thorlabs SH05 Shutter) to the 'SOLENOID' connector on the rear panel of the unit.
2) Connect the INTERLOCK jack plug - see Section 3.4.2
3) Connect the unit to a +15V DC power supply unit (PSU) - see Section 3.3.2
4) Connect the unit to the PC USB bus
5) Switch ON the power to the PSU.
6) Turn ON the keyswitch.

4.5.2 Manual Mode

1) Select Manual mode (see Section 4.4.2).
2) Move the wheel upwards. The SH05 shutter opens.
3) Move the wheel down. The SH05 shutter closes.

4.5.3 Single Mode

1) Select Single mode (see Section 4.4.2).
2) Move the wheel upwards. The SH05 shutter opens for the time set in the ON time menu option, (see Section 4.4.3) then closes. If the wheel is moved down before the ON time is completed, the SH05 shutter closes and the remaining ON time is ignored.

4.5.4 Auto Mode

1) Select Auto mode (see Section 4.4.2).
2) Move the wheel upwards. The SH05 shutter begins to open and close. Unless the default settings have been changed, the following settings apply:

   ON (Open) time: 1s

   OFF (Closed time: 1s

   Number of Cycles: 0 (i.e. infinite)

   See Section 4.4 for more information on these settings.
3) Move the wheel down. The SH05 shutter closes.
4) Turn OFF the keyswitch.
5) Switch OFF the power to the PSU.

Chapter 5 PC Operation - Tutorial

The following brief tutorial guides the user through a typical series of moves and parameter adjustments performed using the PC based Kinesis software.

5.1 Preparation

1) Connect a solenoid actuated device (e.g. a Thorlabs SH05 Shutter) to the 'SOLENOID' connector on the rear panel of the unit.
2) Connect the INTERLOCK jack plug - see Section 3.4.2.
3) Connect the unit to a +15 V DC power supply unit (PSU) - see Section 3.3.2
4) Connect the unit to the PC USB bus.
5) Switch ON the power to the PSU.
6) Turn ON the keyswitch.

5.2 Using the Kinesis Software

The Kinesis application allows the user to interact with any number of hardware control units connected to the PC USB Bus. This program allows multiple graphical instrument panels to be displayed so that multiple units can be controlled. All basic operating parameters can be set through this program, and all basic operations (such as operating the solenoid/shutter) can be initiated. Hardware configurations and parameter settings can be saved, which simplifies system set up whenever the software is run up.

