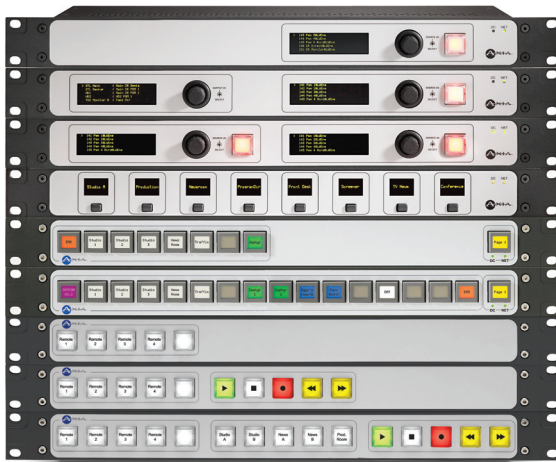


Axia Router Control Panels & Studio Accessory Panels

Configuration and User Guide



Manual Version 2.1.1 June 2014
XYR Panel Software 1.02 and higher

IMPORTANT NOTE:

Axia Livewire devices are intended for use with an Ethernet Switch that supports multicast and QoS (Quality of Service). On a non-switched Ethernet hub, or a switch that is not enabled for multicast, this will result in network congestion that could disrupt other network activity.

USA Class A Computing Device Information To User. Warning:

This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used as directed by this manual, it may cause interference to radio communication. This equipment complies with the limits for a Class A computing device, as specified by FCC Rules, Part 15, Subpart J, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense. NOTE: Objectionable interference to TV or radio reception can occur if other devices are connected to this device without the use of shielded interconnect cables. FCC rules require the use of only shielded cables.

Canada Warning:

"This digital apparatus does not exceed the Class A limits for radio noise emissions set out in the Radio Interference Regulations of the Canadian Department of Communications." "Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la Classe A) prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada."

Important Safety Information

To reduce the risk of electrical shock, do not expose this product to rain or moisture. Keep liquids away from the ventilation openings in the top and rear of the unit. Do not shower or bathe with the unit.

Caution

The installation and servicing instructions in the manual are for use by qualified personnel only. To avoid Electric Shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified personnel.

Electrical Warning

To prevent risk of electric shock: Disconnect power cord before servicing.

This equipment is designed to be operated from a power source that includes a third "grounding" connection in addition to the power leads. Do not defeat this safety feature. In addition to creating a potentially hazardous situation, defeating this safety ground will prevent the internal line noise filter from functioning.

Ventilation Warning

The Axia Router Control Panel use convection cooling. Do not block the ventilation openings in the side or top of the unit. Failure to allow proper ventilation could damage the unit or create a fire hazard. Do not place the unit on a carpet, bedding, or other materials that could interfere with the rear and top panel ventilation openings.

Customer Service

We support you...

By Phone/Fax in the USA.

- You may reach our 24/7 Support Team anytime around the clock by calling +1 216-622-0247. For billing questions or other non-emergency technical questions, call +1 216-241-7225 between 9:30 AM to 6:00 PM USA Eastern Time, Monday through Friday.

By E-Mail.

- Non-emergency technical support is available at **Support@AxiaAudio.com**.

Via World Wide Web.

- The Axia Web site has a variety of information which may be useful for product selection and support. The URL is **<http://www.AxiaAudio.com>**.

Feedback

We welcome feedback on any aspect of Axia products or this manual. In the past, many good ideas from users have made their way into software revisions or new products. Please contact us with your comments.

Updates

The operations of Element, PowerStation and StudioEngine are determined largely by software. Periodic updates may become available - to determine if this is the case, visit our web site periodically, or contact us for advice concerning whether a newer release is more suitable to your needs.

Our electronic newsletter has announcements of major software updates for existing products, as well as keeping you up to date on the latest Axia, Telos, and Omnia product releases. Subscribe at www.AxiaAudio.com/signup.htm.

