

# Filter Wheel Keypad Operation Manual

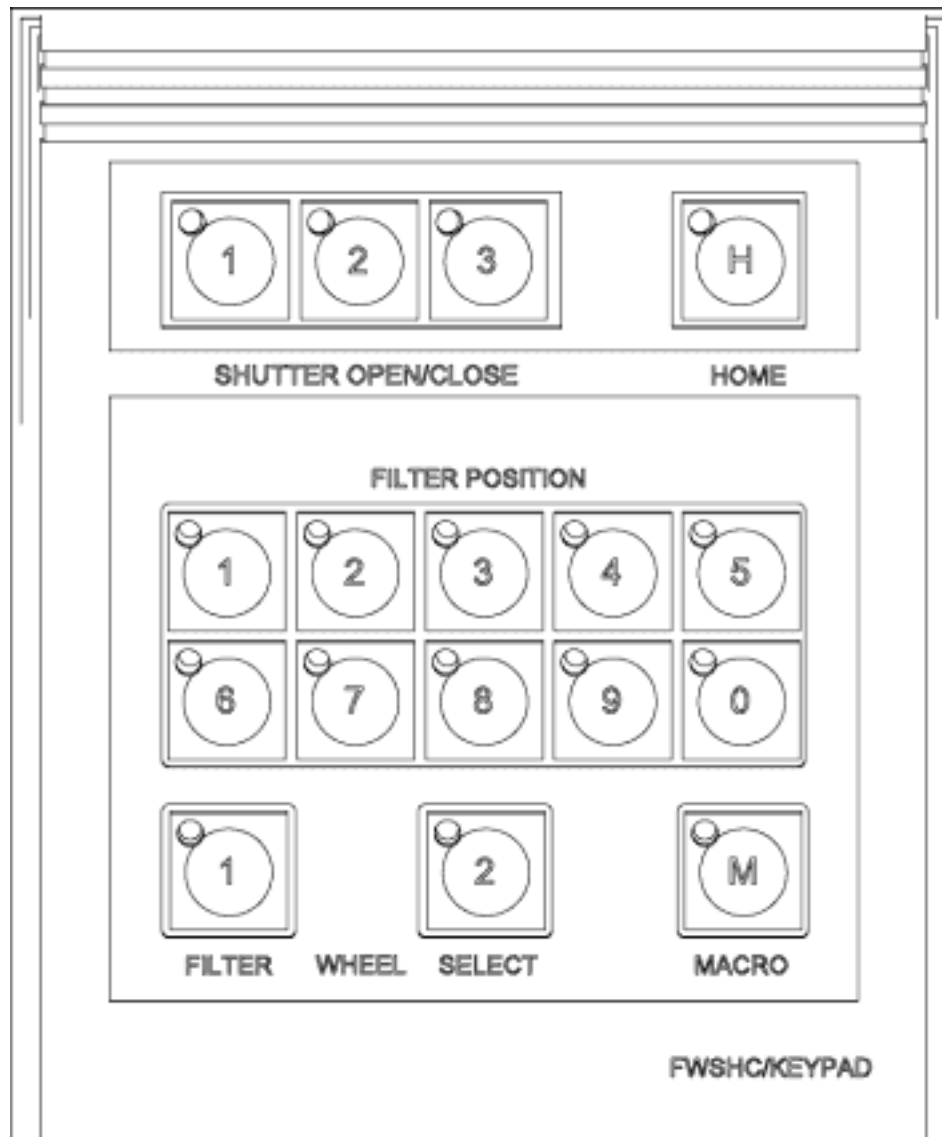




# Contents

<b>Contents .....</b>	<b>1</b>
<b>1.0 Keypad Layout .....</b>	<b>2</b>
<b>1.1 Key &amp; LED Functions .....</b>	<b>3</b>
<b>2.0 General.....</b>	<b>3</b>
<b>3.0 Power-up.....</b>	<b>3</b>
<b>4.0 Operating Modes.....</b>	<b>4</b>
<b>4.1 Normal Mode.....</b>	<b>4</b>
<b>Shutter controls.....</b>	<b>4</b>
<b>Filter wheel controls .....</b>	<b>4</b>
<b>Macros.....</b>	<b>5</b>
<b>4.2 Macro Execution .....</b>	<b>5</b>
<b>4.3 Macro Learn Mode .....</b>	<b>5</b>