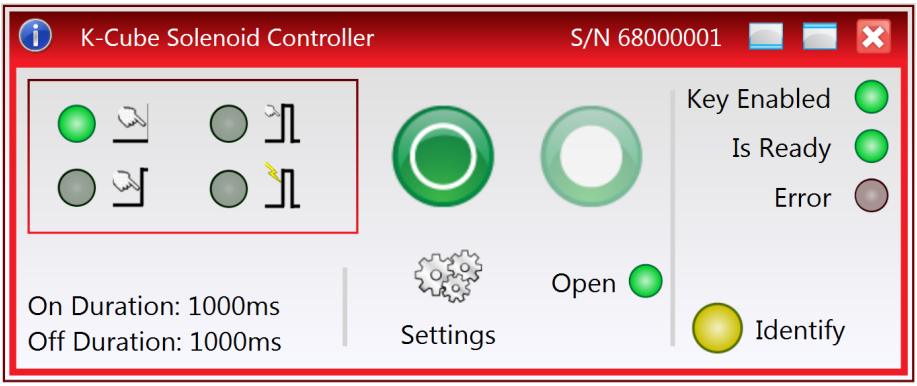


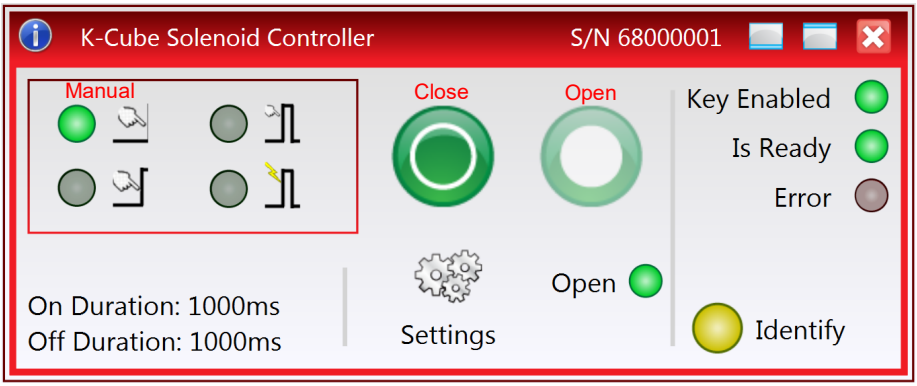
Fig. 5.1 Typical Kinesis Screen

1) Run the Kinesis software - Start/All Programs/Thorlabs/Kinesis/Kinesis.
2) The PC detects the hardware connected to the USB bus and the GUI panel for the Solenoid Controller is displayed. For an explanation of the GUI panel - see Section

6.2 For further details on the parameter values shown in the 'Settings' display - see Section 6.3

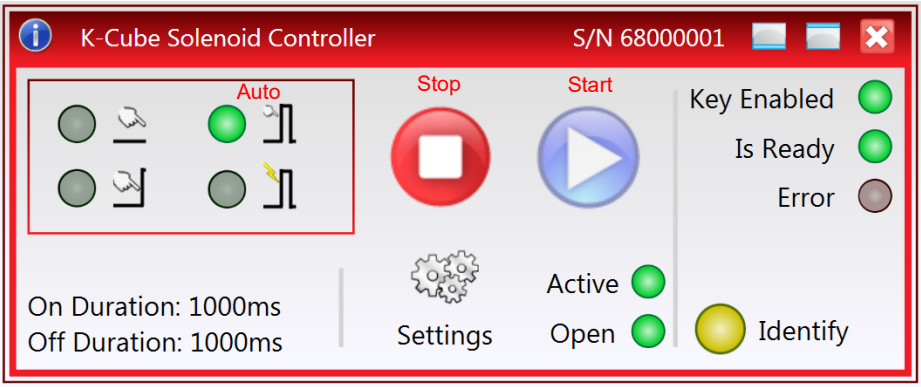
The Kinesis software will be used throughout the rest of this tutorial to interface with the Solenoid Controller K-Cube.

5.2.1 Setting Manual Mode



1) Press the Manual Mode button
2) Press the Open button. The SH05 shutter opens and the Open LED is lit.
3) Press the OFF button. The SH05 shutter closes and the Open LED is extinguished.

5.2.2 Setting Auto Mode



1) Press the Auto Mode button.
2) Press the Start button. The SH05 shutter begins to open and close. The Active LED is lit and the Open LED is lit while the shutter is open.
   Unless the default settings have been changed, the following settings apply:

ON (Open) time: 1000 ms

OFF (Closed) time: 1000 ms

Number of Cycles: 10,000

See Section 6.3.2 for more information on these settings.

3) Press the Stop button. The SH05 shutter closes. The Active and Open LEDs are extinguished.

5.3 Changing and Saving Parameter Settings

When the Kinesis Server is run up, suitable default settings are loaded and these values have been chosen to proved safe performance in the majority of applications. However, for applications where these settings need to be changed, a new set of Device Start Up settings', must be created which can then be applied and/or uploaded on subsequent start up. See the *Kinesis Helpfile* for more details.

5.4 Creating a Simulated Configuration

The Kinesis Simulator utility can be used to set up simulated hardware configurations. In this way it is possible to create any number and type of simulated (virtual) hardware units in order to emulate a set of real hardware. This is a particularly useful feature, designed to assist in learning how to use the software and as an aid to developing custom software applications ‘offline’.

Any number of 'virtual' control units can be combined to emulate a collection of physical hardware units For example, an application program can be written, then tested and debugged remotely, before running with the hardware.

Please see the Kinesis Simulator helpfile (Start/All Programs/Thorlabs/Kinesis/ Kinesis Simulator Helpfile) for more information.

Chapter 6 Software Reference

6.1 Introduction

This chapter gives an explanation of the parameters and settings accessed from the Kinesis software running on the PC.