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Notice

All versions, claims of compatibility, trademarks, etc. of hardware and software products not made by Axia mentioned in this manual or accompanying material are informational only. Axia makes no endorsement of any particular product for any purpose, nor claims any responsibility for operation or accuracy.

Warranty

This product is covered by a Two Year limited warranty, the full text of which is included in the rear section of this manual.

Service

You must contact Axia before returning any equipment for factory service. Axia will issue a Return Authorization number, which must be written on the exterior of your shipping container. Please do not include cables or accessories unless specifically requested by the Technical Support Engineer at Axia. Be sure to adequately insure your shipment for its replacement value. Packages without proper authorization may be refused. US customers please contact Axia technical support at +1 (216) 241-7225. All other customers should contact their local representative to arrange for service.

We strongly recommend being near the unit when you call, so our Support Engineers can verify information about your configuration and the conditions under which the problem occurs. If the unit must return to Axia, we will need your serial number, located on the rear panel.

About This Manual

This manual covers the details of the Axia Router Control Panel family, Axia Console Accessory Panels and Axia Switch Panels. It is assumed in this document that you are familiar with Livewire's basic concepts, as outlined in the companion *Introduction to Livewire: System Design Reference and Primer* or *Audio Over IP: Building Pro AoIP Systems with Livewire* by Steve Church and Skip Pizzi, available from Elsevier Press.

If you have not done so, please review that material first. In it we explain the ideas that motivated Livewire and how you can use and benefit from it, as well as nitty-gritty details about wiring, connectors, and the like. Since Livewire is built on standard networks, we also help you to understand general network engineering so that you have the full background for Livewire's fundamentals. After reading *Introduction to Livewire* you will know what's up when you are speaking with gear vendors and the network guys that are often hanging around radio stations these days.

As always, we welcome your suggestions for improvement. Contact Axia Audio with your comments:

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A Note From The Vice President of Axia

2013 marks a banner year for Axia — this year marks the first decade of the Connected Studio.

In retrospect, it's hard to believe it's been 10 years since a start-up division of Telos grabbed everyone's attention with a radical idea about building radio studios using Ethernet. At a time when "state of the art" meant discrete digital audio, and a routing switcher was something only the richest stations could afford, Axia shocked everyone with the idea that studio peripherals from the console to the audio processor could be networked, and that everyone could have the benefits of a routing switcher — for about a third of the cost of traditional technology.

When we launched Axia, Telos founder Steve Church made a prediction. "Three things will happen," Steve told us. "First, people will say that 'it will never work.' When they're proven wrong, they'll say 'It works, but you don't need that.' And finally, as they see Axia becoming successful, they'll say 'IP-Audio? We do that too!'"

Steve, as always, was right on the money. In 10 years, Axia Livewire has become the world's most popular IP-Audio networking technology, and our mixing consoles are the world's best-selling — they're on-air in over 4,000 studios, and counting. You'll find Axia equipment everywhere: at privately-owned stations, and large clusters run by big conglomerates. At established public broadcasters, and at newly-licensed International stations. At government broadcast facilities, and podcast studios. Needless to say, we're humbled by the trust broadcasters place in us — and by your enthusiasm!

Being first with new technology is nice, but we've never been content to rest on our laurels. So the Telos R&D team continues to innovate and expand the scope

of IP-Audio. Axia consoles are the first and only IP-Audio consoles with a pre-configured network switch built in, to save broadcasters the effort and expense of procuring and programming third-party switches. Our compact xNode AoIP interfaces feature one-button setup, and can run on mains power or Power over Ethernet (PoE) for flexibility and redundancy. We've even developed our own zero-configuration Ethernet switch for Livewire — xSwitch — to make deploying IP-Audio easier than ever.

