User Guide

USB/Ethernet RF Switch Matrices

USB-1SPDT-A18 / RC-1SPDT-A18
DC to 18 GHz
Single SPDT switch

USB-2SPDT-A18 / RC-2SPDT-A18
DC to 18 GHz
Two SPDT switches,
Configurable as: SPDT, DPDT or SP3T

USB-3SPDT-A18 / RC-3SPDT-A18
DC to 18 GHz
Three SPDT switches,
Configurable as: SPDT, DPDT, 3PDT, SP3T,
or SP4T

USB-4SPDT-A18 / RC-4SPDT-A18
DC to 18 GHz
Four SPDT switches,
Configurable as: SPDT, 4PDT, SP3T, SP5T,
Transfer switch and more

USB-8SPDT-A18 / RC-8SPDT-A18
DC to 18 GHz
Eight SPDT switches,
Configurable as: SPDT, SP3T, SP8T, 2x8, dual
Transfer switches and more

USB-1SP4T-A18 / RC-1SP4T-A18
DC to 18 GHz
Single SP4T switch

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Table of Contents

Figure 1: MINI-CIRCUITS USB RF SPDT Switch

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 and Ethernet control RF switch matrices.

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. Ensure the switch matrix air vents are clear** **2. Do not attempt to switch signals of greater power than the switch is rated for in its datasheet.**

1.5 Introduction

Mini-Circuits has developed two series of RF switch matrices, the RC-xxxxx-A18 series capable of USB and Ethernet (HTTP and Telnet protocols) control and the USB-xxxxx-A18 series with just USB control. Both series have SPDT and SP4T switches, like the one shown in *Figure 1.* These switches operate from DC to 18 GHz; all are available in a variety of different configurations with low insertion loss (0.2 dB typ.) and high isolation (85 dB typ). All models are USB HID devices and are "plug & play," with no driver installation needed. Ethernet control in the RC-xxxxx-A18 series allows for both dynamic (DHCP) and static IP. Using the supplied GUI software or most common lab test software you can easily set complex, timed switching sequences using multiple switches with only a single power supply and USB control line, or Ethernet. You can even synchronize other software with the switching sequence. These USB/Ethernet RF switches are light, compact and greatly simplify setting up complex switching sequences.

Using the Ethernet interface the switch matrices can be controlled from any computer with an internet connection, or even your smartphone from almost anywhere!

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1.6 *Service and Calibration*

The USB/Ethernet switch matrix models do not require any periodic service or calibration. The only user service possible for the switch matrix models is external cleaning of the case and connectors as needed. Do not use any detergents or spray cleaning solutions to clean the Switch Matrix. To clean the connectors use an alcohol solution, and to clean the case a soft, damp cloth.

1.7 *Contact Information*

Mini-Circuits inc.
13 Neptune Ave
Brooklyn, NY 11235
Phone: 1-718-934-4500
General Fax: 1-718-332-4661
Sales / Customer Service Fax: 1-718-934-7092
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**

• Capable of 100 million switching cycles

• DC to 18GHz; absorptive failsafe RF switches in break-before-make configuration

• Electromechanical switching; Isolation 85 dB typ.

• High power handling, 10W SPDT, 2W SP4T

• All RF ports SMA(F)

• Easy GUI installation and operation, simplifies complex switching and timing setups

• USB HID "plug & play" device

• For RC-xxxxx-A18 series Telnet and HTTP "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

• User friendly Graphical User Interface for any Windows® 32 or 64 bit computer. command line support for Linux® computers

• For RC-xxxxx-A18 series command line support for any computer with a network connection (HTTP & Telnet protocols)

• 24V_{DC} power adapter included

• Protected by US Patents 5,272,458; 6,414,577; 6,650,210; 7,633,361 and 7,843,289

For specific model features, performance data and graphs, outline drawing, ordering information and environmental specifications, see our catalog at:
http://www.minicircuits.com/products/usb_rfspdt_switches.shtml

1.8.2 Intended Applications

Mini-Circuits USB-xxxxx-A18 and RC-xxxxx-A18 series switch matrices 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.

1.8.3 Conformity

Mini-Circuits USB-xxxxx-A18 and RC-xxxxx-A18 series switch matrices conform to all requirements for the following international standards:

RoHS – The models comply with EU directive for Restriction of Hazardous Substances for 6 substances.

USB 2.0 – The models meet the specifications of the Universal Serial Bus Ver. 2.0 communication standard as described by USB-IF.

USB HID – The models meet 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.

TCP/IP – The RC-xxxxx-A18 series models' Ethernet communication complies with the specifications of the Transmission Control Protocol (TCP) and Internet Protocol (IP) as defined in RFC 791 and RFC 793.

HTTP – The RC-xxxxx-A18 series models' support all requirements for communicating with the Hypertext Transfer Protocol (HTTP) as defined in RFC 1945.

Telnet – The RC-xxxxx-A18 series models' support all requirements for communicating with the Telnet protocol, as defined in RFC 854.

1.8.4 Supported Software environments

Mini-Circuits USB-xxxxx-A18 and RC-xxxxx-A18 series switch matrices 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 switch matrices 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

Additionally the HTTP and Telnet protocols can operate from almost any computer with a network connection.

For more information see Mini-Circuits programming handbook Introduction and Chapter 2 on our website.

1.8.5 Included Accessories and Options

Accessories Available	USB-1SPDT-A18	USB-2SPDT-A18	USB-3SPDT-A18	USB-4SPDT-A18	USB-8SPDT-A18	USB-1SP4T-A18
Software CD	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge
2.7 ft. USB cable						
24V power adaptor						
Hand Flex RF cable	Available as additional accessories	Available as additional accessories	Available as additional accessories	Available as additional accessories, see spec. for details	Not available as accessory	Not available as accessory
6.8 ft. USB cable					Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details
11 ft. USB cable						
US standard power cord	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge
EU standard power cord						
UK standard power cord						
AUS/China standard power cord						
IL standard power cord						

Accessories Available	RC-1SPDT-A18	RC-2SPDT-A18	RC-3SPDT-A18	RC-4SPDT-A18	RC-8SPDT-A18	RC-1SP4T-A18
Software CD	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge	Included with the model at no extra charge
2.7 ft. USB cable						
5 ft. Ethernet cable						
24V power adaptor						
6.8 ft. USB cable	Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details	Available as additional accessories, see spec. for details
11 ft. USB cable						
US standard power cord	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge	When ordering select one power cord to be included at no extra charge
EU standard power cord						
UK standard power cord						
AUS/China standard power cord						
IL standard power cord						

For additional details and ordering information, click on model P/N at the top of the column.

Chapter 2 – Installation and Setup

System requirements for the switch matrix models are a computer (Pentium II or better) with either support for USB HID or an Ethernet connection, and a power source of 110-220V$_{AC}$ (with socket matching the plug of the power cord selected when ordering the switch matrix). 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 for North America, or go to 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. 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.
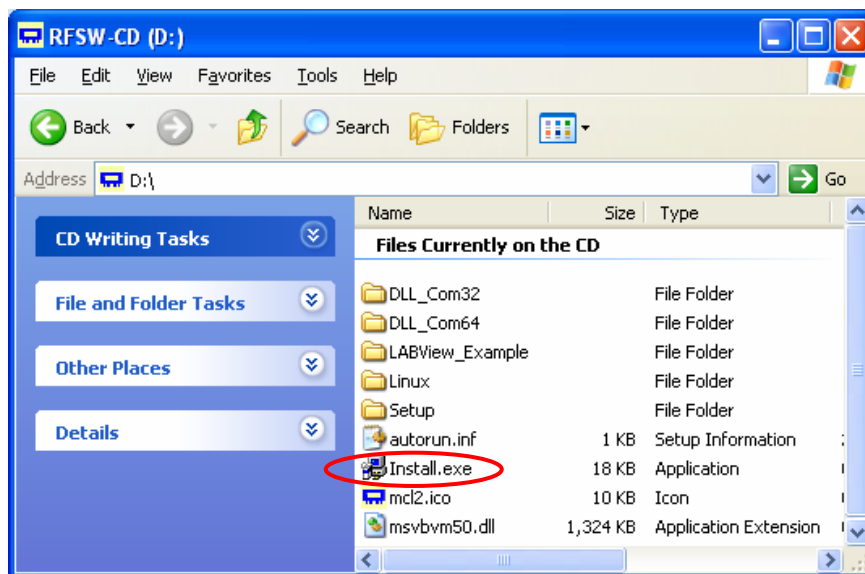

Figure 2.1.3 *CD file listing window*

2.2 **Installation**

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

Figure 2.2.1 *Installation window*

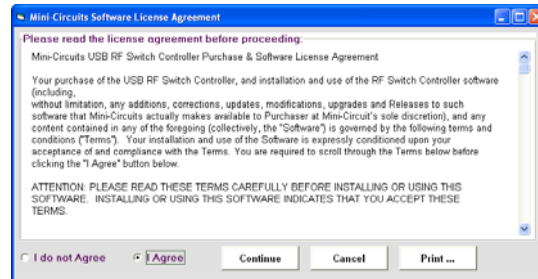2.2.2 ***The license agreement*** should now appear. To proceed, click "I Agree" and the "Continue" button.

