Brookshire Software
LLC

Remote Advanced Playback Unit v3.1

FEATURES

Motion and audio control
  MiniSSC, SMI, SV203, Parallax, Pololu, PicoPic,
    SSC32, K108A, DMX and compatible devices
  Digital 44.1kHz stereo MP3 audio
  As many as 32 devices
  High-speed servo/motor/relay serial port
  DMX output port
  TTL output port
  VSA playback compatibility
 Integrated VSA development support

Flexible user interface
  On-board LCD and keys
  Remote serial port
  Infrared remote control

Expandable routine management
  CompactFlash memory card slot
  USB 1.1 upload port
  Multiple playback modes
  Unlimited routine length support

Applications
  DJ stage lighting
  Production and prototype animatronics
  Open-loop robotics control
  Theme park and ride attractions
  Theatrical prop and stage automation
  Museum and store-front displays
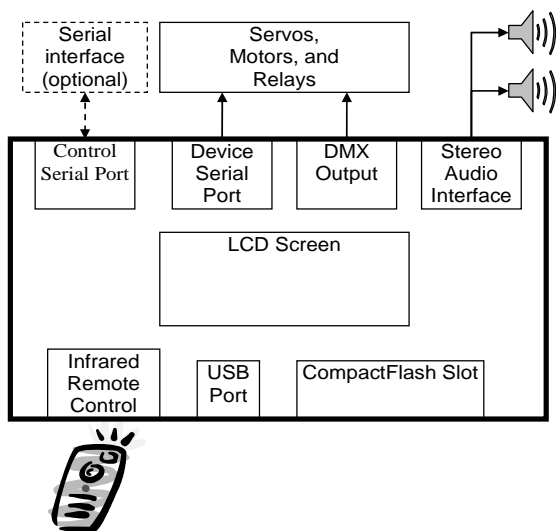 Haunted houses
  Holiday display animations
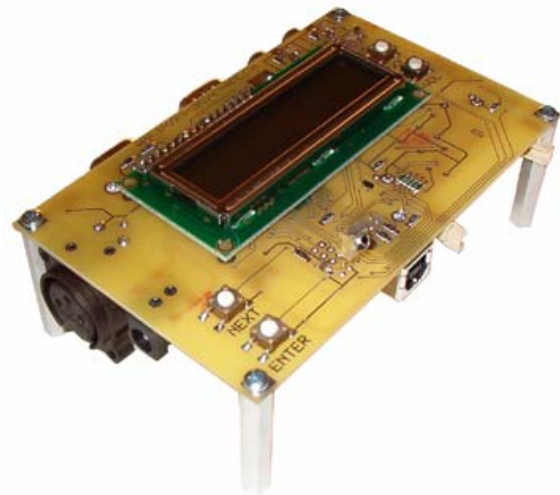
GENERAL DESCRIPTION

The Remote Advanced Playback Unit (RAPU) v3.1 liberates productions from the PC. The RAPU is a plug-and-go replacement for the PC. Take productions and animations perfected on the PC with VSA, upload them to the RAPU via USB, and breathe new realism into the show. The RAPU is the most accurate and advanced solution for production and show control with audio.

The RAPU can control up to 32 devices including MiniSSC servos, SMI motors, SV203 servos and relays, Parallax servos, Pololu servos, PicoPic servos and relays, LynxMotion SSC32 servos and relays, K108A relays, BoC DMX servos, generic DMX devices, and any compatible hardware. The system can be operated at a variety of frame and baud rates. The 4.5" x 3" circuit board can be controlled via its remote serial port, infrared remote control, or from the built in LCD interface. Identical to VSA playback, the RAPU outputs synchronized digital stereo MP3 audio on two RCA jacks. The MP3 audio and device data are stored on a standard CompactFlash card and can be uploaded to the device through the USB interface.