More than 45 Livewire partners believe in the vision of the Connected Studio too. Collectively, they make dozens of hardware and software products (ranging from telephone systems to audio processors to program automation) that interoperate directly with Axia networks via Ethernet — making the connections "smart", and eliminating the need to purchase audio conversion devices. We've also partnered with the high-performance audio standard RAVENNA to expand broadcasters' networking options even further. And there are a lot more great new ideas in the cooker — so watch this space!

In the final analysis, Axia's success isn't due to our efforts. It's you, the broadcast professional, who has embraced our vision, used our technology in ways we never dreamed of, and raved about Axia products to everyone who'd listen. We owe you a huge debt of thanks. And we promise to never stop trying to amaze and delight you.

So here's to the next 10 years.
Onward and upward!

Marty Sacks
Vice President, Axia Audio



Complexity, gone.

Just plug it in and go: that's

what we're talkin' 'bout.

Introducing:

The Axia Panel Families

Types of Panels

Since Axia was introduced to the broadcast industry several years ago, many new products have been added that have increased the flexibility and power of Livewire. Some of these products are designed specifically for console enhancement and others, such as Router Control Panels, may be used without a console. Allow us to introduce our family here.

Router Control Panels

These rackmount panels are used to control audio routing in a Livewire network. They are typically used where hardware control of audio routes is required in a fast-paced, live environment. These panels do not have any audio connections since they control the routing of network audio streams to other devices, typically Axia nodes. Their only connection is a Livewire Ethernet connection. No additional software is required to use these panels.

This group includes the X1, X2 and XY Router Control Panels.



Figure I-1: Router Control Panels

The X1 and X2 are single and double output controllers while the XY Router Control Panel is a full-featured XY panel that may route any input (source) to any destination (output) that you've defined.

Console Accessory Panels

This group includes several accessory panels that are used to provide remote control to microphone and headphone functions related to your Axia console. Some of these panels connect to the console via CANBus and others connect to your network via GPIO ports.

No additional software is required to use these panels. All functionality is already contained within Livewire streams since they include both audio and associated logic.

These panels are typically mounted into your studio millwork or custom turrets. They include:

- Mic Control / Headphone Selector panel
- Headphone Selector Panel
- Mic Control Panel (GPIO)
- Producer's Mic Control Panel (GPIO)



Figure I-2: Console Accessory Panels

LCD SmartSwitch and Film-Cap Switch Panels

These panels include numerous rackmount, console mounted and turret mount styles. They are available in several sizes. Some of these panels connect to your console's CANBus distribution hub and others connect to your Livewire network via Ethernet.

Switch panels are usually combined with Axia's PathfinderPC or PathfinderPro software. Pathfinder can perform many logic-based actions related to routing audio, alarms, console control and much more. Pathfinder has many other uses as well, including the ability to create software router control panels and to emulate some types of hardware audio routers.

The list below provides a summary of the LCD SmartSwitch and Film-Cap switch panels.

Description	Mount	Connection
5-Button Film-Cap	Console	CANBus
10-Button Film Cap	Console	CANBus
5-Button LCD SmartSwitch	Console	CANBus
10-Button LCD SmartSwitch	Console	CANBus
5-Button Film-Cap	Turret	GPIO
4-Button LCD SmartSwitch	Turret	CANBus
5-Button Film-Cap	1U Rack	GPIO
10-Button Film-Cap	1U Rack	GPIO
15-Button Film-Cap	1U Rack	GPIO
9-Button LCD SmartSwitch	1U Rack	Ethernet
17-Button LCD SmartSwitch	1U Rack	Ethernet
8-Button OLED SmartSwitch	1U Rack	Ethernet



Figure I-3: 5-Button Film-Cap and 4-Button LCD SmartSwitch Modules (Turret Mount)



Figure I-4: 5, 10 and 15-Button Film-Cap Rack Panels



Figure I-5: 9 and 17-Button LCD SmartSwitch Panels



Figure I-6: 8-Button OLED SoftSwitch Rack Panel

Stay tuned. Other panels will be added to this family in the future.