Figure 2.2.2 *License agreement*

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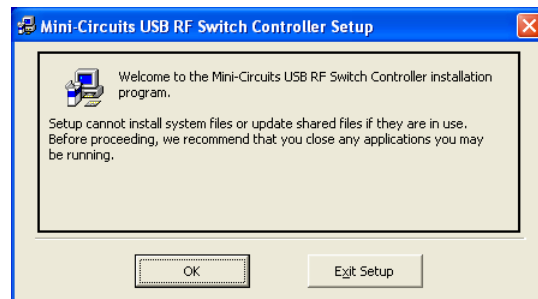

Figure 2.2.3 *Installation Program window*

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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.
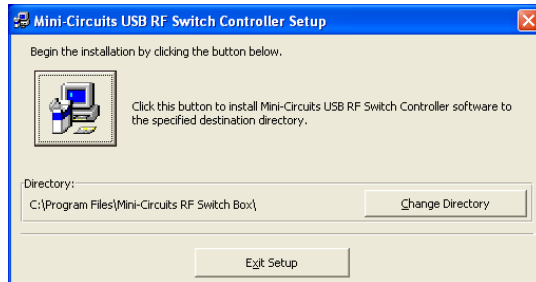

Figure 2.2.4: Destination Directory window

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.
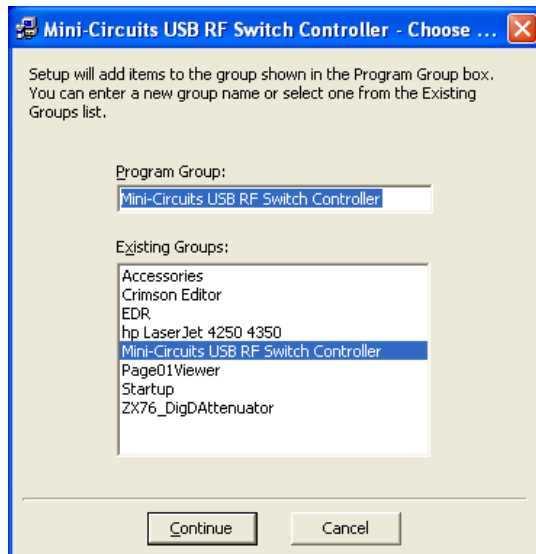

Figure 2.2.5: Program Group Window

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/Ethernet Switch Matrix Physical Setup

2.3.1 **Before** connecting the switch matrix, ensure the power switch is in the OFF position and the control software (either the supplied GUI software or a customer written application) is shut down.

WARNING	**Ensure the wall socket you use to power the switch matrix is intact and connected to a proper ground.**

2.3.2 **Connecting** the switch matrix for USB control:
- -Connect supplied power adapter AC/DC-24-3W1 to mains power supply using the supplied power cord.
- -Connect AC/DC-24-3W1 24V connector to the switch matrix unit 24V power socket.
- -Connect USB cable between switch matrix unit USB port and computer USB port.
- -Note the USB indicator lights up.
- -Turn on the USB/RC switch matrix unit.
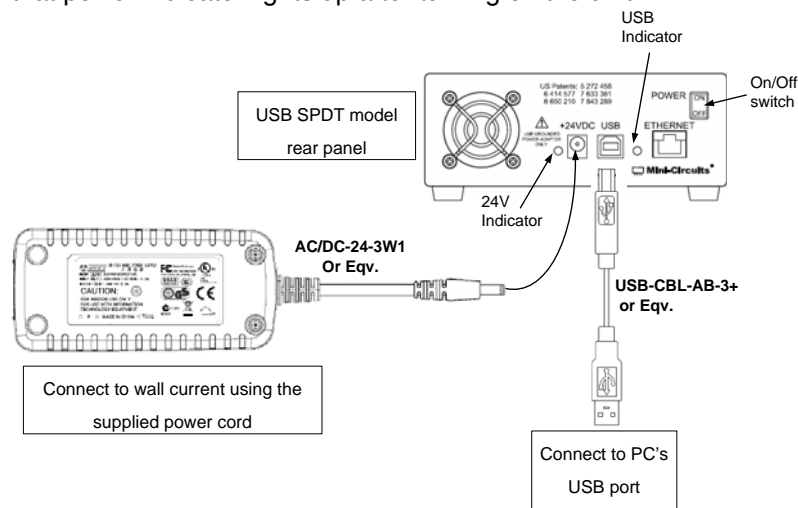- -Note that power indicator lights up after turning on the unit.

Figure 2.3.2a: switch matrix USB control power up setup

Figure 2.3.2b: switch matrix power & USB control connections

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2.3.3 *Connecting* the switch matrix for Ethernet control:

-Connect supplied power adapter AC/DC-24-3W1 to mains power supply using the supplied power cord

-Connect AC/DC-24-3W1 24V connector to USB/ Ethernet switch matrix unit and 24V power socket.

-Connect network cable between switch matrix unit RJ45 socket and suitable network port.

-Turn on the USB/Ethernet switch matrix unit.

-Note that both the power indicator and the right hand network indicator light up in green.

-Once a network connection is established the left hand network indicator will light up intermittently, indicating data transmission.
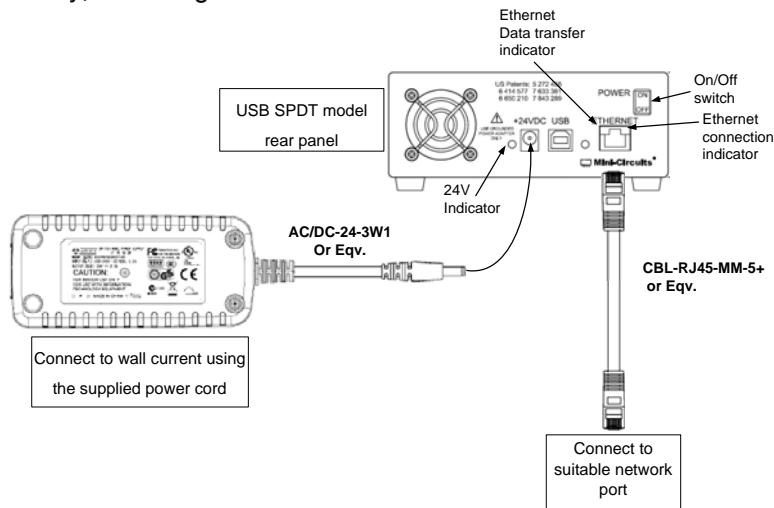

Figure 2.3.3a: switch matrix Ethernet control power up setup

Figure 2.3.3b: switch matrix power & Ethernet control connections

| CAUTION | 1. **Note the maximum rating power input in the datasheet and the conditions specified for it. Exceeding these values may damage the switch matrix.**
2. **Hot switching with power greater than 0.1W may result in reduced switch life.** |

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Note: Changing the Ethernet configuration requires connecting the switch matrix for USB control per section 2.3.2.

2.3.4 ***After the power setup is assembled,*** connect the RF switches in the desired configuration (several preset configuration options are shown in chapter 3), and start the switch controller. Please note that for the SPDT models the RF switches will all initially be in COM->1 state while for SP4T models they'll initially be in DISCONNECT state.

Note: Keep USB/Ethernet switch matrix air vents unobstructed to ensure proper operation of the unit.

2.4 *Controlling the Mini-Circuits Switch Matrix*

Mini-Circuits offers multiple methods of controlling our switch matrices. You can:
- Use the supplied windows program to control the switch matrix via USB (see section 3.1).
- Use the supplied windows program to control the switch matrix via Ethernet (HTTP or Telnet protocols) (see section 3.2).
- Access the switch matrix internal GUI using common web browser software (see section 3.2).
- Use the supplied DLL files to create your own control interface (see Mini-Circuits Programming Handbook for details).
- Use the supplied USB interrupt codes to create your own control interface (See Mini-Circuits Programming Handbook section 2.2 for details).
- Use the commands described in the help file and Mini-Circuits Programming Handbook to control the switch matrix remotely via HTTP or Telnet.

Chapter 3 – Using Mini-Circuits' Switch Matrix

3.1 *USB interface*

Mini-Circuits' GUI Switch controller USB interface allows you to test a wide variety of preset configurations while showing the current state of all switches or running timed sequences of any configuration you can imagine. The switch controller even allows you to run other programs at any point in the timed sequence you select.