The RAPU v3.1 is fully supported in VSA v3.1 and uses the included RAPU Manager software to upload routines.

http://www.brookshiresoftware.com

Table of Contents

1 Introduction

1.1 Unpacking the RAPU

Thank you for purchasing your new RAPU by Brookshire Software, LLC. Please visit our website at http://www.brookshiresoftware.com for the latest updates and documentation. When you first receive your RAPU, check to be sure the following items are included. If any items are missing, please immediately return the unit to the place of purchase.

- The RAPU v3.1
- Infrared remote control
- USB cable
- Power supply

The RAPU will also require that the servos, motors, relays and other control hardware be powered and operational. We suggest that you verify control hardware operation using VSA before migrating to the RAPU. Additionally, a standard CompactFlash card will be needed to store routines.

1.2 Connector Diagram

Use the following diagram to become familiar with the physical aspects of the RAPU.
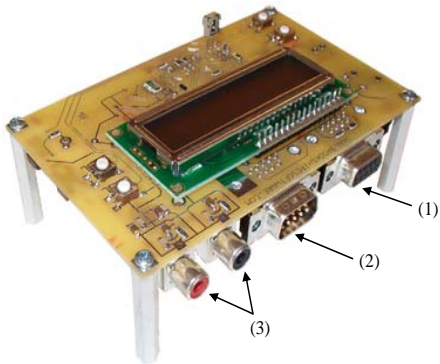
(1) Control serial port	(8) USB port
(2) Device serial port	(9) CompactFlash slot
(3) Audio RCA jacks	(10) *Next* key
(4) LCD screen	(11) *Enter* key
(5) DMX output port	(12) *+VOL* key
(6) Power connector	(13) *-VOL* key
(7) Infrared receiver	(14) TTL port
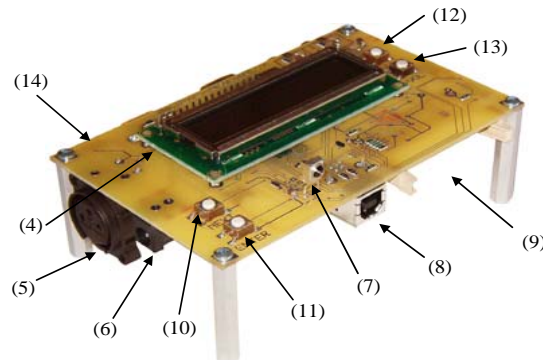
1.3 Technical Specifications

Parameter	Value
Voltage Supply	6 – 12 VDC
Current Consumption	300 mA
Audio connectors	One left and one right RCA jack
Maximum audio current	50 mA
Playback Modes	Play single routine, repeat single routine, repeat all routines, play random routine
Baud Rates (non-repeater mode)	2400, 4800, 9600, 19200, and 38400 bps
Baud Rates (repeater mode only, see Section 2.6)	2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps
Device Support	MiniSSC, SMI, SV203, Parallax, Pololu, PicoPic, LynxMotion SSC32, K108A, DMX and compatible
Frame Rates	33, 50, 66, 100, and 200 FPS

1.4 Install Visual Show Automation

Refer to the Visual Show Automation Getting Started Guide for details on how to install the software. Visit http://www.brookshiresoftware.com/vsa_downloads.htm for more details.

1.5 Installing the RAPU3 Manager

The RAPU3 Manager must be installed before the RAPU is linked to the PC via USB.
Installing the RAPU3 Manager will install all necessary software and drivers. If installing on Windows Vista, see Section 1.5.3.

1. Download the RAPU3 Manager and remember the destination directory.
2. Select **Run** from the Windows **Start** menu.
3. Enter **C:\Download\r3m_setup_web.exe** (or **r3m_setup_cd.exe**) where "C:\Download\" is the directory to which you saved the download (from step 1).
4. Follow the on-screen prompts to install the software and drivers.
5. When finished, select the **RAPU3 Manager** program group from the Windows **Start | Programs** menu.
6. Select **RAPU3 Manager** to start the upload software.

