

# User Guide

## USB Solid State RF Switch



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USB-SP4T-63  
1 to 6000 MHz  
Single SP4T switch

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# **Chapter 1 – General Information**

## **1.1 Scope of the User Guide**

This user guide provides general introduction, installation instructions and operating information for Mini-Circuits USB solid state switches.

## **1.2 Warranty**

See Mini-Circuits website <http://www.minicircuits.com/support/ordering.html> for warranty information.

## **1.3 Definitions**

**Note:** A note advises on important information you may need to ensure proper operation of the equipment. There is no risk to either the equipment or the user.

### **CAUTION**

**A caution advises about a condition or procedure which can cause damage to the equipment (no danger to users).**

### **WARNING**

**A warning alerts to a possible risk to the user and steps to avoid it. DO NOT proceed until you are sure you understand the warning.**

## **1.4 General safety precautions**

Please observe the following safety precautions at all times when using Mini-Circuits USB RF switch matrices.

### **WARNING**

**Ensure that all instruments using mains power supply are properly grounded to prevent risk of electrical shock.**

### **CAUTION**

- 1. Do not attempt to switch signals of greater power than the switch is rated for in its datasheet.**
- 2. Safe power input degrades below specified frequency range. Do not input signals below the specified frequency range.**

## **1.5 Introduction**

Mini-Circuits has developed a new solid state USB RF switch. The USB-SP4T-63 is a compact case (2.25" x 1.50" x 0.475") with all power drawn from USB and no moving parts. The switch operates from 1 to 6000 MHz; with high isolation (50 dB typ). The switch is a USB HID devices and is "plug & play," with no driver installation needed. The USB-SP4T-63 can be controlled via the supplied GUI, or most common lab test software using supplied DLLs. Mini-Circuits even provides the command codes for direct control (See programming guide for details)

## 1.6 Service and Calibration

The USB-SP4T-63 does not require any periodic service or calibration. The only user service possible for the switch is external cleaning of the case and connectors as needed. Do not use any detergents or spray cleaning solutions to clean the switch. To clean the connectors use an alcohol solution, and to clean the case a soft, damp cloth.

## 1.7 Contact Information

Mini-Circuits inc.

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General Fax: 1-718-332-4661

Sales / Customer Service Fax: 1-718-934-7092

[sales@minicircuits.com](mailto:sales@minicircuits.com)

For regional offices and tech support see <http://www.minicircuits.com/contact/offices.html>

## 1.8 Technical description

### 1.8.1 Features of Mini-Circuits Switch Matrices

- 1 to 6000 MHz; absorptive solid state switch
- Electronic switching; Isolation 50 dB typ.
- High power handling, 1W
- All RF ports SMA(F)
- Programmable, timed switching sequence as fast as 5 $\mu$ sec between transitions
- Easy GUI installation and operation, simplifies complex switching and timing setups
- USB HID "plug & play" device
- ActiveX com object and .Net class library for use with other software: C++, C#, CVI®, Delphi®, LabVIEW® 8 or newer, MATLAB® 7 or newer, Python, Agilent VEE®, Visual Basic®, Visual Studio® 6 or newer, and more (see programming handbook and application note [AN-49-001](#) for details)
- User friendly Graphical User Interface for any Windows® 32 or 64 bit computer command line support for Linux® computers
- All power via USB

For Additional details, performance data and graphs, outline drawing, ordering information and environmental specifications, see our catalog at:

[http://www.minicircuits.com/products/usb\\_rfspd\\_switches.shtml](http://www.minicircuits.com/products/usb_rfspd_switches.shtml)

### 1.8.2 Intended Applications

Mini-Circuits USB-SP4T-63 switches are intended for indoor use in:

- Lab and test equipment setups for both manual and automated measurements
- Control systems
- Automated switching of signal paths in a complex system

The models can be used by anyone familiar with the basics of electronics measurements or electronic control systems.



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### 1.8.3 Conformity

Mini-Circuits USB-SP4T-63 switches conform to all requirements for the following international standards:

- RoHS – The model complies with EU directive for Restriction of Hazardous Substances for 6 substances.
- USB 2.0 – The model meets the specifications of the Universal Serial Bus Ver. 2.0 communication standard as described by USB-IF.
- USB HID – The model meets the requirements for Universal Serial Bus Human Interface Devices according to USB-IF's Device Class Definition for Human Interface Devices firmware rev. 1.11.