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

3.1.2 *The Switch Controller Startup screen will* appear. For USB click on the USB button, for Ethernet control see section *3.2.*
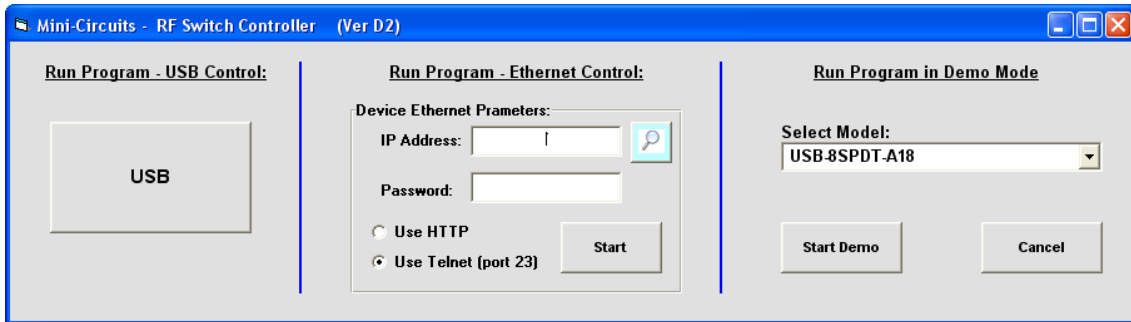

Figure 3.1.2: Switch Controller Startup screen

3.1.3 *If multiple switch matrices are connected* to the computer via USB, 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.*
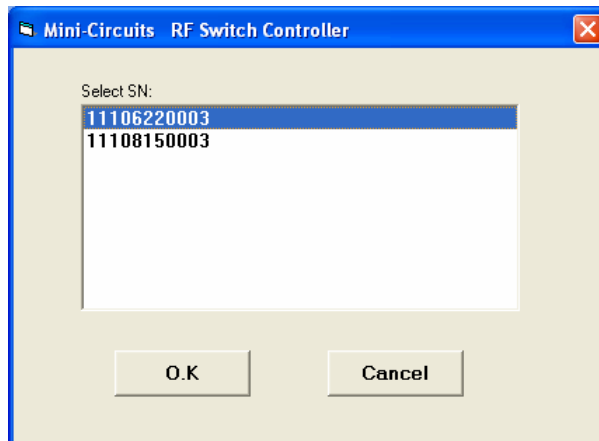

Figure 3.1.2: Unit selection screen

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3.1.4 *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.
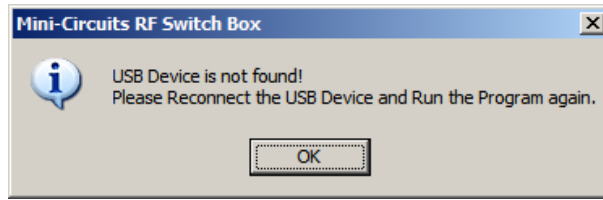

Figure 3.1.3: No USB Unit found

3.1.5 *Once the USB unit is selected* the computer will automatically identify the model type and open the appropriate main screen. See **section 3.3** for details.

3.1.6 *The Ethernet Configuration can* only be accessed from the USB control main screen. Click on the Ethernet-Config button shown in the figure below and the Ethernet configuration screen will appear.

Figure 3.1.5: Ethernet-Config button on USB main screen

3.1.7 *The Ethernet Configuration screen will* open showing the current configuration. Figure 3.1.6 is showing the factory default of the switch matrices. If these settings fit your local network, you do not need to access the setup before connecting the switch matrix to the network.
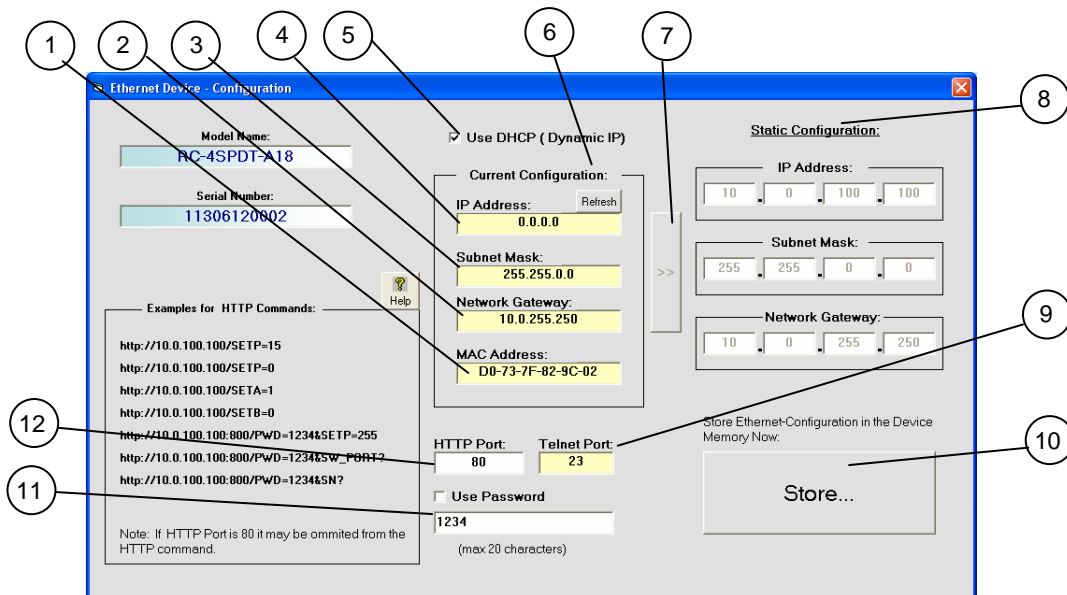

Figure 3.1.6: Ethernet Config. screen (showing factory default state)

Note: If you are using a proxy server for your LAN connections you may need to define a name for the switch matrix IP address, or disable the proxy server to connect to the switch matrix via Ethernet.

3.1.8 *The Ethernet Configuration settings are:*

#	Name	Description
1	MAC Address	Media Access Control Address – a unique, unchanging identifier for the switch matrix unit.
2	Network gateway	IP address of the network gateway. When DHCP is selected this is assigned by the server and will change according to the server.
3	Subnet Mask	The Network's Subnet Mask. When DHCP is selected this is assigned by the server and will change according to the server.
4	IP Address	The IP address of the unit in your Network. When DHCP is selected this is assigned by the server and will change according to the server.
5	Use DHCP	When selected the Switch matrix will query the server for appropriate parameters with no input from the user and will disregard IP Address, Subnet Mask and Network gateway entered manually.
6	Refresh	Request IP address, Gateway and Subnet mask from Server.
7	Copy state	Copies current state of dynamic IP to static IP, not available when DHCP is selected.
8	Static Configuration	When DHCP is not selected the User must specify the values below and will not be changed by the server.
9	Telnet Port	Port to be used for telnet communication. Can not be changed by User
10	Store	After you've made all changes you want to click on this button to save the settings.
11	Password	If you want to limit the users able to access the Switch box select "Use Password" and enter the desired password (up to 20 characters).
12	HTTP Port	Specify the port to use for communications with the Network (default 80). Note Port address does not get assigned by the Server when DHCP is selected. Port 23 is reserved for Telnet communication and cannot be used.

3.1.9 *After making the changes you want, click on "Store"* and the changes
will be saved to the switch matrix's memory. See section 3.2 for working with Ethernet control.

3.2 *Ethernet Interface*
Mini-Circuits provides two Graphical User Interfaces for Ethernet (HTTP) control of the switch matrix and one for Ethernet (Telnet). These interfaces allow you to control the switch matrix remotely from almost any computer connected to a network, or even a smartphone. If the switch matrix is connected to the same network as the computer or smartphone you wish to use to control the switch matrix you can proceed directly to control it as detailed below. In order to control the switch matrix over the internet you will first need to set up a Virtual Private Network(VPN).

3.2.1 A basic GUI interface is programmed into each switch matrix, and can be accessed simply by typing the switch matrix' IP address into the address window of most common browsers (See Figure 3.1.1). This interface is usable from almost any Windows, Mac or Linux computer.
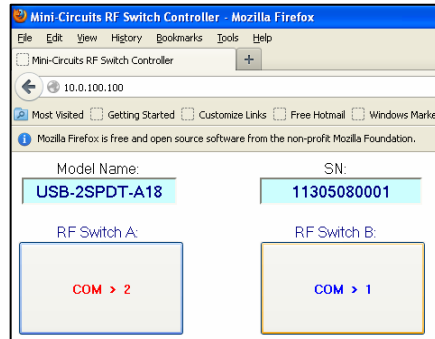

Figure 3.2.1: Web-browser GUI Interface

3.2.2 A more sophisticated interface with options for setting up timed sequences and running external programs at preselected times is available on the switch controller program from the included CD. This program allows communication using either HTTP or Telnet protocols as selected, but requires a Windows Operating system. For installation instructions see chapter 1.

3.2.4 To start the program, go to the Start menu and select All Programs>Mini-Circuits RF USB Switch Controller (default), or go to the other destination address you selected earlier. The "Mini-Circuits RF USB Switch Controller" icon should be waiting there for you. Click on it and get started!

3.2.4 The Switch Controller Startup screen will appear. For USB control see section 3.1, for Ethernet control either type the IP address or click on the search icon next to the IP address field.
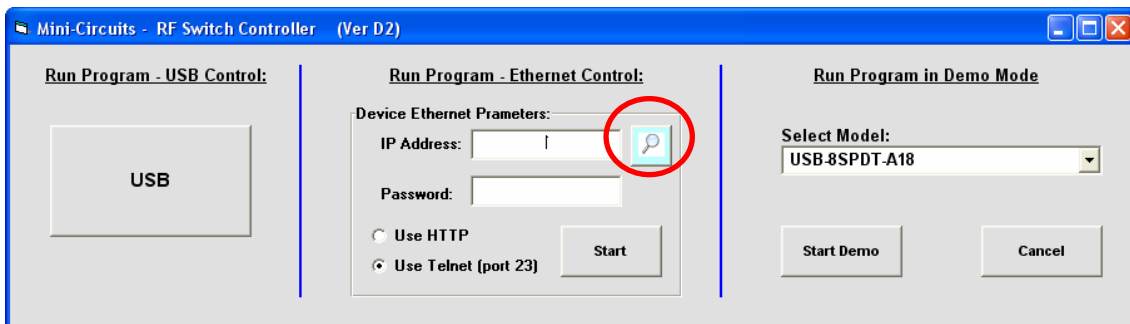

Figure 3.2.4: Switch Controller Startup screen

Note: Depending on the browser used and your network configuration you may need to disable the proxy server for your computer, or add the switch matrix's IP address to the list of addresses in the proxy server.