What’s Next

In the following chapters we will look at each of these groups and explain the installation and use of the different types of Axia panels.

In Appendix A, we will give you an introduction to Pathfinder and give you a couple of Switch Panel examples.

Note: Since this manual covers all of our current Accessory and Switch panels, some chapters contain information that may not apply to you. ↻

Chapter One:

The Router Control Panels

Overview

Axia Router Control Panels are used with other equipment as a part of a Livewire network. These panels control audio routes within a Livewire network and they are always used in conjunction with other Livewire equipment. The Remote Control Panels do not have any audio connections since they are simply controllers of audio streams to and from other Livewire devices.

The Axia Router Control Panel family currently consists of three products:

- The **X1 Router Control Panel** - allows you to instantly route any source on your Livewire network to a single specified destination.
- The **X2 Router Control Panel** - provides the equivalent of two X1 panels allowing you to instantly and independently route any source on your Livewire network to two specified destinations.
- The **XY Router Control Panel** - lets you route any Livewire source to any destination (as configured) on your Livewire network.

All of the Router Control Panels may have restrictions imposed by Access Control Lists so users will be granted access only to those sources and destinations that have been permitted. In addition to preventing undesired or accidental route changes, this scheme ensures the privacy of users in a networked audio environment.

Front Panel Controls and Indicators

The Livewire Router Control Panels incorporate various front panel controls and indicators to allow the

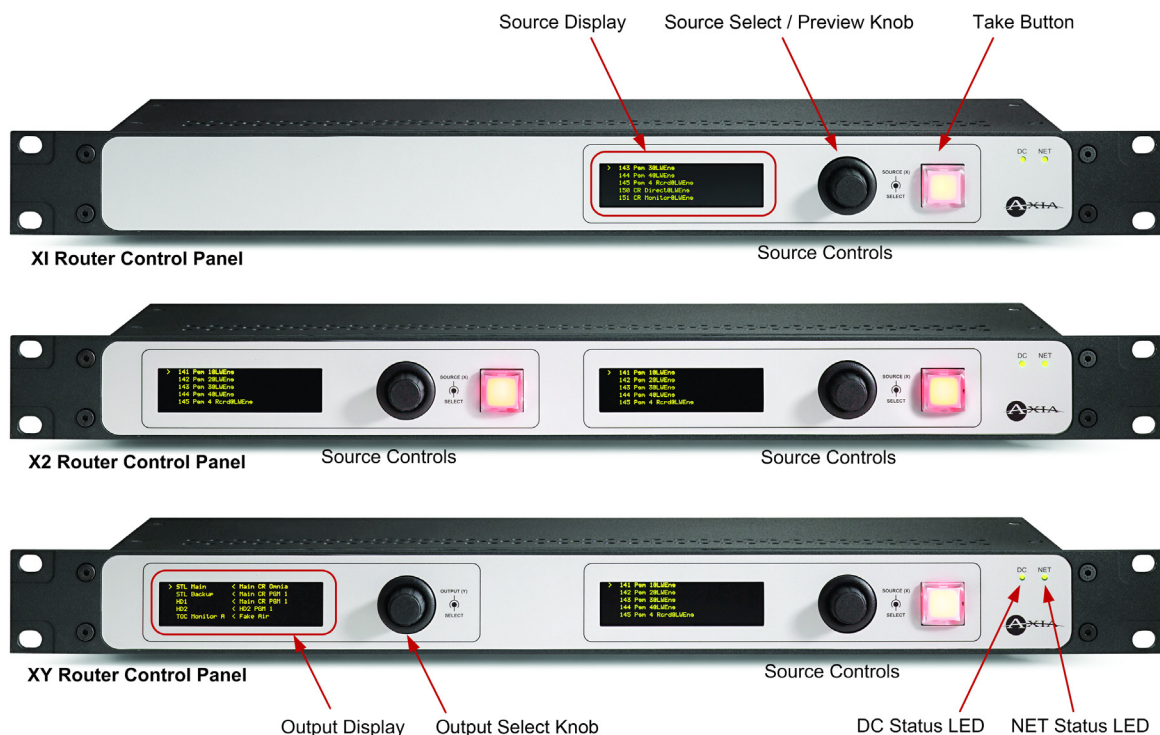


Figure 1-1: Axia Router Control Panels - Front Panel Callouts

operator to perform and verify operations quickly and confidently.