### 1.8.4 Supported Software environments

Mini-Circuits USB-SP4T-63 switches have been tested in the following operating systems:

32 bit systems: Windows 8, Windows 7, Windows Vista, Windows XP Windows 98

64 bit systems: Windows 8, Windows 7, Windows Vista, Linux

The switches will work with almost any software environment that supports ActiveX or .Net including: C++, C#, CVI®, Delphi®, LabVIEW® 8 or newer, MATLAB® 7 or newer, Python, Agilent VEE®, Visual Basic®, AutoIT, Visual Studio® 6 or newer, and more

For more information see the Synthesized Signal Generator [Programming](#) Manual and application note [AN-49-001](#) on our website.

### 1.8.5 Included Accessories and Options

The USB-SP4T-63 is supplied with a 2.6 ft' USB cable and a software CD. For additional details and ordering information, go to

[http://www.minicircuits.com/MCLStore/ModelSearch?search\\_type=info&model=USB-SP4T-63](http://www.minicircuits.com/MCLStore/ModelSearch?search_type=info&model=USB-SP4T-63) .



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## Chapter 2 – Installation and Setup

System requirements for the switch are a computer (Pentium II or better) with support for USB HID. To run the GUI program a Windows operating system for either 32 or 64 bits is also required.

### 2.1 Software Setup

 **If you have had any problems installing the software, we're here to help.**  
Try following these complete step-by-step instructions. If you still experience problems, give us a call at Mini-Circuits Worldwide Technical support. It's (718) 934-4500 or e-mail [apps@minicircuits.com](mailto:apps@minicircuits.com) for North America, or go to [minicircuits.com/contact/worldwide\\_tech\\_support.html](http://minicircuits.com/contact/worldwide_tech_support.html) for other regional numbers and addresses.

2.1.1 **First** save all work in progress and close any other programs that may be running.

2.1.2 **Next**, Insert the *Mini-Circuits* CD into the CD-ROM drive, or download the full CD software from [minicircuits.com](http://minicircuits.com). If installing from files downloaded from the web - unzip the downloaded files to a temporary folder on your desktop or C: drive, then open the file folder you created and double-click the "Install" icon.

2.1.3 **If installation from the CD does not start automatically, run *install.exe*** from the <CD drive> root directory.

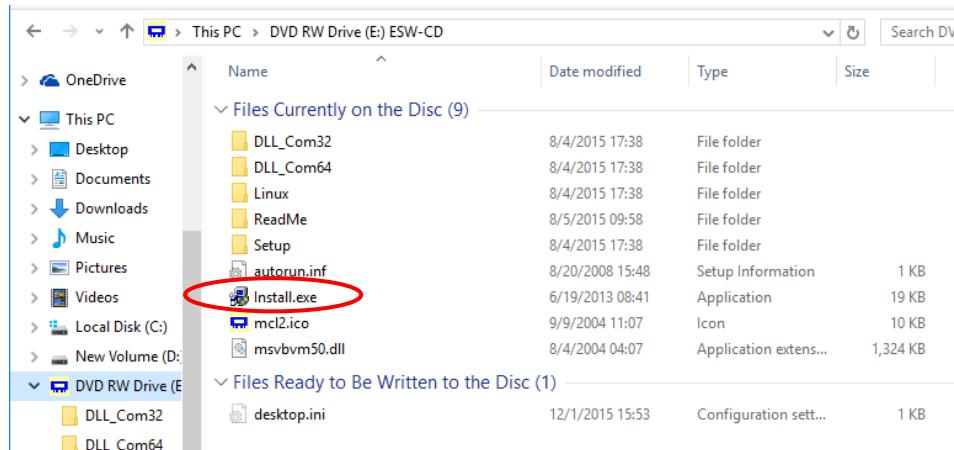


Figure 2.1.3 CD file listing window

## 2.2 Installation

2.2.1 **The installer window** should now appear. Click the “Install Now” button.



Figure 2.2.1 Installation window

2.2.2 **The license agreement** should now appear. To proceed, click “I Agree” and the “Continue” button.