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3.2.5 **After clicking on the search icon** The IP search will pop up with a list of switch matrix IP addresses found and their HTTP ports on the left side of the screen, and full details of each unit on the right. Mark the IP address you wish to use and click select. The search window will close and the IP address will be entered in the IP address field of the initial screen automatically.
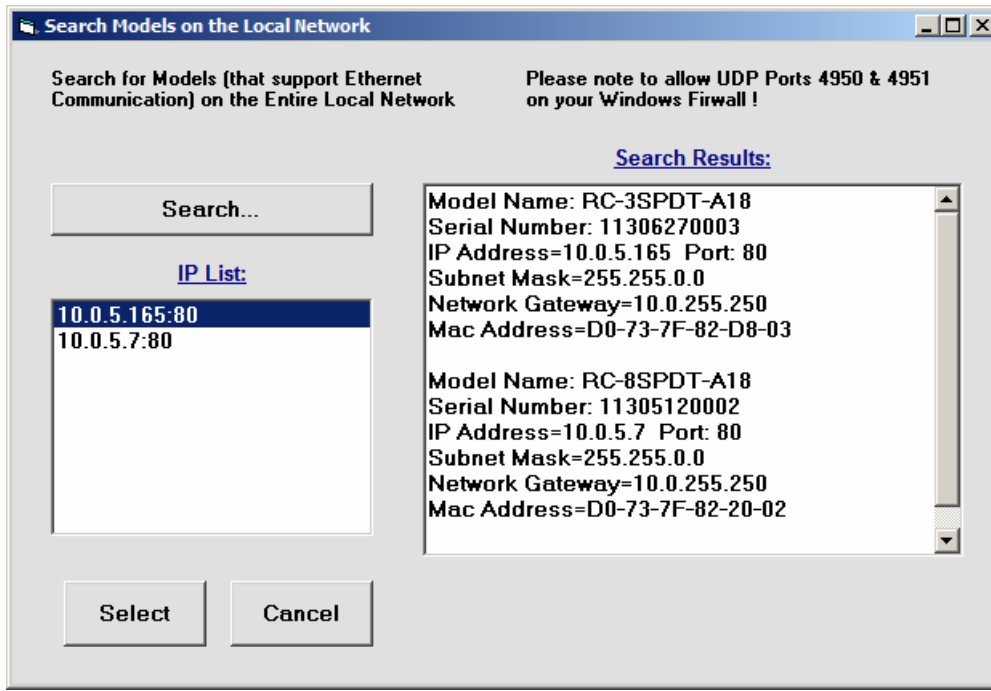

Figure 3.2.5: Ethernet IP search window

Notes:
1) To refresh the list of units found click on the Search button.
2) The search function uses ports UDP 4950 and UDP 4951 for communication, ensure your firewall allows access to these ports.

3.2.6 **After entering the IP address** enter your password if you set one (see **section 3.1.7**), select the communication protocol you wish to use (HTTP or Telnet) and click start, the unit's main screen will open.
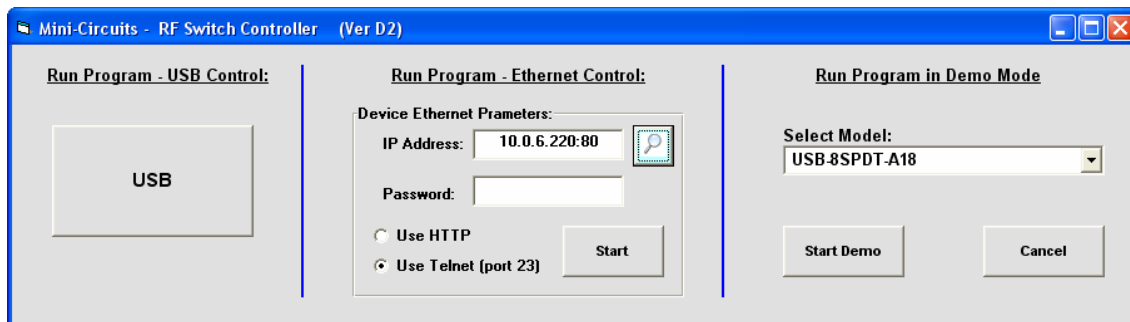

Figure 3.2.6: Ethernet startup screen

Note: changing Ethernet settings is only possible via USB control, see section 3.1.7 for details.

3.2.7 Telnet or HTTP text commands can also be used to control the Switch matrix. Just type in the command in the address field of your internet browser or implement a Get/Post HTTP function in your selected application (for HTTP) or establish a telnet connection(for Telnet). A full list of the commands available and their syntax is available in Mini-Circuits programming handbook chapter 2, and in a text file on the CD provided with the switch matrix, in the Ethernet directory.

3.3 Switch Configurations

Several different preset configurations are available in the Mini-Circuits GUI switch controller and are described below. Where external RF cables are required for the configuration this is noted and the placement of the RF cables shown in the configuration screen. These preset configurations are currently available only via USB control for complex configurations with timing considerations or setting configurations via Ethernet control see Section 3.4.

3.3.1 USB-1SPDT-A18 / RC-1SPDT-A18

These models have only a single absorptive SPDT switch, and thus there are no additional configurations beyond that of an SPDT switch. The switch state can be changed either by clicking on the button above the switch drawing circled in **Fig. 3.3.1** (the button will change between 'COM->2' and 'COM->1' to indicate the current switch state) or in the user sequence window, opened by clicking on the user sequence button (see **section 3.4**).
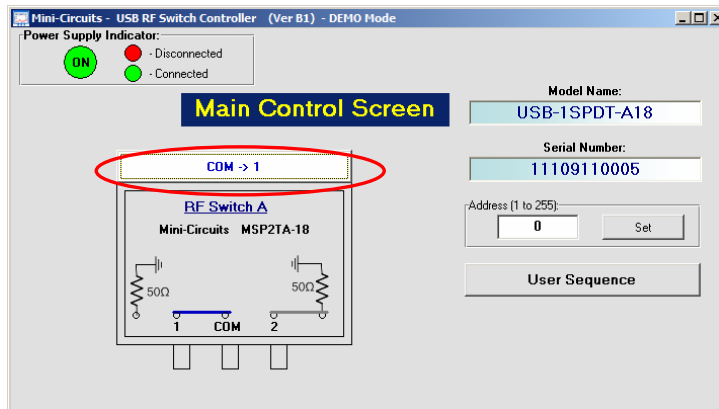

Figure 3.3.1: USB-1SPDT-A18 main window

3.3.2 *USB-2SPDT-A18 / RC-2SPDT-A18*

These models have two absorptive SPDT switches and can be configured as a DPDT or SP3T switch in addition to two SPDT switches. In the default configuration each switch state can be changed independently by either clicking on the button above the corresponding switch drawing (the button will change between 'COM->2' and 'COM->1' to indicate the current switch state) or in the user sequence window, opened by clicking on the user sequence button (see **section 3.4**).
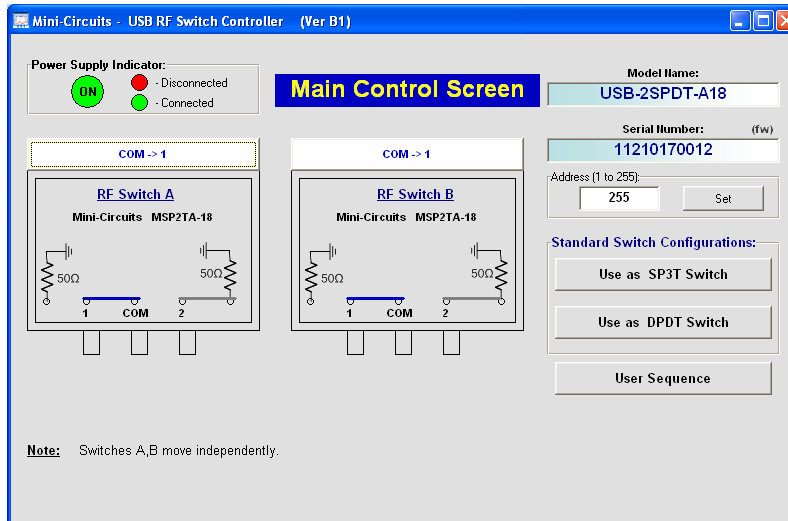