Controls

This section will discuss the function and operation of the front panel controls.

A word about Sources and Destinations:

Remember the fundamental concepts when working with Router Control Panels:

- A **Source** is an audio stream that is being delivered to your Livewire network. Sources typically originate at node inputs or may be mixes created by StudioEngines.
- A **Destination** usually corresponds to an output to which a Livewire audio stream is being delivered.

Select Knob

The **Select** knob is a rotary encoder that is used to scroll through a list of sources or destinations. The knob also acts as a button. The button for the source selection knob acts as a **Preview**. Pressing the knob will route the selected source; releasing the knob will return the previous route. This control is also used in assigning an IP address, as described in the Installation Guidelines section later in this chapter.

Take Button

Pressing the **Take** button will immediately route the selected source. Destinations are pre-configured for the X1 and X2 Router Control Panels. In the case of an XY Router Control Panel, the selected Source will be routed to the specific selected Destination. If the highlighted source is different than the current route, the Take button will blink red.

Source/Destination Display

The Router Control Panels feature OLED high reso-

lution displays to indicate the status of the sources or destinations depending on the function of the display. The currently selected audio source is highlighted by the display of a > pointer to the left of the source name. In the case of an XY Router Control Panel, the > indicator will be displayed beside both active source and destination (output). Inverted video is used to highlight your selection as you scroll through the displayed list of sources or destinations.

Status LED Indicators

Two front-panel LEDs indicate the status of the Router Control Panel's Power Supply and Ethernet connections.

DC

When illuminated, this LED indicates DC power being delivered from the internal power supply. If this indicator is not illuminated, check the mains.

NET

When illuminated continuously, this LED represents the presence of a live Ethernet link to another Ethernet 100Base-T device.

Rear Panel Connections

The rear Panel of all Remote Control Panels is identical. As you might expect, there are no audio connections since these are "control" panels; they control the sources or destinations of other Livewire devices.

Livewire (100 Base-T) Connector

This connector is for connection to an approved Ethernet switch. It has two integral LEDs. The green "Link"



Figure 1-2: Axia Router Control Panels - Front Panel Callouts

LED indicates the presence of a live signal (same as the front panel “Link” LED). The green “Speed” LED indicates a 100 Mbps connection when illuminated.

IMPORTANT NOTE: Axia Livewire devices are intended for use with an Ethernet Switch that supports multicast and QoS (Quality of Service). If you attempt to use them with non-switched Ethernet hubs, or a switch that is not enabled for multicast, you will experience network congestion that could disrupt other network activity.

Should you wish to connect a node to a non-Livewire network for access to the web configuration interface, etc, you must first confirm that streaming is disabled as described in Chapter 2.

Installation Guidelines

Power

There is one standard IEC receptacle for your mains power. This is auto-sensing for voltages in the range from 90 to 240 VAC.

It is essential that the third “grounding” pin not be defeated on the power cord and that the power cord be connected to a properly grounded receptacle. If a grounded receptacle is not available, a qualified electrical contractor familiar with the regulations in your area should be contracted to install one.

The Axia Router Control Panels may also be powered through PoE (Power over Ethernet). If you have an Ethernet switch that supplies PoE, connecting the control panel to it will power up the device.

Rack Mounting and Ventilation

The Axia Router Control Panels are designed to be used at ambient air temperatures between 0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit) and a relative humidity of 0 to 98% non-condensing.

The Router Control Panels should not be placed on bedding, carpet or other materials where the ventilation openings could be blocked. Do not block the ventilation openings on the top and sides of the unit.