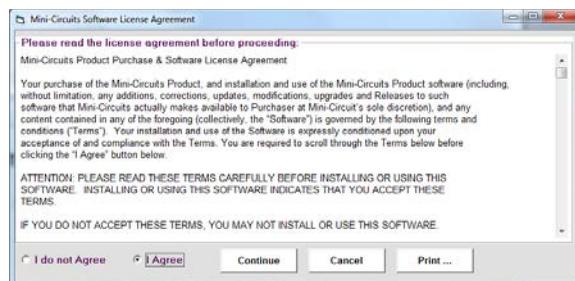


Figure 2.2.2 License agreement

2.2.3 **The installation program will launch.** Click the “OK” button to continue.

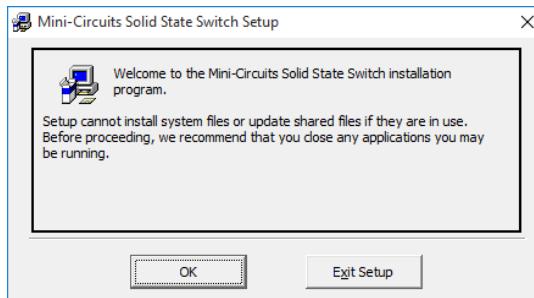
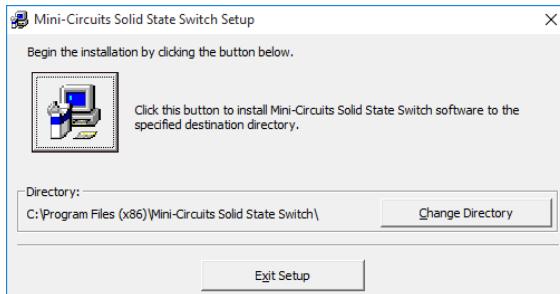


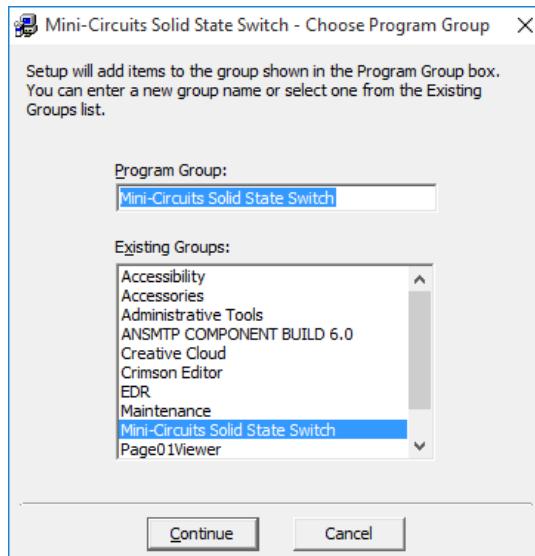
Figure 2.2.3 Installation Program window

**2.2.4 The destination directory window** will appear. At this point it's a good idea to take a second and confirm the full destination address for the software. In most cases, the default will be your computer's hard drive (C:)\Program Files\Mini-Circuits RF Switch Box\. Or Change it then click the large button at the top to continue.



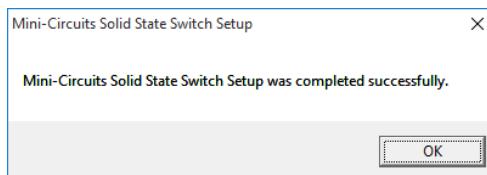
**Figure 2.2.4: Destination Directory window**

**2.2.5 The Program Group window** will appear. This window allows you to select the program group under which the link for the switch controller program in the Start Menu will be created. If you change the Program Group for this software, be sure to record that information together with your destination address. Click on "Continue" to proceed.



**Figure 2.2.5: Program Group Window**

**2.2.6 In a second or two, your installation will be complete.** Click "OK" to close the installer.



**Figure 2.2.6: Installation complete**

## 2.3 **USB-SP4T-63 Physical Setup**

Connect the USB-SP4T-63 to the computer using the provided MUSB-CBL-3+ USB cable or equivalent, then connect the required RF connections.