6.2 GUI Panel

The following screen shot shows the graphical user interface (GUI) displayed when accessing the Solenoid Controller K-Cube using the Kinesis software.

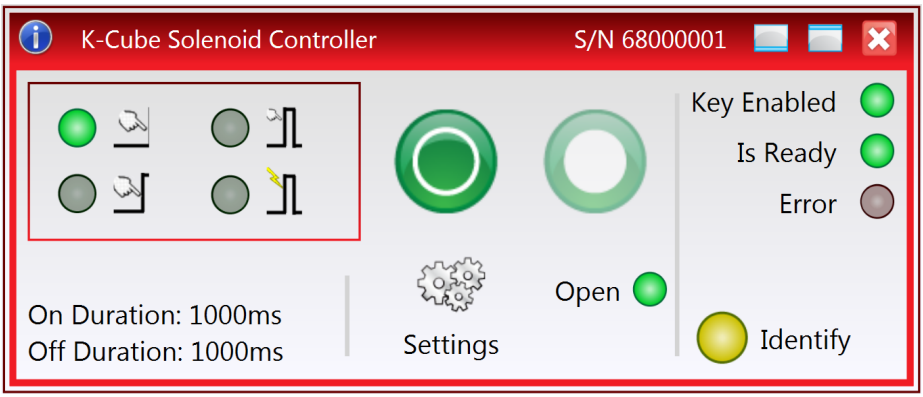
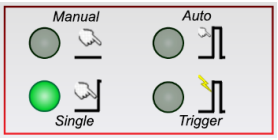


Fig. 6.1 Solenoid Controller K-Cube Software GUI

Note

The serial number of the Solenoid Controller K-Cube associated with the GUI panel is displayed in the top right hand corner. This information should always be provided when requesting customer support.

Mode Buttons - these buttons set the operating mode of the unit as follows.



Note. The captions for each mode are not displayed on the GUI, and are provided here for reference only. However, hovering the mouse over a particular button on the GUI will generate a pop up window stating its function.

Manual - In this mode, operation of the solenoid is via the top panel wheel, or by the buttons on the GUI panel.

Single - In this mode, the solenoid will open and close each time the top panel wheel is moved, or the 'Output ON' button on the GUI panel is clicked. The ON and OFF times are entered in the 'Settings' panel - see Section 6.3

Auto - In this mode, the solenoid will open and close continuously after the top panel wheel is moved, or the 'Output ON' button on the GUI panel is clicked. The ON and OFF times, and the number of cycles performed, are those entered in the 'Settings' panel - see Section 6.3

Triggered - In Triggered mode, a rising edge (logic high) on rear panel TRIG IN BNC input will open the shutter, which will remain open until a falling edge (logic low) is detected. In this way, the shutter can be opened and closed in relation to the duty cycle of the trigger input signal. The unit must be primed (i.e. the top panel wheel has been moved up) before the unit can respond to the external trigger.

Close and Open Buttons - when manual mode is selected, these buttons are displayed to close/open the solenoid. When the solenoid is open, the associated Open LED Open is lit.



Stop and Start Buttons - when Single, Auto or Triggered mode is selected, these buttons are displayed to stop and start the solenoid sequence. When the Start button is pressed, the Active LED Active is lit. When the solenoid is open, the Open LED Open is lit.



Cycle Parameters - the present setting for the On and OFF times.

These settings can be adjusted as described previously, or by clicking the Settings button to display the settings window, see Section 6.3.2

On Duration: 1000ms
Off Duration: 1000ms

Key Enabled - Lit when the key-operated enable switch is turned on.

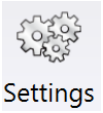
Key Enabled

Is Ready - Lit when the unit is ready for use.

Is Ready



Identify - when this button is pressed, the ACTIVE LED on the front panel of the associated hardware unit will flash for a short period.