1.5.1 Windows 98/ME

When linking the RAPU to the PC with USB (see Section 2.2) for the first time on Windows 98/ME, you may be prompted to locate one or more driver files. The necessary files are available (after following the preceding steps in Section 1.5) in the installation directory you selected (typically "C:\Program Files\Brookshire Software\RAPU3 Manager").

If you see the following dialog (left), select "Search for the best driver for your device" and press "Next". The dialog on the right will appear; select "Specify a location" and enter the

directory where you installed the RAPU3 Manager software (typically "C:\Program Files\Brookshire Software\RAPU3 Manager"). Continue to press "Next" until the installation is complete.
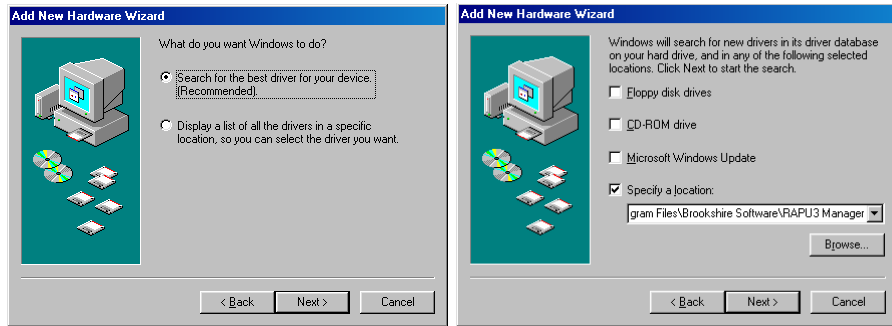
On some versions of Windows 98/ME, the following dialog may appear. Enter the path where you installed the RAPU3 Manager software.
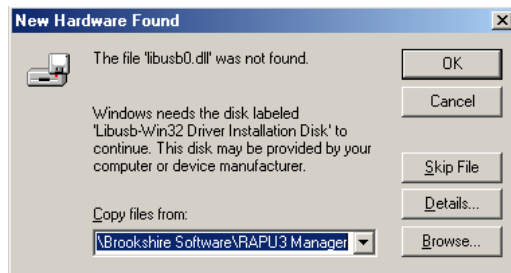
1.5.2 Windows XP

When linking the RAPU to the PC with USB (see Section 2.2) for the first time on Windows XP, you will be prompted by the Windows Hardware Wizard as shown below. Follow the preceding steps (see in Section 1.5) to install the RAPU Manager software. Then, choose to "Install the software automatically" and press "Next."
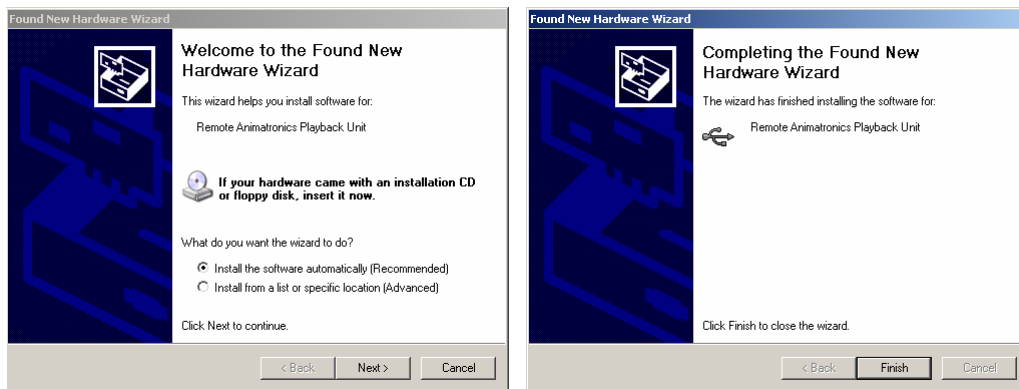
The Hardware Wizard will locate and install the appropriate drivers for Windows XP. When finished, the click "Finish" and begin to use your RAPU device.