### CAUTION

**Note the maximum rating power input in the datasheet and the conditions specified for it. Exceeding these values may damage the switch.**



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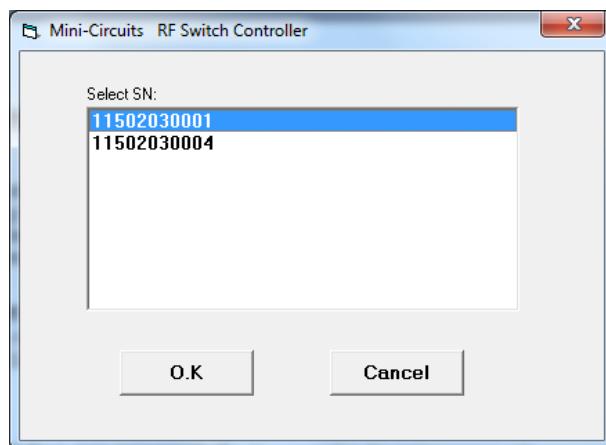
# Chapter 3 – Using Mini-Circuits' USB-SP4T-63

## 3.1 **USB interface**

Mini-Circuits' Solid State Switch controller GUI allows you to set manually the switch state or run a timed sequence of any configuration you can imagine.

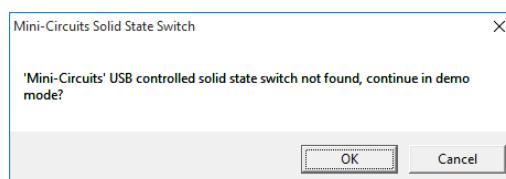
**3.1.1 Go to the Start menu** and select All Programs>Mini-Circuits Solid State Switch (default), or go to the other destination address you selected earlier. The "Mini-Circuits Solid State Switch" icon should be waiting there for you. Click on it and get started!

**3.1.2 If multiple switches are connected** to the computer, the initial screen will show a list of S/N for connected units. Select the unit you wish to start with and click **OK**, or click **Cancel** to exit the program. The program can handle up to 24 units connected *simultaneously*.



**Figure 3.1.2: Unit selection screen**

**3.1.3 If no switch matrices are connected** to the computer via USB, or there is a problem with the power or USB connection of the unit an alert will pop up. Click **OK**, then check the power and USB connections of the unit before trying again.



**Figure 3.1.3: No USB Unit found**

### 3.1.4 Once the GUI is started you can:

- Click on the switch setting you wish to use
- Use the Sequence mode to set a timed switching sequence (see **section 3.2**)
- Select the (fw) indicator to upgrade the firmware (See **section 3.3**)
- Update the unit address by entering an integer in the 1-255 range in the Address field below the S/N and clicking Set.