The Router Control Panels are contained in a “1U” (rack unit) 19” rack-mount enclosure. The systems do not contain cooling fans, only convection cooling is available. Always leave a blank rack space above your Router Control Panels.

Initialization

NOTE: Only approved and properly programmed Ethernet switches incorporating the proper Multicast and QoS standards should be used. See www.AxiaAudio.com/switches/ for details.

Assigning an IP Address

When a new Router Control Panel is powered up for the first time, you will be presented with the setup screen shown below. It is necessary to assign an IP address to your new panel.

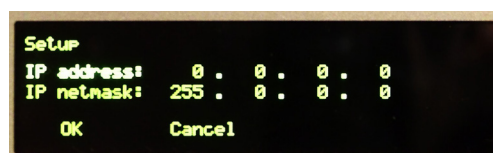


Figure 1-3: Initial IP Setup Display

Rotate the scroll knob until IP Address is highlighted and then depress the scroll knob to select IP address.

Use the scroll knob to select and set each of the four address octets in the IP address and the IP netmask. When you have selected the field, rotate the knob until the desired address is displayed and then depress the scroll knob to save and advance to the next octet.

Once you have configured the IP address and Netmask, your display should look something like this:

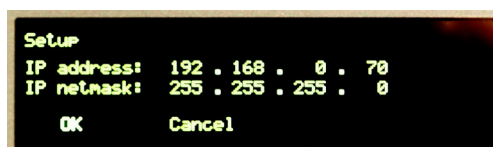


Figure 1-4: Typical Configured Unit

Rotate the scroll knob until OK is highlighted. Press the scroll knob to save the new settings and reboot the Router Control Panel.

If your panel is connected to a Livewire network, the source display should now display the available sources in your network. Further adjustments to this list are discussed in the following section.

Factory Reset

If for any reason, you find it necessary to reset the Router Control Panel, this can be done by powering up the panel while pressing the **Scroll Knob** and **Take** button on the right hand side of the panel. Hold these buttons until you see the words “**Factory Reset**” displayed. This will take approximately 20 seconds. Once you see “Factory Reset” you may release the buttons.

After the unit has rebooted, you will see the same setup screen that is displayed when a new unit powered up for the first time. Follow the steps in the previous section to assign an IP address to the panel.

Advanced Setup

Once you have assigned an IP address to your panel, and it is connected to your Livewire network, the panel is configured by using your web browser in a manner very similar to your other Axia devices.

The Home Page for a Router Control Panel is shown in Figure 1-5.

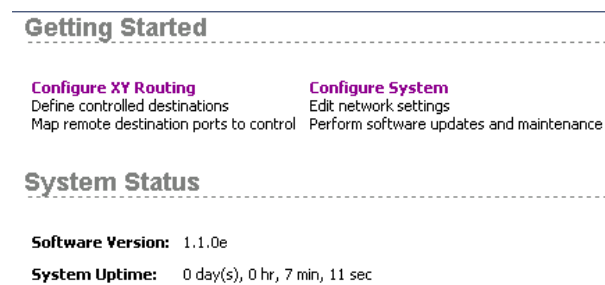


Figure 1-5: Router Control Panel - Home Page

When you select the link to one of the configuration pages, you will be prompted for a user name and password. By default, the user name is “user” and there is no password.

Since there are three different types of Router Control Panels, we will show the three different variations on the **Control Destinations** page. The **System Parameters** page is identical for all three panel types.

XY Routing

This configuration page allows you to control the Sources and Destinations used by the Router Control Panel.

XYR Destinations

The destination configuration for an X1 panel consists of a single destination as shown in Figure 1-6. Selecting a destination is done by writing the IP address of the device and the port in the following syntax:

Figure 1-6: X1 - Sources and Destinations

Figure 1-7: X2 - Sources and Destinations

In the case of an XY Panel, you will have control over as many destinations as you wish. Each of these destinations must be added in this configuration page. In

the example shown in Figure 1-8 the XY Panel is controlling three destinations on a node.