1.5.3 Windows Vista

When installing RAPU3 Manager, you may receive the following Security Warning (left). After verifying that the file name is correct and the software was provided from Brookshire

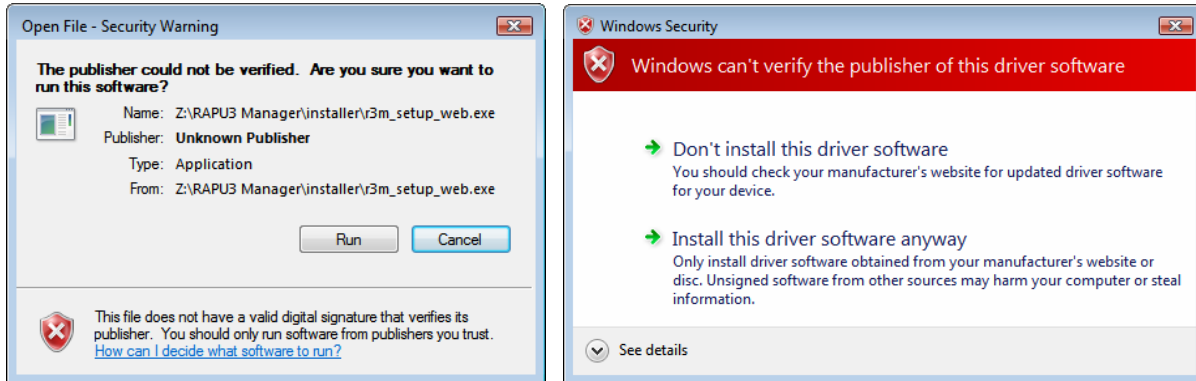Software, LLC, press "Run" to continue. If User Account Control (UAC) is enabled or you are logged on without Administrator privileges, you may be prompted for the Administrator password.

During installation, the installer will register the device drivers required for proper RAPU operation. The above (right) Windows Security warning may appear twice. Select "Install this driver software anyway" both times. When linking the RAPU to the PC with USB (see Section 2.2) for the first time on Windows Vista, you will see the following two notifications. You are now ready to use your RAPU device.

1.6 Setting up the RAPU

After unpacking the RAPU and verifying that all components are included, several connections should be made to your external hardware. Refer to Section 1.2 for the locations of connectors.

1. Connect the stereo audio jacks (3) to the speaker or amplifier system. Refer to the Technical Specifications for details.
2. Connect the device serial port (2), the DMX output port (5), or the TTL port (14) to servo, motor, dimmer, or relay control hardware. For example, the serial port would connect through a 9-pin straight-through cable to the MiniSSC/SMI/SV203/Parallax/Pololu/PicoPic/SSC32/K108A control board. The TTL port (14) is compatible with the Parallax TTL serial port. The device serial port, the DMX output port, and/or the TTL port cannot be used simultaneously.
3. Insert the CompactFlash card (not included) into the CompactFlash slot (9).
4. Optionally, connect the control serial port (1) to a microprocessor, other embedded control device, or PC. The control serial port is RS232 compatible.
5. Optionally, connect the USB port (8) to the PC to upload routines to the CompactFlash card. If you plan to use the RAPU as a repeater (see Section 2.6), the USB connection must be made to the PC.
6. Plug the included power adapter into the wall and, then, into the RAPU power connector (6). The RAPU will immediately power on and a screen similar to the following will be displayed:

```
RAPU vX.XX
www.brookshiresoftware.com
```
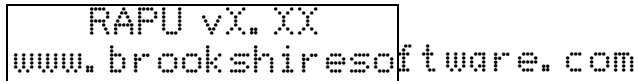
1.7 Mounting

The RAPU comes with four 4-40 threaded hex nut standoffs which can be used as mounting points. These standoffs are not grounded on the RAPU. Furthermore, care should be taken to insulate the RAPU and shield it from interference.