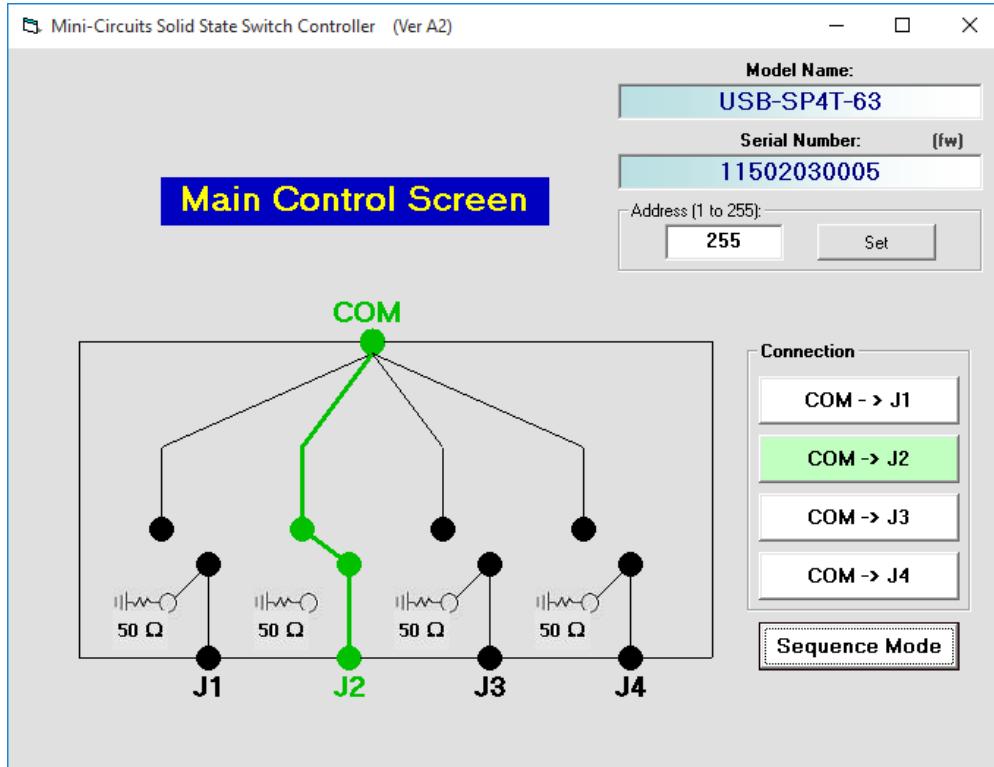


Figure 3.1.4 Main screen

## 3.2 Sequence Mode

USB-SP4T-63 supports a “Sequence Mode” which allows the user to program a timed sequence of switch states. This sequence can either be controlled from the computer or loaded into the switch’s internal microcontroller, allowing very fast switching sequences to be triggered with no further USB communication. The sequence mode is available with Firmware Rev. A3 or greater. See **section 3.3** for details on upgrading firmware.

### 3.2.1 After clicking on the Sequence mode button, the User sequence window will open. The user sequence can be used in two modes

- **PC control** where each command is sent individually with timing controlled by the computer. Minimum dwell time in PC control is 5 msec and the GUI will show an indicator of the current state and number of cycles run.
- **High speed mode** where the entire sequence is sent to the device and timing is controlled by the switch’s internal micro-controller. Minimum dwell time in high speed mode is 5  $\mu$ sec, however no external indication of the switch state is available while the sequence is running and any command sent to the switch will cause it to stop the sequence.