Settings - Displays the 'Settings' panel, which allows the operating parameters to be entered for the motor drive - see Section 6.3

6.2.1 Keyboard Shortcuts

Certain functionality can also be accessed via PC keyboard shortcuts as follows:

Jog Forwards	'Ctrl' + 'F', 'Ctrl' + '+'
Jog Backwards	'Ctrl' + 'B', 'Ctrl' + '-'
Home	'Ctrl' + 'H', 'Ctrl' + 'Home'
Stop	'Ctrl' + '0'
Forward1	'LeftCtrl' + '1' (Hold to move)
Forward2	'LeftCtrl' + '2' (Hold to move)
Forward3	'LeftCtrl' + '3' (Hold to move)
Forward4	'LeftCtrl' + '4' (Hold to move)
Backward1	'RightCtrl' + '1' (Hold to move)
Backward2	'RightCtrl' + '2' (Hold to move)
Backward3	'RightCtrl' + '3' (Hold to move)
Backward4	'RightCtrl' + '4' (Hold to move)
GoTo	'Enter' (On target position box)

6.3 Settings Panel

When the 'Settings' button on the GUI panel is clicked, the 'Settings' window is displayed. This panel allows operation parameters e.g. On and OFF times, to be modified. Note that all of these parameters have programmable equivalents (refer to the *Kinesis Server helpfile* for further details.

6.3.1 Persisting Settings to Hardware

Many of the parameters that can be set for the Solenoid Driver K-Cube can be stored (persisted) within the unit itself, such that when the unit is next powered up these settings are applied automatically. This is particularly important when the driver is being used manually in the absence of a PC and USB link. The Trigger and Mode parameters described in the following sections are good examples of settings that can be altered and then persisted in the driver for use in absence of a PC. To save the

settings to hardware, check the '*Persist Settings to the Device*' checkbox before clicking the 'OK button.

Caution

The 'Persist Settings' functionality is provided to simplify use of the unit in the absence of a PC. When the unit is connected to a PC and is operated via the Kinesis software, the default settings will be loaded at boot up, even if the 'Persist Settings' option has been checked.

6.3.2 Settings Tab

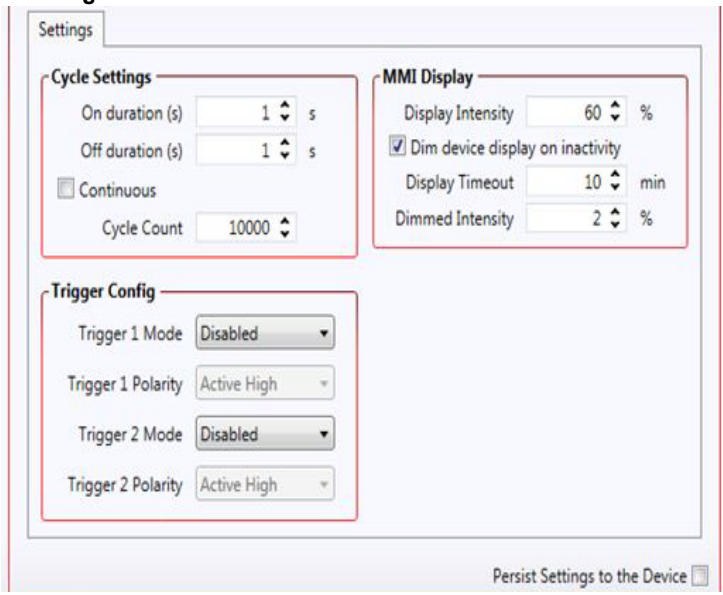


Fig. 6.2 Solenoid Controller - Settings

Auto Mode Settings

On duration (ms) - The time which the solenoid is activated (i.e. the shutter/ solenoid is open) 100 ms to 10000 ms in 1 ms steps.

Off duration (ms) - The time which the solenoid is de-activated (i.e. the shutter/ solenoid is closed) 100 ms to 10000 ms in 1 ms steps.

Cycle Count - The number of Open/Close cycles (0 to 1,000,000) to perform when the unit is operating in 'Auto' mode. If set to '0' the unit cycles indefinitely.

Note

If operating in 'Triggered' mode with the *Number of Cycles* parameter set to '0', then the solenoid ON and OFF times are defined respectively by the HIGH and LOW values of the trigger pulse.