## 1.0 Keypad Layout



## **1.1 Key & LED Functions**

<b>KEY</b>	<b>KEY FUNCTION</b>	<b>LED FUNCTION</b>
SH1	Shutter 1 Control	On -Shutter Open, Off -Closed
SH2	Shutter 2 Control	On -Shutter Open, Off -Closed
SH3	Shutter 3 Control	On -Shutter Open, Off -Closed
Home	Home Position Control	On -Controller Busy, Off -Not Busy
1	Filter Position 1 Control	On -Wheel 1, Blink Wheel 2
2	Filter Position 2 Control	On -Wheel 1, Blink Wheel 2
3	Filter Position 3 Control	On -Wheel 1, Blink Wheel 2
4	Filter Position 4 Control	On -Wheel 1, Blink Wheel 2
5	Filter Position 5 Control	On -Wheel 1, Blink Wheel 2
6	Filter Position 6 Control	On -Wheel 1, Blink Wheel 2
7	Filter Position 7 Control	On -Wheel 1, Blink Wheel 2
8	Filter Position 8 Control	On -Wheel 1, Blink Wheel 2
9	Filter Position 9 Control	On -Wheel 1, Blink Wheel 2
10	Filter Position 10 Control	On -Wheel 1, Blink Wheel 2
FIL1	Filter Wheel 1 Control	On -Wheel 1 Controller
FIL2	Filter Wheel 2 Control	On -Wheel 2 Controller
Macro	Macro Mode Control	On -Macro Mode, Blink Macro Learn Mode

## **2.0 General**

Compatible with stepper motor and DC servo filter wheels, the keypad serves to indicate the current state of the filter wheels and shutters as well as providing a convenient means to control the positions of the wheels and shutters.

The filter wheel keypad connects to the MAC 5000/6000 keypad connector located on the rear of the 73005042/73006042 communication module. Once connected, the filter wheel keypad can be used simultaneously with other application software connected to either or both the USB and RS-232 communication ports.

The minimum MAC 5000/6000 system configuration must include a 73005042/73006042 interface module and either a 73005080/73006080 stepper motor filter/shutter controller or a 73005081/73006081 DC servo filter/shutter controller module. The filter wheel keypad will only recognize a single filter/shutter controller module located at address 17(default). The filter wheel keypad will automatically sense the filter wheel type and the number of filter positions on each wheel. Shutters cannot be automatically detected, but are assumed to be present.

## **3.0 Power-up**

On power-up the system flashes all the Keypad LEDs waiting 22 seconds before opening communication with the filter wheel controller. The Home LED will be on during this interval.

- If the filter wheel controller is not found the Home LED remains on and the beeper will sound 3 times.
- If the controller is present, the Home LED will turn off.

The Home LED functions to indicate that the system is busy and whenever there is communication activity between the controller and the Keypad.

Once the power-up initialization process is complete, the keypad will indicate the shutter and filter wheel position status with updates every 250ms. The keypad will now enter the Normal Mode.

## 4.0 Operating Modes

### 4.1 Normal Mode

In normal mode the keys have the following functions.

- To use the alternate functions hold the key down for more than 4 seconds.

KEY	NORMAL KEY FUNCTION	ALTERNATE KEY FUNCTION
SH1	Toggle the current state of Shutter 1	Toggles the AutoClose Mode on Shutter1
SH2	Toggle the current state of Shutter 2	Toggles the AutoClose Mode on Shutter2
SH3	Toggle the current state of Shutter 3	
Home	Move both filter wheels to position 1	
1	Move the current filter wheel to position 1	
2	Move the current filter wheel to position 2	
3	Move the current filter wheel to position 3	
4	Move the current filter wheel to position 4	
5	Move the current filter wheel to position 5	
6	Move the current filter wheel to position 6	
7	Move the current filter wheel to position 7	
8	Move the current filter wheel to position 8	
9	Move the current filter wheel to position 9	
10	Move the current filter wheel to position 10	
FIL1	Puts the Keypad in Filter Wheel 1 Control	
FIL2	Puts the Keypad in Filter Wheel 2 Control	
Macro	Puts the Keypad in to Macro Mode	Puts the Keypad in to Macro Learn Mode

*If an invalid key is pressed (such as position 7 for a 6 position filter wheel), a long (250ms) error beep will sound.*

#### Shutter controls

Pressing either of the shutter control keys (SH1, SH2, SH3) will toggle the state of the shutter. If the shutter is open, it will close and conversely, if it is closed it will open. The LED indicates the state of the shutter, when lit the shutter is in the OPEN state.