2 Using the RAPU

2.1 Creating Routines

The routines created on VSA can be directly exported to the RAPU where playback will exactly match that of the PC. For details on how to use VSA to author routines, refer to the **VSA Help** documentation included with VSA. Once you have completed the routine in VSA, select **Tools** and then **RAPU Export…**. Refer to the VSA Help documentation for details about the different RAPU export settings. Note the directory to which you save the ".rapu" file.

For the best performance, author routines with an MP3 file which has a 44.1kHz sample rate and a 128kbps data rate. If the MP3 file associated with the routine does not adhere to these standards, the RAPU Manager will automatically convert the MP3 file. The MP3 conversion process may slightly alter the timing characteristics of the audio and result in a timing mismatch with the animation data. An MP3 file with a 44.1kHz sample rate and a 128kbps data rate will not require conversion and will best match the original VSA routine. This conversion process may require an MP3 encoder which is not included with the RAPU Manager (see http://www.brookshiresoftware.com/rapu3_faq.htm for more details).

2.2 Uploading .rapu files

Once the RAPU Manager is installed (see Section 1.5), the .rapu file can be directly uploaded to the RAPU using the USB interface.

1. Power on the RAPU and insert a CompactFlash card.
2. Connect the RAPU to your PC's USB 1.1/2.0 port using the provided cable.
3. Verify that the RAPU3 Manager software has been properly installed (see Section 1.5)
4. From the RAPU's MAIN MENU select Setup USB Link. This will establish a USB connection with the PC.
5. Start the **RAPU3 Manager** software.
6. Press the **Refresh** button to detect any recently installed devices.
7. From the drop-down list to the left of the Refresh button, select the desired RAPU device. If the proper RAPU is not listed, then the RAPU has not been successfully detected by the system.
8. Select **Add routine…** and open the desired .rapu file. The progress bar will indicate status as the file is uploaded to the RAPU. If the proper MP3 encoding files are installed, the audio file will be converted to the appropriate MP3 format, if necessary. Otherwise, you may be prompted to install additional MP3 encoding tools. Visit http://www.brookshiresoftware.com/rapu3_faq.htm for details.

Routines may only be deleted from the end of the disk. Press **Remove last routine** to delete the last routine. The USB link may be disconnected by pressing *Enter* (11) on the RAPU. Be careful not to unplug the RAPU power or USB cables during an upload or delete procedure.

If you use Windows 2000/XP/Vista, it is also possible to upload routines to CompactFlash cards indirectly without using the RAPU. If your PC is equipped with a CompactFlash card reader, it will also be recognized by the RAPU3 Manager. Because the RAPU3 Manager will overwrite all data on the selected drive, it is essential that you backup all data on your PC. Once you have completed your backup, connect the CompactFlash card and proceed to Step 5 (above), selecting the appropriate disk drive instead of the RAPU. The RAPU3 Manager software will only recognize drives that are removable and do not contain the "C" partition. The RAPU3 Manager software will erase all data on the selected drive. Windows 98 does not support the CompactFlash card reader feature.

2.3 Playing routines

The RAPU will display all detected routines in the MAIN MENU. Press *Next* (10) to scroll through the available options. When you wish to start playback, press *Enter* (11) when the desired routine's title is shown.

```
MAIN MENU
my_routine1
```

During playback, the routine's title and the current playback time will be displayed. Press *Next* to scroll through the available options (FWD, STOP, and REV). To skip to the next routine, press *Enter* when FWD is displayed; to return to the previous routine, press *Enter* when REV is displayed. To halt playback and return to the MAIN MENU, press *Enter* when STOP is displayed.

```
my_routine1
STOP          0:10
```

The RAPU has a number of playback options which determine which routine is played after one completes. From the MAIN MENU, press *Next* until the Options Menu is displayed. Press *Enter* and the OPTIONS MENU is presented. Use *Next* to scroll through the available options and press *Enter* when the desired playback mode is displayed. An asterisk (✳) will appear next to the currently selected playback mode.