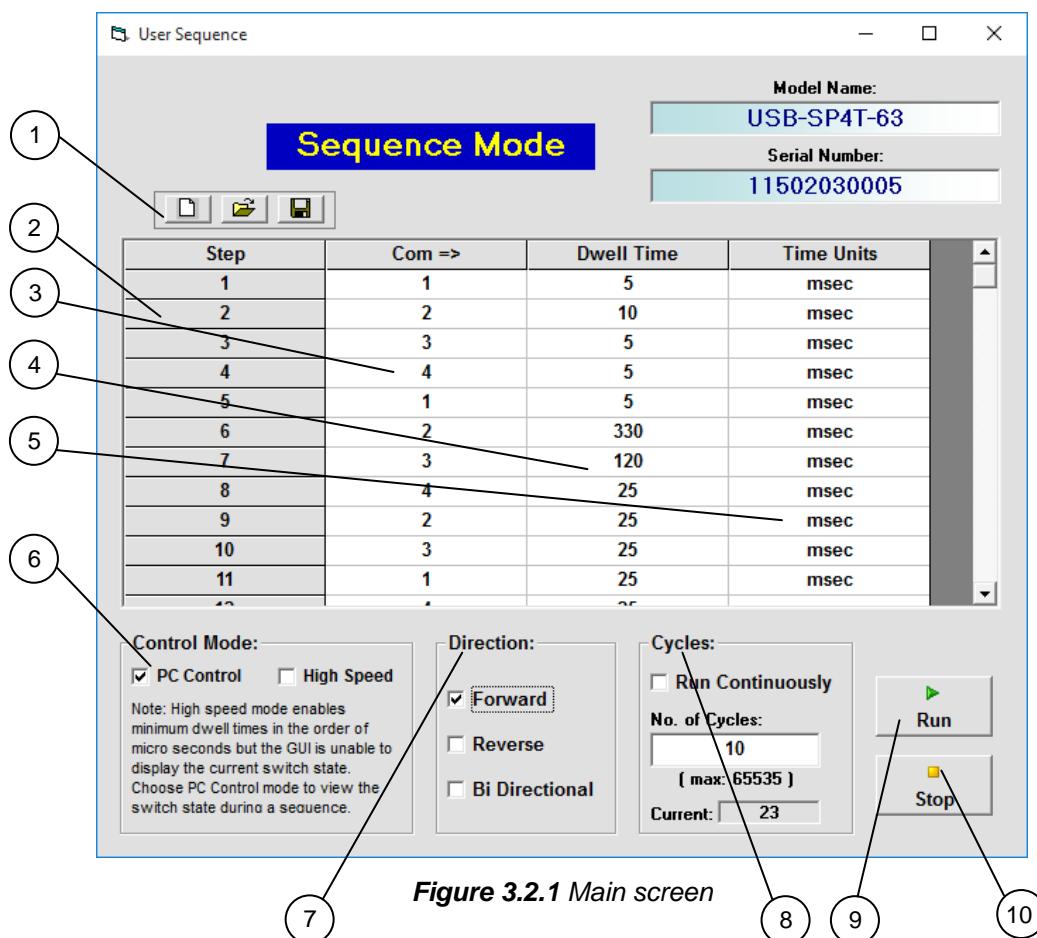


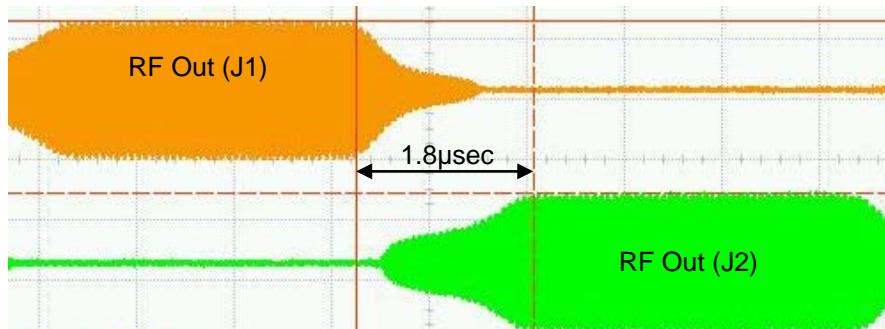
Figure 3.2.1 Main screen

### 3.2.2 The user sequence controls are:

#	Name	Description
1	Icons	Allow clearing a current sequence, opening a previously saved sequence or saving the current sequence.
2	Step	Listing of the step number in the sequence. Up to 100 steps in a sequence are possible.
3	Com =>	The port to which the Com port connects in any given step
4	Dwell Time	The time the switch will hold at each step.
5	Time units	The time units of the dwell time set in each step. The time units can be set independently for each step to seconds, milliseconds or microseconds(available only in high speed mode)
6	Control mode	Select PC control or high speed mode
7	Direction	Select direction the sequence will run. Forward is the sequence as shown, reverse will run the sequence from last step to first and bi-directional will run the sequence from first step to last, then from last step to first.
8	Cycles	Number of cycles to run, can be set from 1 to 65535. If "run continuously" is selected the sequence will keep repeating until stopped.
9	Run	Start running the sequence with the current settings.
10	Stop	Stop the switch in the current setting

3.2.3 **To insert a new step into the middle of a sequence** click on the step number following the desired location and press 'Insert'. To delete a line click on the relevant step number and press 'delete'.

3.2.4 **Regardless of the dwell time set, or which mode the** GUI is in switching time will remain the same.

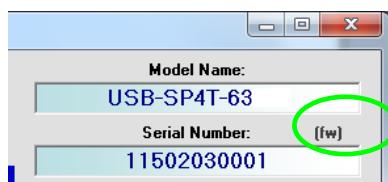


**Figure 3.2.4** Switching time with dwell time=5 $\mu$ sec

### 3.3 *Firmware update*

3.3.1 **All USB-SP4T-63 units are shipped with** the latest available firmware and an update is usually not required. Mini-Circuits occasionally makes firmware update files available as a courtesy to add additional features or correct known issues. Please contact [testsolutions@minicircuits.com](mailto:testsolutions@minicircuits.com) for details.

3.3.2 **Once the switch controller GUI** is installed and started (see chapter 2) you will note an **(fw)** indicator in the upper right corner of the main screen.