XYR Destinations

Label <small>Listed alphabetically</small>	Destination Address (IP/port) <small>Example: 192.168.2.121/1</small>	Password	Delete
Codec	192.168.100.15/1		<input type="checkbox"/>
Engineer Spkr	192.168.100.14/3		<input type="checkbox"/>
WXYZ STL	192.168.100.41/8		<input type="checkbox"/>
+ New Destination			NEW

Source Channel Filter

Channel range: - (all channels: 1 - 32767)

Channel list:
(comma separated list, example: 1,2,3,100-200,500)

Security

Front panel unlock PIN (4 digits, blank if none):

[Apply](#)

Figure 1-8: XY - Sources and Destinations

All three panels provide an option to add password access to the destination device, if the device has been configured with a password. By default, there is no password.

Source Channel Filter

The X1 and X2 Router Control Panels have an identical Source Channel Filter section. This is where you will impose restrictions on the source channels that this Router Control Panel is permitted to route. A “wide open” panel will have a channel range of 1 through 32767 specified as shown above. A smaller range may be imposed if desired.

In addition to the Channel Range parameter, you may also specify more restrictions in the Channel List. In the example shown in figure 1-6, we have left the Channel Range wide open, but the Channel List includes only two small ranges plus another single channel. This Router Control Panel will have access only to the channels specified within the Channel List.

Security

If you want to restrict front panel controls to authorized users, a 4 digit PIN can be configured. Once the PIN is correctly entered, access to the route control functions are shown. After 60 seconds of no operation, the front panel will return to the PIN request.

System Parameters

This page has the network settings that you created when the panel booted up for the first time. You will now have the option of making changes to these settings. This is also where you can give the panel a useful name.

The System Parameters page, shown in Figure 1-9 allows re-configuring the panel’s IP address and related settings. It also permits choosing between a primary and secondary bank of software and provides for the download of new software into the secondary bank. The currently running software version is displayed here as well. Click the **Apply** button for changes to take effect.

IP Settings

These are the usual IP-related settings (see *Introduction to Livewire; System Design Reference & Primer* for an overview and references with additional information). Your network administrator should be able to provide the needed values. Each unit must be assigned a unique IP address. DHCP is intentionally not supported.

Host name

The name is a 12-character, alphanumeric name for this panel that may include hyphens but NOT spaces; those will be converted to hyphens. This name is used to identify the device on the network. You may wish to include the location of the panel (studio or rack) in the name for ease of reference.

Network address (IP Address)

The IP address of the device. Each Router Control Panel must have a unique IP address. Normally this would be set using the front panel at first-time power-up, but it can be checked or changed from this web page, if needed.

NOTE: If you change the IP address you will lose your browser connection when you click Apply, and will need to reconnect using the new IP address.

Netmask (Subnet mask)

This is the IP subnet mask of the local unit. The typical setting that is suitable for most cases is 255.255.255.0.

IP settings:

Host name: (1-12 characters: letters, numbers, hyphen)

Network address:

Netmask: ▼

Gateway:

NTP server:

System location:

System contact:

SNMPv1/2c community name: (empty - SNMPv1/2c disabled)

Syslog server (IP address):

Syslog severity level filter: ▼

User password:

New password: (5-8 characters: letters and numbers)

Retype new password: (verify)

Firmware version:

Hardware revision: Axia XYR

☒ Bank 0 ver. 1.1.0e (build Mon Oct 22 14:02:56 EDT 2012)

☐ Bank 1 empty

update:

Warning: System will reboot after changing current bank.

Figure 1-9: System Configuration Page

- Error: error conditions
 - Warning: warning conditions
 - Notice: normal but significant condition
 - Informational: forwards informational messages and all other message levels.
 - Debug: debug-level message
- Only messages with a severity higher than that specified by the filter will be forwarded to the remote logger.