The shutter controls for shutter 1 and 2 have an alternate function. When the SH1 or SH2 keys are held for 4 seconds the auto-close mode is toggled for the respective shutter. When auto-close is active, the shutter will automatically close when the filter wheel is changed. Shutter 1 is synchronized with filter wheel 1 while shutter 2 is synchronized with filter wheel 2.

#### Filter wheel controls

The numeric keys 1-10 provide random access control for filter positioning. The FIL1, FIL2 and Macro keys determine whether the control is targeted to filter wheel 1, filter wheel 2 or a

combination of targets through macro programming (see section 4.2) . When the selected target is enabled, the LED will be lit.

## Macros

The keypad has the capability of recording macros which can be used to either group together filter/shutter changes or to create a sequence of specific filter/shutter combinations to be executed in sequence.

### 4.2 Macro Execution

In Macro Mode the MACRO LED will light and keys will have the following functions. If a macro is not present the buzzer will sound the Error Tone.

- To use the alternate functions hold the key down for more than 4 seconds.

KEY	NORMAL KEY FUNCTION	ALTERNATE KEY FUNCTION
SH1	Toggles the current state of Shutter 1	Toggles the AutoClose Mode on Shutter1
SH2	Toggles the current state of Shutter 2	Toggles the AutoClose Mode on Shutter2
SH3	Toggles the current state of Shutter 3	
Home	Resets the following Macro to the beginning of its sequence	
1	Runs Macro 1	
2	Runs Macro 2	
3	Runs Macro 3	
4	Runs Macro 4	
5	Runs Macro 5	
6	Runs Macro 6	
7	Runs Macro 7	
8	Runs Macro 8	
9	Runs Macro 9	
10	Runs Macro 10	
FIL1	<i>Not Used</i>	
FIL2	<i>Not Used</i>	
Macro	Puts the Keypad in to Macro Mode	Puts the Keypad in to Macro Learn Mode

### 4.3 Macro Learn Mode

The user can define up to 10 macros, each having up to 8 steps. The Macros are stored in the nonvolatile memory of the keypad.

Stepwise macro creation:

- To enter the Macro Learn Mode hold down the **Macro** key until the buzzer confirm beep is heard.
- Once in Macro Learn Mode the **Macro** Led will blink, all position and shutter Leds will be turned off.
- Select one of the numeric keys 1-10. This assigns the Macro number. At this point the Shutter LEDs will blink and the position LEDs will still be turned off. The blinking shutter LEDs indicates the Shutter State is unchanged.
- To change the shutter state, press the shutter key, this will toggle the shutter state.

- To set the filter wheel position, first make sure the current filter wheel is selected with keys **FIL1** and **FIL2** and then press the position keys 1-10.
- Positions and shutters can be changed as many times as you want and will not be stored until the macro step is saved.
- Once you have the current position and shutter state selected press either the **Home** or **Macro** key to save the macro. When the macro step is saved, the state of each shutter and filter wheel will be recorded. If a particular shutter or filter wheel position has not been changed since the last macro step save, the state will *not* be recorded for the particular shutter or filter wheel.
- The **Home** key will save the current state and remain in macro learn mode so that additional steps can be stored to create a multi step sequencing macro.
- The **Macro** key saves the macro and returns you to Normal Mode.
- In a multiple step macro hit the **Macro** key on the last macro state to save the macro and return to Normal Mode.
- It is possible to save a macro step with no position movement and/or shutter change. To do this, just don't hit any position and/or shutter keys before pressing the **Home** or **Macro** key.
- To erase a macro, enter Macro Learn Mode, select the macro number with the position keys 1-10 and then hit the **Macro** key again.

Sample Macro Learn Mode Key Sequence:

- 1) Hold Down **Macro** Key – Enters Macro Learn Mode. **Macro** Led will blink.
- 2) Select Macro Num using Position Keys 1-10 – Shutter LEDs will blink.
- 3) Select desired position and/or shutter state. – Position & Shutter LEDs will represent the current state.
- 4) Save the macro step with **Home** or **Macro** key.
  - Pressing **Macro** will save the macro and return you to Normal Mode.
  - Pressing **Home** will save the macro step and return you to item 3 for the next macro step entry.



# NOTES





Ludl Electronic Products designs and manufactures a wide range of automation accessories for microscopes and instrumentation.

*[www.ludl.com](http://www.ludl.com)*

**Ludl Electronic Products, Ltd.**

171 Brady Avenue  
Hawthorne, NY 10532  
Voice: (888) 769-6111  
Fax: (914) 769-4759

[Support@ludl.com](mailto:Support@ludl.com)  
[Sales@ludl.com](mailto:Sales@ludl.com)