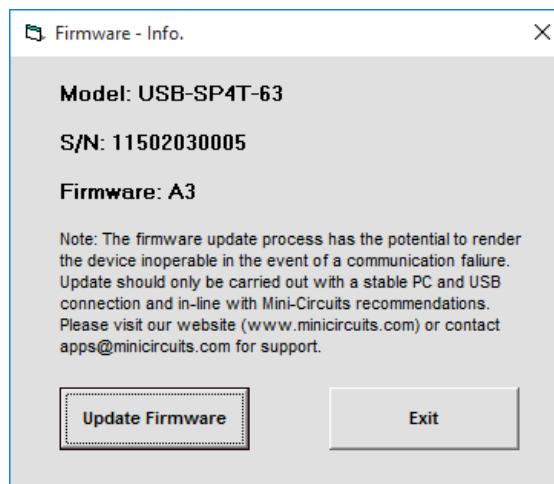
**Figure 3.3.2** Firmware indicator on main screen

3.3.3 **In order to update your switch firmware**, you must have a switch a Windows computer with Mini-Circuits' Switch Controller software installed.

#### CAUTION

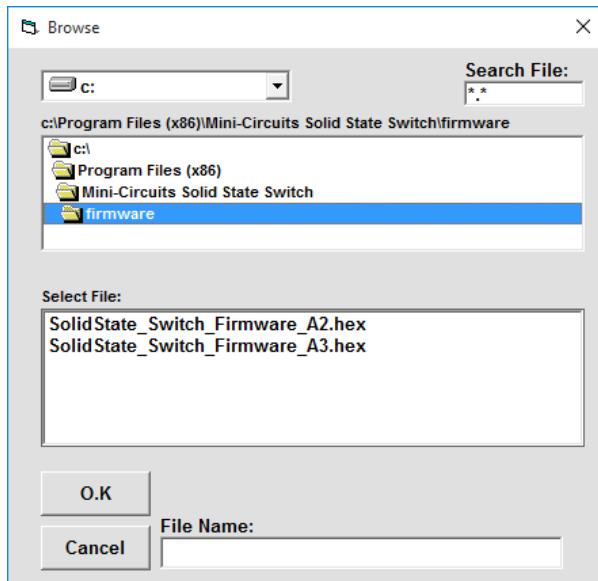
A power interrupt, to either the computer or the switch while the firmware is being updated may cause the firmware to be corrupted. It is therefore recommended to only update the firmware while both the switch and the computer are connected to an Uninterruptable Power Supply (UPS).

3.3.4 **Click on the '(fw)' indicator**, this will cause the firmware - info window to open (See **Fig. 3.3.4**). The 'Firmware' listed is the version of the firmware installed in your switch matrix. Click on "Update Firmware" to select a new firmware version to install or click 'Exit' to close the firmware – info window.



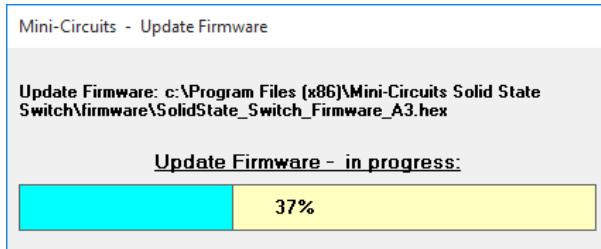
**Figure 3.3.4:** Firmware Information Window

**3.3.5 A browse window will open to the firmware directory** under the path you selected when installing the GUI program (See **Fig. 3.3.5**). Navigate to where you saved your firmware file, Select the firmware version you wish to install and click 'O.K'.



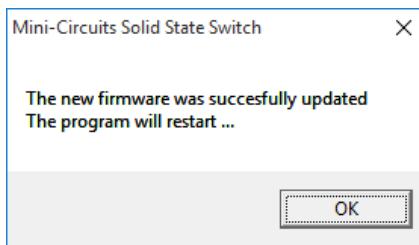
**Figure 3.3.5: Firmware - Browse Window**

**3.3.6 The selected file will be installed in the switch** the process will take up to a minute.



**Figure 3.3.6: Firmware - Progress Bar Window**

**3.3.7 After the firmware has updated** an alert will appear. Click 'OK' to shut down the Switch Controller program and then restart it normally.



**Figure 3.3.7: Firmware - Successful Update**

## Chapter 4 – Revision history

June 25, 2015: Created user guide Rev OR.

January 20, 2016: Updated firmware upgrade section; Added description of new switching sequence function. Rev A



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