Figure 3.3.2: USB-2SPDT-A18 main window

3.3.2.1 *USB-2SPDT-A18 / RC-2SPDT-A18 as a SP3T switch*

Clicking on the 'Use as SP3T switch' button in the main window will transfer you to a new window - the SP3T configuration screen. In order to use the switch box in this configuration the user needs to connect external RF cable A as shown in **Fig. 3.3.2.1.** Clicking on the switch state buttons on the right side of the screen will change the state of the switches accordingly and the signal path and current state will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
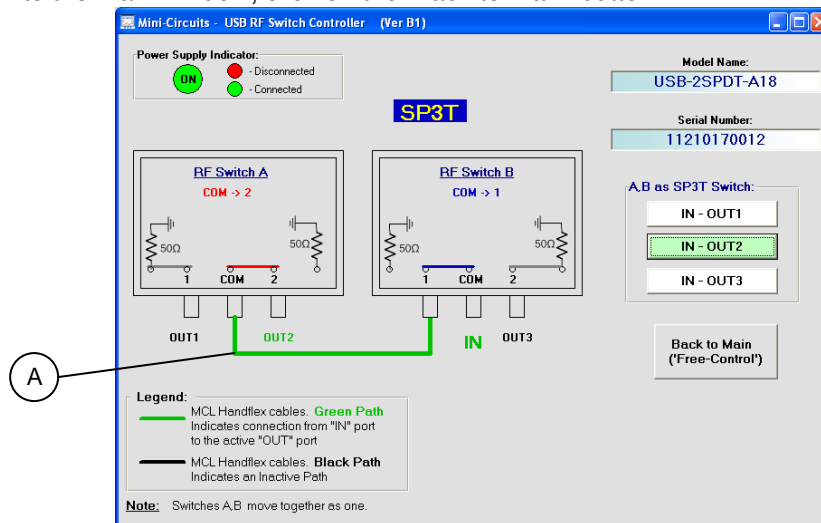

Figure 3.3.2.1: USB-2SPDT-A18 SP3T configuration window

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3.3.2.2 *USB-2SPDT-A18 / RC-2SPDT-A18 as a DPDT switch*

Clicking on the 'Use as DPDT switch' button in the initial screen will transfer you to a new window - the DPDT configuration screen. This configuration does not require any external RF cables to work. Clicking on the circled button will toggle both switches simultaneously as a single DPDT switch. In order to return to the main window, click on the 'Back to Main' button.
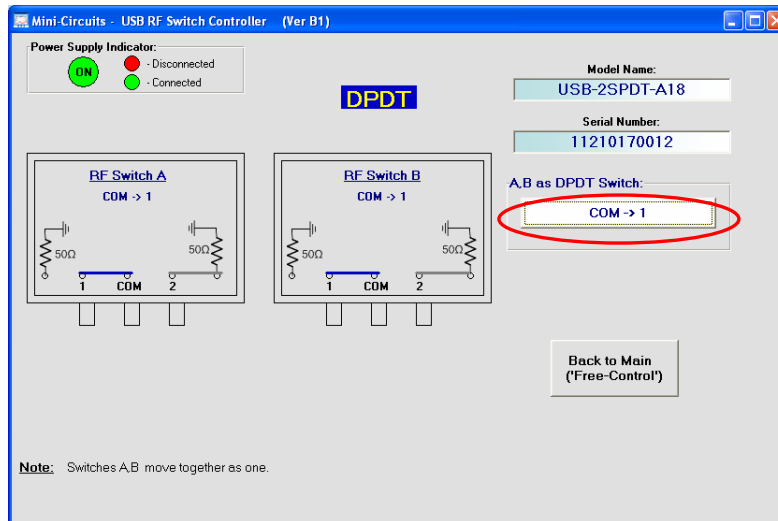

Figure 3.3.2.2: USB-2SPDT-A18 DPDT configuration window

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3.3.3 *USB-3SPDT-A18 / RC-3SPDT-A18*

These models have three absorptive SPDT switches and can be configured as a DPDT and a SPDT or a 3PDT with no external RF cables needed (same procedure as **section 3.3.2.2**) or as a SP3T and SPDT or SP4T switch with external RF cables as shown in the relevant screen (same procedure as **section 3.3.2.1**) in addition to the base configuration as three independent SPDT switches. In the default configuration each switch state can be changed independently by either clicking on the button above the corresponding switch drawing (the button will change between 'COM->2' and 'COM->1' to indicate the current switch state) or in the user sequence window, opened by clicking on the user sequence button (see **section 3.4**).
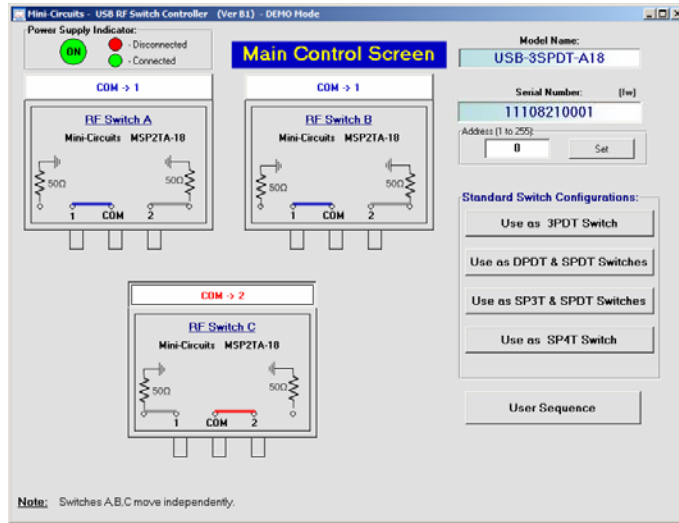

Figure 3.3.3: USB-3SPDT-A18 main window

3.3.3.1 *USB-3SPDT-A18 / RC-3SPDT-A18 as a SP3T, and an SPDT switch*

Connect RF cable A as shown in **Fig. 3.3.3.1.** Clicking on the buttons on the right will change the state of the switches accordingly and the signal path and will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
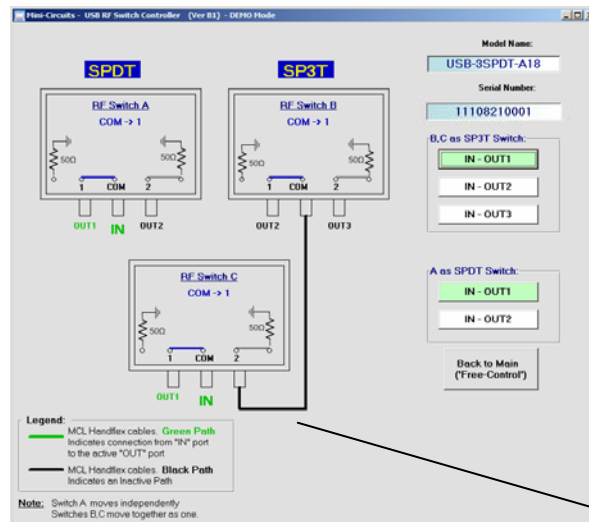

Figure 3.3.3.1: USB-3SPDT-A18 as a SP3T and SPDT

3.3.3.2 *USB-3SPDT-A18 / RC-3SPDT-A18 as a SP4T switch*

Connect RF cables A and B as shown in **Fig. 3.3.3.2.** Clicking on the buttons on the right will change the state of the switches accordingly and the signal path and will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
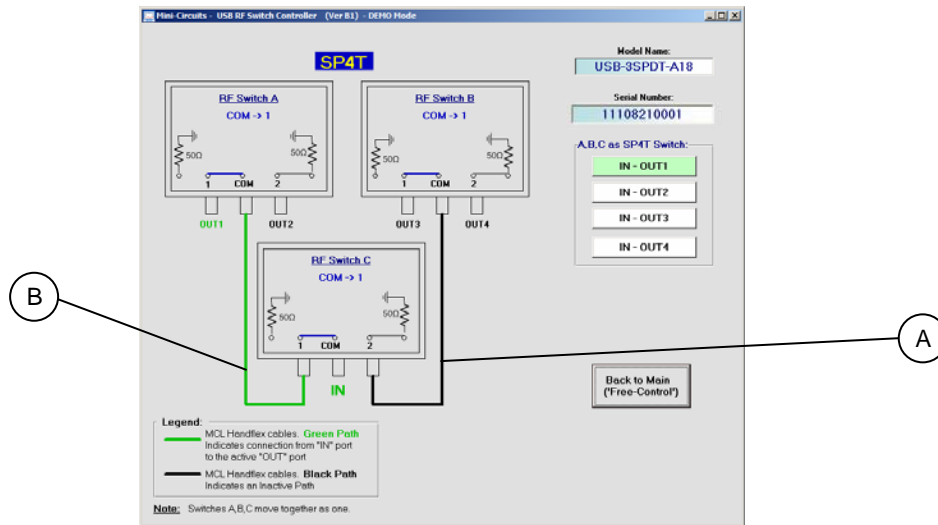
.