Play Once – Play the selected routine once and then stop playback.
Loop All – Play the all routines in order continuously.
Repeat Single – Play the selected routine continuously.
Random – Randomly select a routine to play continuously.

During playback or from any menu, use the *+VOL* (12) and *-VOL* (13) keys to raise or lower the volume of the audio.

2.4 Error messages

`Insert flash card` – A flash card was not detected, please insert a flash card and upload routines (see Section 2.2).

`Remove card Card inserted improperly` – The flash card is either inserted improperly (upside down) or the type of card is not supported. Use Compact Flash 1 type cards only.

2.5 IR Remote control

All playback functions of the RAPU may be controlled remotely with the IR remote control. There must be an unobstructed line of sight between the remote control and the IR receiver (7) on the RAPU. The following listing describes the functionality of the remote control; keys that are not listed are not supported.

The following keys are supported in "TV" and "VCR" mode (press the *TV* or *VCR* button to select the remote control mode):

CHANNEL UP – This key scrolls through the list of available options and is similar to pressing the *Next* key.
CHANNEL DOWN – This key scrolls through the list of available options in reverse.
VOLUME UP – This key increases the volume and is similar to pressing the *+VOL* key.
VOLUME DOWN – This key decreases the volume and is similar to pressing the *-VOL* key.
RETURN or *ENT* or *ENTER* – This key is similar to the *Enter* key.
MUTE – This key sets the volume to zero.
NUMBER KEYS (0-9) – To start play of a specific routine, key in the routine's number. The routines are 1-based (i.e., the first routine can be started by pressing "1").

The following keys are supported only in the "VCR" mode:

PLAY – This key is similar to the *Enter* key.
STOP – This key will halt a playback in progress.
REW – In the `MAIN MENU` and `OPTIONS MENU`, this key functions similar to the *CHANNEL DOWN* key. During playback, this key immediately moves play to the previous track.
FF – In the `MAIN MENU` and `OPTIONS MENU`, this key functions similar to the *CHANNEL UP* key. During playback, this key immediately moves play to the next track.

2.5.1 Programming the IR remote control

The remote control is a universal remote which is preconfigured for the RAPU. If the remote should loose its configuration (e.g., when batteries are replaced), it may become necessary to reprogram it. Use the following directions, depending on the model of the remote. The model number may be found on the back of the remote or the underside of the battery compartment.

Universal RCA Remote RCU410 and RCU404

1. Press and hold the CODE SEARCH button until the INDICATOR LIGHT lights, then release the CODE SEARCH button.
2. Press and release the TV button (The INDICATOR LIGHT will blink then remain lit).
3. Enter the code 0-0-2 using the Number Buttons. After your code is entered, the INDICATOR LIGHT will turn off.
4. Press and hold the CODE SEARCH button until the INDICATOR LIGHT lights, then release the CODE SEARCH button.
5. Press and release the VCR button (The INDICATOR LIGHT will blink then remain lit).
6. Enter the code 0-9-9 using the Number Buttons. After your code is entered, the INDICATOR LIGHT will turn off.

Radio Shack 3-IN-ONE Remote 15-2143
1. Press and hold the CODE SEARCH button until the red indicator stays on, and then release the CODE SEARCH button.
2. Press and release the TV mode button. The red indicator blinks, and then stays lit.
3. Enter the three digit code 4-1-4. Note: after a valid code entry, the red indicator turns off. For an invalid code, the red indicator flashes.

2.6 Repeater Operation

The RAPU can also be used as a USB-to-serial repeater. When acting as a repeater, the RAPU simply passes commands from VSA sent across the USB port to the serial port. When acting as a repeater, the RAPU can be used to convert legacy serial devices to USB and control DMX devices. Audio playback will be through VSA on the PC's speakers; the audio output on the RAPU will not be used.