Persist Settings to Hardware

The parameters described above, together with the 'Mode' parameter set via the GUI panel, can be stored (persisted) within the unit itself, such that when the unit is next powered up these settings are applied automatically. This is particularly important when the unit is being used manually in the absence of a PC and USB link. To save the settings to hardware, check the 'Persist Settings to Hardware' checkbox before clicking the 'OK button.

MMI Display

In certain applications, it may be necessary to adjust the brightness of the LED display on the top of the unit. The brightness is set in the *Display Intensity* parameter, as a value from 0 (Off) to 100 (brightest). The display can be turned off completely by entering a setting of zero, however, pressing the MENU button on the top panel will temporarily illuminate the display at its lowest brightness setting to allow adjustments. When the display returns to its default position display mode, it will turn off again.

Furthermore, 'Burn In' of the display can occur if it remains static for a long time. To prevent this, the display is automatically dimmed after the time interval specified in the *Display Timeout* parameter has elapsed. The time interval is specified in minutes in the range 1 to 480. The dim level is set in the *Dimmed Intensity* parameter, as a percentage of full brightness from 0 (Off) to 10 (brightest) but is also limited by the *Display Intensity* parameter if this is lower. These settings are only visible and active if the *Dim device display on inactivity* box is checked.

Triggering Introduction

The K-Cube solenoid controllers have two trigger ports that can be used to read an external logic signal or output a logic level to control external equipment. TRIG1 is preconfigured as an input and TRIG2 as an output. The active logic state can be selected High or Low to suit the requirements of the application. Electrically, TRIG2 outputs a 5 Volt logic signal and TRIG1 is designed to be driven from a 5 Volt logic.

In the input mode, the logic levels are TTL compatible, i.e. a voltage level less than 0.8 Volt will be recognized as a logic LOW and a level greater than 2.4 Volt as a logic HIGH. The input contains a weak pull-down, so the state of the input with nothing connected will default to a logic LOW.

The output provides a push-pull drive of 5 Volts, with the maximum current limited to approximately 8 mA. The current limit prevents damage when the output is accidentally shorted to ground or driven to the opposite logic state by external circuity.

Warning: do not drive the TRIG ports from any voltage source that can produce an output in excess of the normal 0 to 5 Volt logic level range. In any case the voltage at the TRIG ports must be limited to -0.25 to +5.25 Volts.

Trigger Mode

The mode of the trigger port is specified in the *Trigger 1 Mode* and *Trigger 2 Mode* parameters as follows:

Disabled - The trigger is disabled.

Input - The IO port is set as a trigger input.

Output - The IO port is set as a trigger output.

Trigger Polarity

The polarity of the trigger pulse is specified in the *Trigger 1 Polarity* and *Trigger 2 Polarity* parameters as follows:

Active High - The active state of the trigger port is logic HIGH 5 V (trigger input or output on a rising edge).

Active Low - The active state of the trigger port is logic LOW 0 V (trigger input or output on a falling edge).

Persist Settings to Hardware - Many of the parameters that can be set for the Solenoid Driver K-Cube can be stored (persisted) within the unit itself, such that when the unit is next powered up these settings are applied automatically. This is particularly important when the driver is being used manually in the absence of a PC and USB link. The trigger parameters described here are good examples of settings that can be altered and then persisted in the driver for use in absence of a PC. To save the settings to hardware, check the 'Persist Settings to Hardware' checkbox before clicking the 'OK button.

Caution

The 'Persist Settings' functionality is provided to simplify use of the unit in the absence of a PC. When the unit is connected to a PC and is operated via the Kinesis software, the default settings will be loaded at boot up, even if the 'Persist Settings' option has been checked.

Appendix A Rear Panel Connector Pinout Details

A.1 Rear Panel SOLENOID Connector

The ‘SOLENOID’ connector provides connection to the shutter, or other solenoid actuated device. The pin functions are detailed in Fig. A.1.