Figure 3.3.3.2: *USB-3SPDT-A18 as SP4T*

3.3.4 *USB-4SPDT-A18 / RC-4SPDT-A18*

These models have four absorptive SPDT switches and can be configured as two DPDT, a 3PDT and a SPDT, or a 4PDT with no external RF cables needed (same procedure as **section 3.3.2.2**) or as two SP3T, a SP4T and a SPDT, a SP5T, or a transfer switch with external RF cables as shown in he relevant screen (same procedure as **section 3.3.2.1**) in addition to the default configuration of four independent SPDT switches. In the default configuration each switch state can be changed independently by either clicking on the button above the corresponding switch drawing (the button will change between 'COM->2' and 'COM->1' to indicate the current switch state) or in the user sequence window, opened by clicking on the user sequence button (see **section 3.4**).
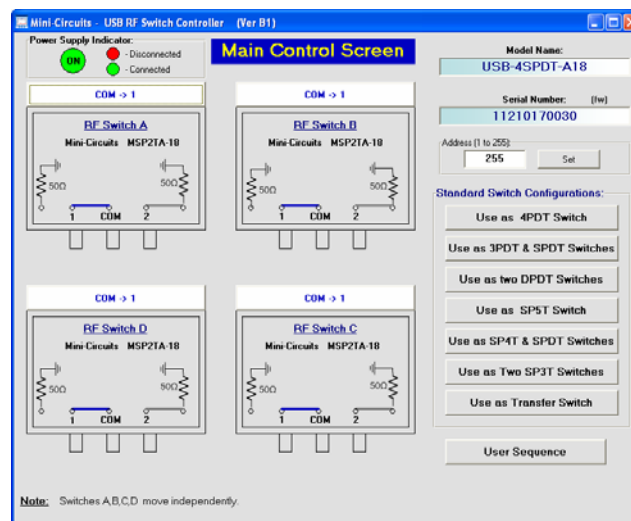

Figure 3.3.4: *USB-4SPDT-A18 main window*

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3.3.4.1 *USB-4SPDT-A18 / RC-4SPDT-A18 as a SP5T switch*

Connect RF cables A, B and C as shown in **Fig. 3.3.4.1.** Clicking on the buttons on the right will change the state of the switches accordingly and the signal path and will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
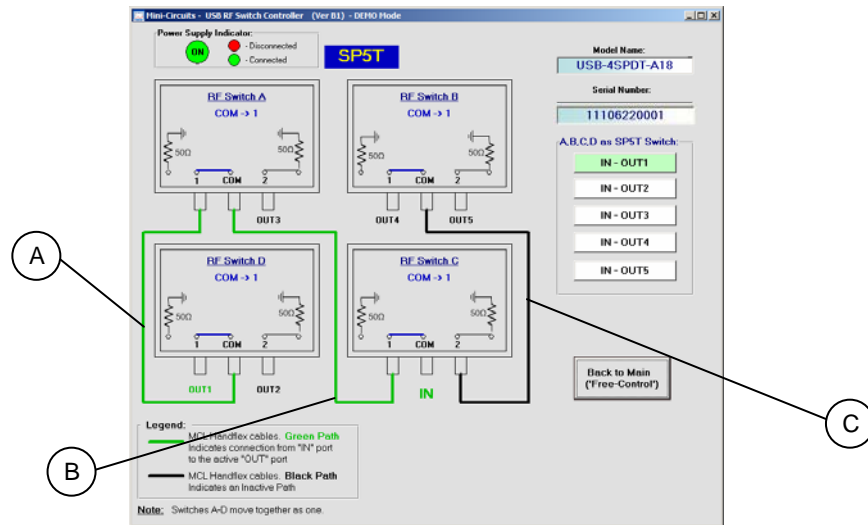

Figure 3.3.4.1: *USB-4SPDT-A18 as SP5T*

3.3.4.2 *USB-4SPDT-A18 / RC-4SPDT-A18 as a SP4T, and a SPDT switch*

Connect RF cables A and B as shown in **Fig. 3.3.4.2.** Clicking on the buttons on the right will change the state of the switches accordingly and the signal path and will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
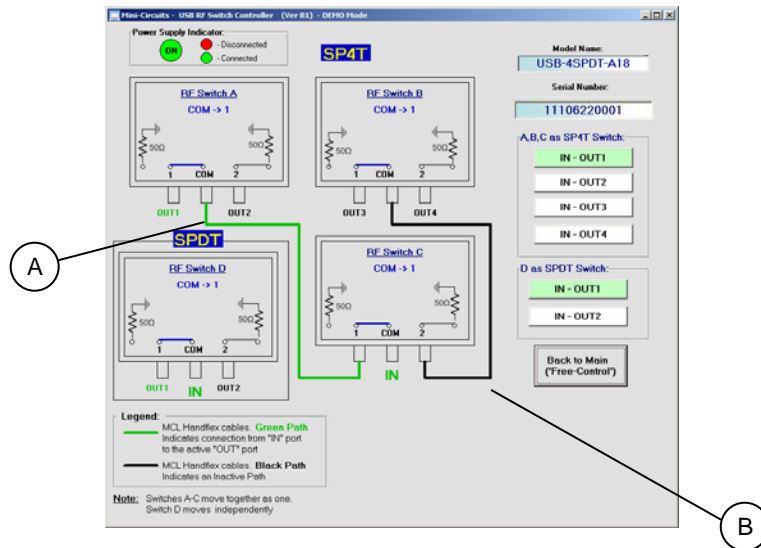

Figure 3.3.4.2: *USB-4SPDT-A18 as a SP4T and SPDT*

3.3.4.3 *USB-4SPDT-A18 / RC-4SPDT-A18 as two SP3T switches*

Connect RF cables A and B as shown in **Fig. 3.3.4.3.** Clicking on the buttons on the right will change the state of the switches accordingly and the signal path and will be highlighted in green. In order to return to the main window, click on the 'Back to Main' button.
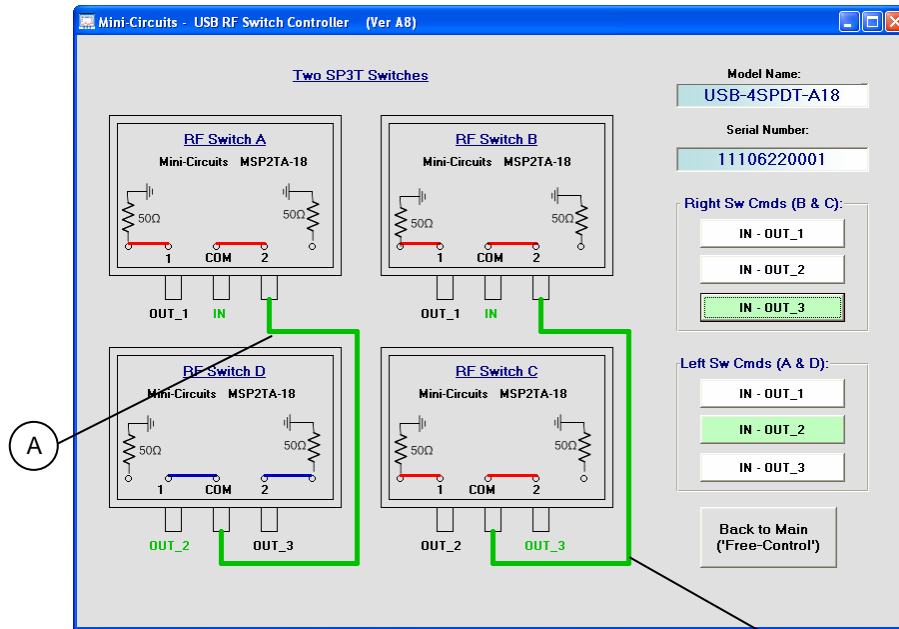

Figure 3.3.4.3: USB-4SPDT-A18 as two SP3T

3.3.5 *USB-8SPDT-A18 / RC-8SPDT-A18*

This model has eight absorptive SPDT switches and can be configured in many different configurations in similar fashion to those shown in previous sections in addition to the default configuration of eight independent SPDT switches. In the default configuration each switch state can be changed independently by either clicking on the button above the corresponding switch drawing (the button will change between 'COM->2' and 'COM->1' to indicate the current switch state) or in the user sequence window, opened by clicking on the user sequence button (see **section 3.4**).
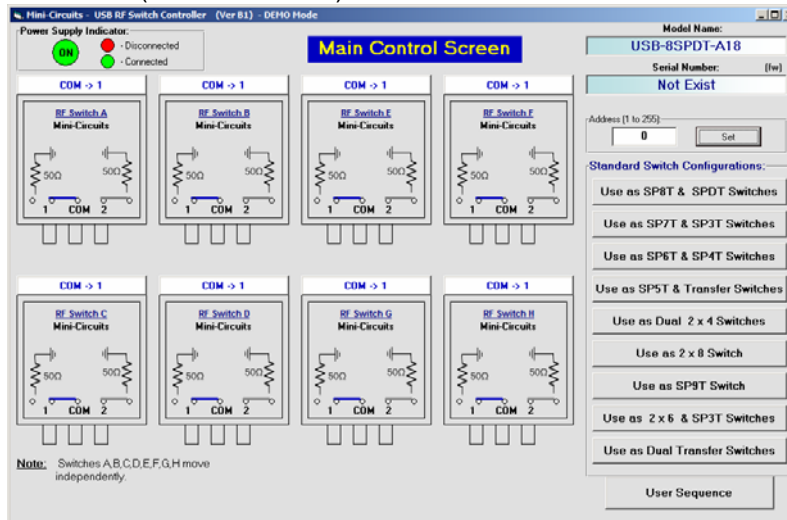

Figure 3.3.5: USB-8SPDT-A18 main window

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3.3.6 *USB-1SP4T-A18 / RC-1SP4T-A18*