1. Follow steps (1) through (4) in Section 2.2. Do not start the RAPU3 Manager.
2. Start VSA. VSA must be started after the RAPU is linked via USB to the PC.
3. See the VSA help files for detailed support. The RAPU will be listed along with serial and parallel ports as a device output port.

2.7 Control serial port

Many of the RAPU's operations may be controlled through the control serial port (1). The serial port operates at 19.2kbps, 8 data bits, no stop bits, and one parity bit. The port implements a standard RS232 interface and conversion circuitry may be required to interface to a TTL serial port (e.g., Basic Stamp or other microcontroller). The port provides a console-like interface that is designed for human or automated operation. A typical terminal interaction might resemble the following:

```
RAPU vX.XX
www.brookshiresoftware.com
>ls
000: my_routine1
001: my_routine2
002: my_routine3
>play 0
>status
p 0 239
>
```

The console is prepared to receive input when the ">" prompt is displayed. Several functions are unavailable (e.g., list) when playback is in progress because these functions would otherwise interfere. Care should be taken not to constantly poll the RAPU during playback (e.g., to check to see if playback is complete) as the control serial port interface can consume processor resources. For the most reliable performance, queries should be limited to 1Hz during playback. Additionally, all commands are unavailable if a flash card is not inserted or the USB link is active.

`reset, re`
These commands will reboot the RAPU.

`list, ls`
These commands will list all the track titles. The track titles will be listed in: "`<track number>: <track title>`" format. This command is not available when a routine is being played.

`pm [mode]`
If the optional `[mode]` parameter is supplied, this command sets the current playback mode. If the mode parameter is not supplied, this command retrieves the current playback mode (0:play once, 1:repeat single, 2:loop all, 3:random play). This command is not available when a routine is being played.

`play <track number>`
This commands starts playback and requires an argument that indicates the number of the track to play (e.g., the first track is track zero).

`vol [volume]`
This command sets the volume if the optional parameter `[volume]` is supplied. Otherwise, this command returns the current volume.

`status`
This command retrieves the current state of the RAPU unit. The command will return "`s`" if the unit is stopped. The command will return "`p <track number> <frame>`" if a routine is being played. The current time can be determined by dividing the returned frame argument by the frames per second rate of the routine.

`stop`
This command halts all playback.

`help, ?`
These commands will print a summary of all available commands.

2.8 Upgrading the Firmware

The RAPU will come preprogrammed with the most recent firmware version. Bug fixes and feature enhancements may require a firmware update. It is recommended that you only update the firmware when instructed to do so by Brookshire Software, LLC. Unnecessary firmware upgrades will shorten the life of the RAPU and incomplete or failed firmware

updates may permanently damage the RAPU. If you are unsure if a firmware update is necessary, contact Brookshire Software, LLC at techsupport@brookshiresoftware.com for assistance.

1. Download the most recent firmware image file (the extension will be ".img") from www.brookshiresoftware.com.
2. Power on the RAPU.
3. Connect the RAPU to your PC's USB 1.1/2.0 port using the provided cable.
4. Verify that the RAPU3 Manager software has been properly installed (see Section 1.5).
5. On the underside of the RAPU, there are two small dip switches (adjacent to the CompactFlash connector). Flip the dip switch labeled "I" to the "ON" position.
6. Press and release the nearby *RESET* button.
7. Flip the dip switch labeled "U" to the "ON" position.
8. The RAPU will connect to the PC via USB as an "AT89C51SND1C/AT89C51SND2C" device. The driver files can be found in the directory where the RAPU3 Manager software was installed. The installation process is similar to installing the RAPU (see Sections 1.5.1 and 1.5.2).
9. Start the **RAPU3 Manager** software.
10. No devices will appear since the RAPU is in a special firmware upgrade mode. Press **Load firmware…**. Follow the on screen directions if you have not already done so above.
11. Select the appropriate image file to begin programming.
12. When programming is complete, flip the dip switch labeled "U" and "I" to the "OFF" positions.
13. Press and release the nearby *RESET* button.