Pin	Description
1	Opto Anode (12 V limited to 20mA)
2	Shutter Coil 15 V Pulse, 10 V steady state (0.4A max)
3	Shutter Coil Ground (When ON) Open CCT (When OFF)
4	Opto Cathode Ground
5	Opto Emitter Ground
6	Opto Collector (2.5 V)

Fig. A.1 SOLENOID Connector Pin Identification

A.2 TRIG IN and TRIG OUT Connectors

The rear panel provides two SMA outputs for use in triggering applications. The TRIG IN is a 5 V TTL type input. The TRIG OUT is an open collector, pulled up to 5 V.

Appendix B Preventive Maintenance

Warning

The equipment contains no user serviceable parts. There is a risk of electrical shock if the equipment is operated with the covers removed. Only personnel authorized by Thorlabs Ltd and trained in the maintenance of this equipment should remove its covers or attempt any repairs or adjustments. Maintenance is limited to safety testing and cleaning as described in the following sections.

B.1 Safety Testing

PAT testing in accordance with local regulations, should be performed on a regular basis, (typically annually for an instrument in daily use).

B.2 Cleaning

Warning

Disconnect the power supply before cleaning the unit.

Never allow water to get inside the case.

Do not saturate the unit.

Do not use any type of abrasive pad, scouring powder or solvent, e.g. alcohol or benzene.

The fascia may be cleaned with a soft cloth, lightly dampened with water or a mild detergent.

Appendix C Specifications and Associated Parts

C.1 Specifications

Parameter	Value
Maximum Exposure Rate	20 Hz
Minimum Exposure Time	15 ms
Typical Transfer Time	1.5 ms
Accuracy	0.3 ms (at 15 ms exposure)
On/Off Times	10 ms to 1000 s
Maximum steady state power	3.5 W
Hold voltage range	6.5 to 7.5 Average Volts PWM
Voltage Output	15 V Max (7 V Average PWM Hold)
Trigger Input/Output	TTL
Output Enable	Key Switch and Interlock Jack Plug
Operating Modes	
Manual	User Controlled On/Off
Single	DSP Controlled Single On/Off Cycle
Auto	DSP Controlled Multiple On/Off Cycles
Triggered	Externally Triggered On/Off
TRIG 1	Trigger Input, SMA, TTL Type 5V
TRIG 2	Trigger Output, SMA, TTL Type 5V
Output (6 Way Hirose)	
Solenoid Drive	15 V Pulse (10 V Hold)
Position Sensor Feedback	Photodiode
Input Power Requirements	
Voltage	15 V Regulated DC
Current	1A Peak, 300mA Steady State
General	
Housing Dimensions (W x D x H)	60 x 60 x 47 mm (2.4" x 2.4" x 1.8")
USB Connector Type	USB 3.0
USB Connection Speed	USB 1.1 Full Speed (12 Mbps)
Instrument Weight	160 g (5.5 oz)

C.2 Associated Products

Product Name	Part Number
3-Channel K-Cube Controller USB Hub	KEH3[a]
6-Channel K-Cube Controller USB Hub	KEH6[b]
Single Way Power Supply	KPS201[c]
1/2” Shutter	SH05
1” Shutter	SH1

a. The previous-generation KCH301 3-Channel K-Cube Controller USB Hub is also compatible.
b. The previous-generation KCH601 6-Channel K-Cube Controller USB Hub is also compatible.
c. The previous-generation KPS101 power supply is also compatible.

Appendix D Regulatory

D.1 Declarations Of Conformity

D.1.1 For Customers in Europe

See Section D.2

D.1.2 For Customers In The USA

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

Changes or modifications not expressly approved by the company could void the user's authority to operate the equipment.

D.2 CE Certificate

EU Declaration of Conformity

Manufacturer: Thorlabs LTD

Address: 204 Lancaster Way, Ely, CB6 3NX

We hereby declare under our sole responsibility that:

Product: **KSC101**

Product description: **K-Cube Solenoid Controller.**

is/are in conformity with the following directive(s):

2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2014/35/EU	Low Voltage Directive (LVD)
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS), including 2015/863

and (harmonized) standards / technical specifications :

EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010 + A1:2019 + AC:2019
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	2018

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications and complies with all applicable Essential Requirements of the Directives.

Signed: Keith Dhese

Name: Keith Dhese *On:* 6/24/2024

Position: General Manager

CE

Appendix E 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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