These models have only a single absorptive SP4T switch and thus there are no additional configurations beyond that of an SP4T switch. The switch state can be changed either by clicking on the buttons on the right side of the screen in **Fig. 3.3.6** (the button will change color to indicate the current switch state) or in the user sequence window, opened by clicking on the 'User Sequence' button (see **section 3.4**).
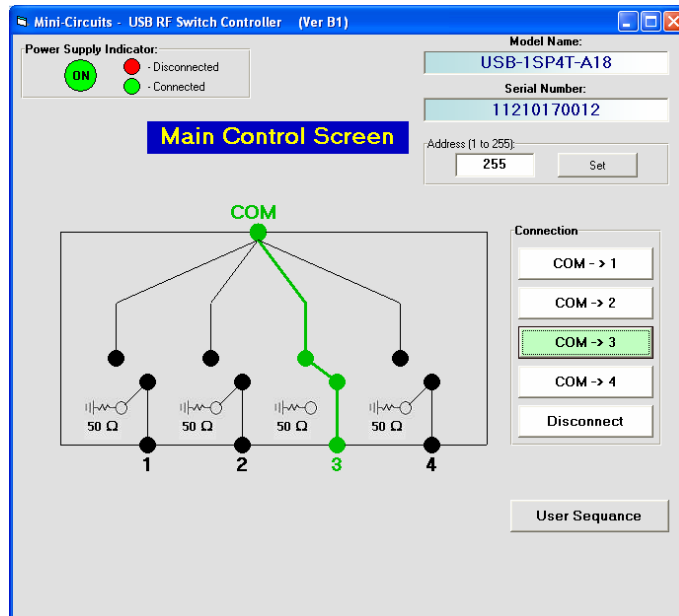

Figure 3.3.6: USB-1SP4T-A18 main window

3.3.7 *Additional configurations, not shown here*

For additional configurations not mentioned here of all models, or for configurations via Ethernet control click on the 'User Sequence' button to open the user sequence window.

3.4 *User Sequence*

Clicking on the 'User Sequence' button in the main window of any model will open a new window – the User Switching sequence window (see **Fig. 3.4.1**). This screen allows the user to run timed sequences of switching any of the switches in the model either individually or together, and run external programs synchronized with the switching sequence.

3.4.1 *User sequence screen buttons and indicators*

| #	Name	Description
1	Switching Set Name	Shows the name of the sequence displayed. If the sequence is not saved this indicator will be blank.
2	Switching Sequence	The list of commands in the sequence with an arrow pointing to the current command. Double clicking on the state of a switch in a command will change its state.
3	Switch states	Shows the state of each switch in the command. Double click on a state to change it.
4	Insert	Add the command above the current command
5	Add	Add a command to end of sequence
6	Count Limit	Enables setting a maximum number of cycles for the 'run continuously' option – Need to enter a number or uncheck option before clicking on 'run continuously'
7	Time Limit	Enables setting a maximum duration for the 'run continuously' option – Need to enter a value (in minutes) or uncheck option before clicking on 'run continuously'
8	Current Step	Run current command and remain on the same step
9	Continuously	Run all commands in the sequence, in a continuous loop until stopped by user or reach specified limit (if limit is set)
10	Stop	Stop the continuous run loop of all commands in sequence
11	Back to Main	Return to the initial screen of the model
12	View Switches	When selected opens a graphical presentation window beside the user sequence window (**Fig 3.4.2**)
13	Remove	Delete current command
14	Dwell ime	The delay (in mSec) after toggling the switches to their new state before going to the next step (in 'run continuously'). If no value is entered the program will proceed immediately to the next step
15	Exec Program	If you wish to run an external program after changing the switches to their current state enter the file name here. File must be placed in C:\MCL_SwitchBox
16	Clear List	Delete all commands in sequence
17	Recall	Recall a previously saved sequence
18	Save	Save the sequence in one of 99 sequence registers. Unless specifically named sequence will be saved as Seq-XX where XX is the register number.
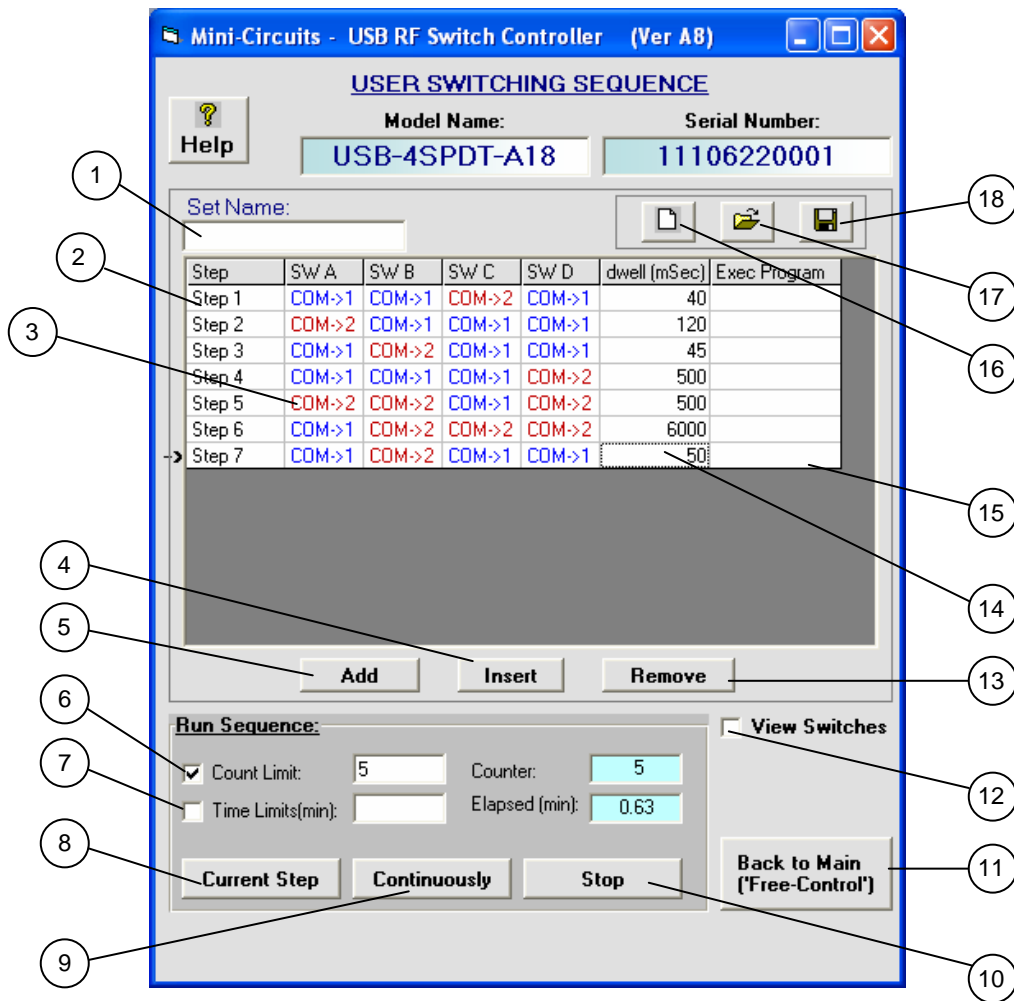
Figure 3.4.1: User Switching Sequence screen

Notes:
1. Typical switching time is 25 mSec, attempting to toggle a given switch twice with too short a delay between the commands may produce errors.
2. If time limit is set to a value which is not a multiple of sequence run time it will be rounded up to nearest multiple.

3.4.2 *User sequence graphical switch presentation*

This window is opened beside the user sequence window by selecting the 'View Switches' option. This window shows the current state of all switches and allows you to illustrate multi switch setups by 'dragging' one of the connector circles to another switch's connector for example 2(A) to COM(B) (see **Fig. 3.4.2a**).

Each connector can be connected to only one other connector and can not be connected to another connector in the same switch. Adding a second line between switches to a connector will erase the previous line and replace it with the new one.

Start and end of active signal paths are highlighted in the same color, with each signal path using a different color while the inactive connectors will remain white.

Clicking on the tab of a connector allows you to type in a new name for the connector instead of the default '1', 'COM' or '2'.
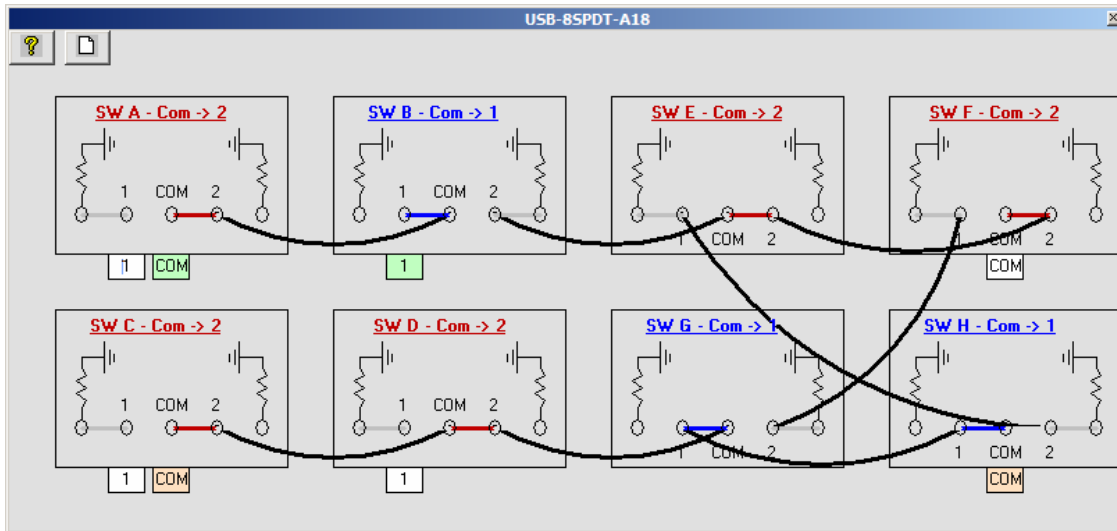
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Figure 3.4.2a: *User Switching graphical switch view window (8SPDT)*
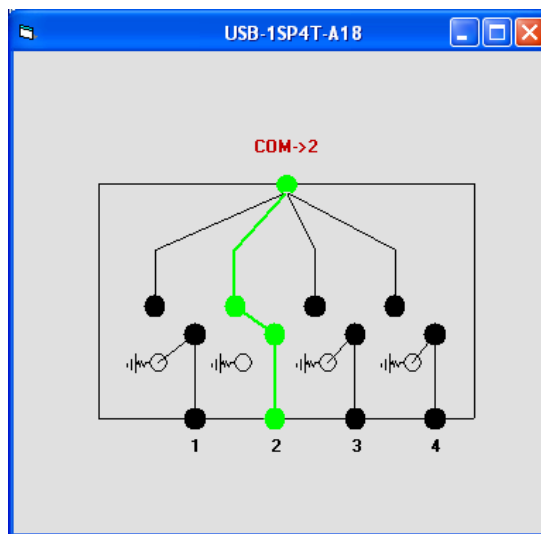

Figure 3.4.2b: *User Switching graphical switch view window (1SP4T)*

Note: Connections shown between switches need to be added by the user using external RF cables.

3.5 *Firmware update*

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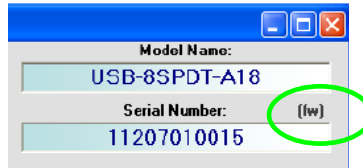

Figure 3.5.1 Firmware indicator on main screen

3.5.2 ***In order to update your switch matrix firmware,*** you must have a switch matrix unit with firmware revision B3 or later and a Windows computer with Mini-Circuits' Switch Controller software installed.

CAUTION	**A power interrupt, to either the computer or the switch matrix 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 matrix and the computer are connected to an Uninterruptable Power Supply (UPS).**

3.5.3 ***Click on the '(fw)' indicator,*** this will cause the firmware - info window to open (See **Fig. 3.3.3**). 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.
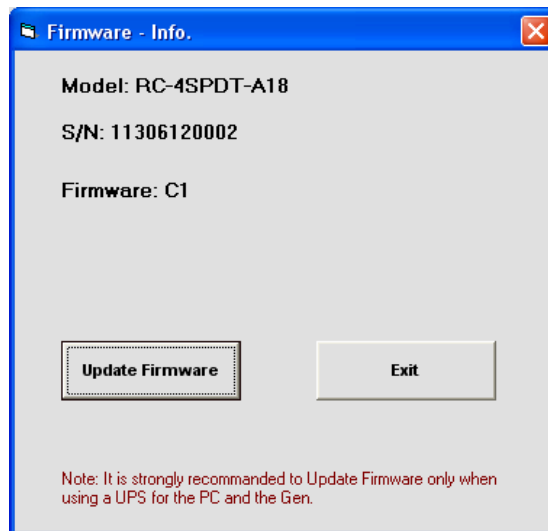

Figure 3.5.4: Firmware Information Window

3.5.4 **A browse window will open to the firmware directory** under the path
you selected when installing the GUI program (See **Fig. 3.3.4**). Navigate to where you saved
your firmware file, Select the firmware version you wish to install and click 'O.K'.
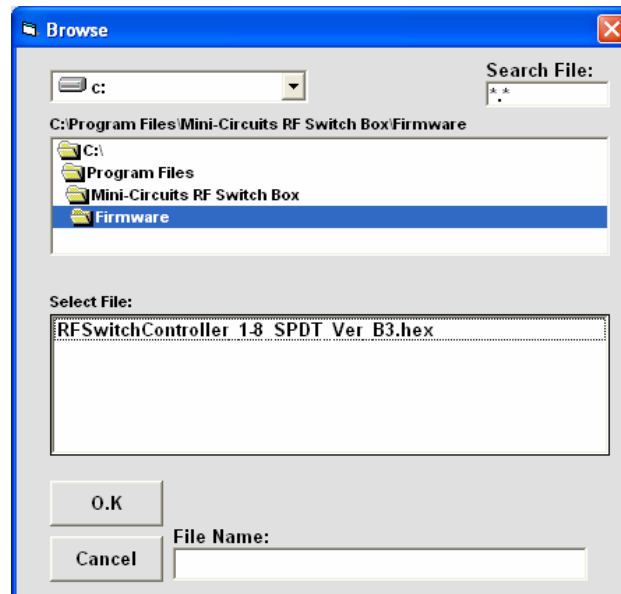

Figure 3.5.5: Firmware - Browse Window

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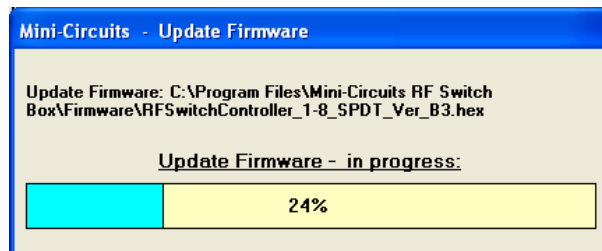a minute.

Figure 3.5.6: Firmware - Progress Bar Window

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

Figure 3.5.7: Firmware - Successful Update

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3.6 Demo Mode

3.6.1 **This mode allows you to see all the** GUI functions of all switch matrix models available in the catalog.

3.6.2 **To start the Demo Mode** select the model requested from the drop box in the right side of the initial screen of the switch controller software. The default option of the demo mode is USB-8SPDT-A18.
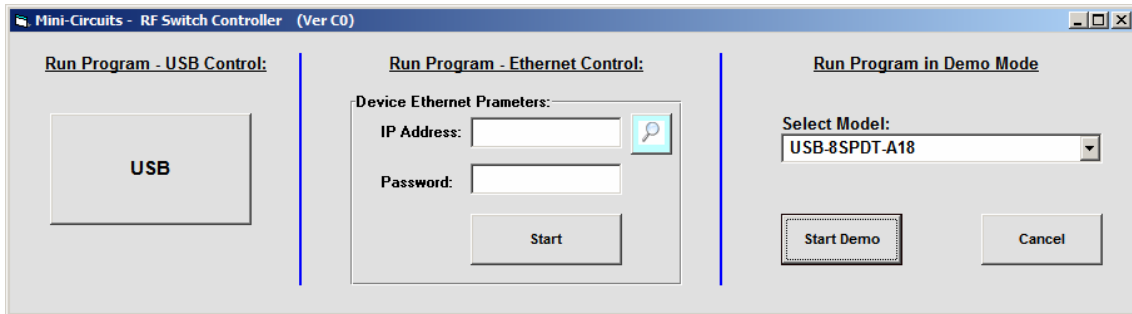

Figure 3.6.1: Demo mode selection screen

3.6.3 **The main screen of the model selected** will appear with all options available for the model selected, however they are simulated, with no communication to any unit connected to the computer. When in demo mode the unit S/N will show "not exist" instead of the unit's S/N and control method will be noted as "Demo control".
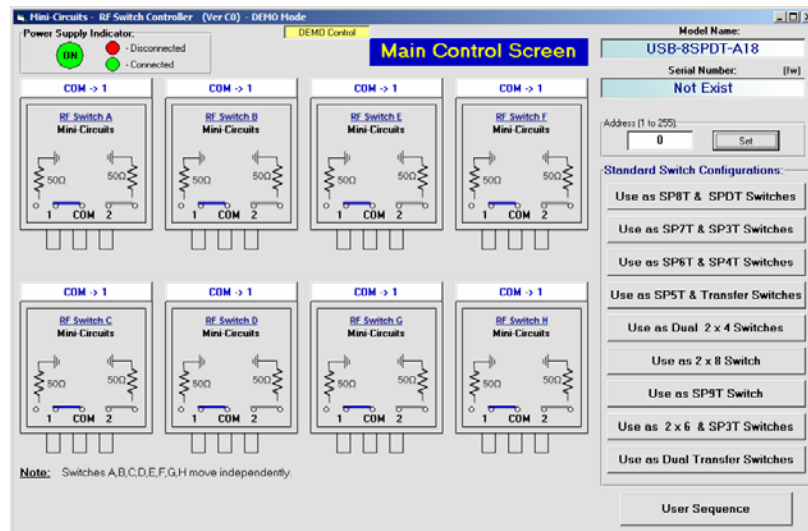

Figure 3.6.2: Demo mode 8SPDT main screen

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