User password

This is the password required to connect to the unit. It must be at least 5 characters long and may be as long as 8 characters. Only alphanumeric characters are permitted. To change the password you must enter the new and old passwords and then click Apply. NOTE: If you changed the IP or Firmware settings the unit will reboot. If you have only entered a new password the unit will not reboot.

IMPORTANT! Changing device passwords can have serious implications on the operation of your PathfinderPC software. Consult the PathfinderPC manual before making changes to your password scheme.

Gateway (Router)

This may be the IP address of the IP Router connecting the local IP network with some other IP network. This is not used or required in most cases.

Syslog Server (IP address)

Various services generate syslog (RFC 3164) messages, which can be forwarded to a remote syslog daemon. The remote syslog daemon IP address can be entered on the System configuration page.

Syslog severity level filter

You can customize syslog logging by choosing log detail level:

- Emergency: system is unusable
- Alert: action must be taken immediately
- Critical: critical condition

When logging into the panel any of the following “user names” may be used: user, USER, axia, Axia, AXIA. The default password is blank for any of the above users.

Firmware version

Each Router Control Panel has two internal memory “banks”. Each bank contains room for a complete version of operating software. This approach allows a software update to be completed and checked without danger of making the unit inoperable if the download were to be incomplete or corrupted. It also provides an easy way to try a new software version and still return to the old version.

The software version in each bank is displayed here. To change banks simply click in the “radio button” for the desired bank and then click on **Apply**.

IMPORTANT! The router panel will reboot after you click **Apply** if you change the software version. This will result in loss of control while the panel reboots. Any existing audio routes will continue will not be interrupted.

Saving Bank 1 Software

Software is always downloaded to bank 1 (the secondary bank). Downloading new software to your panel (see below) will overwrite any software currently in this bank. You can save the software currently in Bank 1, by “committing” it to Bank 0 as follows:

- Click on **Commit this version to Bank 0** box
- Click on **Apply**.

Downloading New Software

A new version of software can be downloaded into Bank 1 as follows:

1. Go to www.AxiaAudio.com/downloads/ and download the desired software update for your Router Panel to your computer (this should be the computer that you will use to access the panel’s web page configuration). Your local computer operating system should display a prompt to permit you to choose where you wish to locate the downloaded file. You can choose any convenient location, just be sure to note the drive and location where the file is to be saved.
2. Open a web browser and connect to the device to be updated. Enter the complete path and file name for the software file (e.g. the file downloaded from the Axia site), or click on the Browse button to locate the file. Once the proper path and filename are displayed, click on **Apply** to download the file.
3. A successful download will be indicated by the new version being displayed in the Bank 1 field. If the download is unsuccessful the field for Bank 1 will be blank.
4. To run the new software click on Bank 1 radio button

and then click on **Apply** to reboot the device. It will take approximately 20-30 seconds for the reboot.

Router Control Panel Operation

This section will walk you through the operation of the three different models of Router Control Panels.

X1 Router Control Panel

The X1 panel is pre-configured by you to control a single destination of your choice. The user may select from a list of permitted sources.

Source Display

This display lists up to 5 sources that have been included in the Access control list for this panel. When the list exceeds five items, the list can be scrolled with the Source Select controller.

The Source display indicates:

- The source’s Livewire channel number
- The source’s name
- The source’s origin (node name, StudioEngine name, etc)

Source Select Control

This control lets the user scroll through the list of permitted sources. The currently selected source is displayed with inverted colors. The user can push the knob to make a temporary route or “preview” of the selected source.

Take Button

Pressing the Take button performs the function of routing the selected source. The selected source will be delivered to the panel’s pre-configured destination. When the selected source is different than the current routed source, the Take button will blink red.

X2 Router Control Panel

Each portion of the X2 Router Control Panel performs the same as the X1 panel described above. Each of the two Source Selectors deliver the selected source to a pre-configured destination. Note that the Source Channel

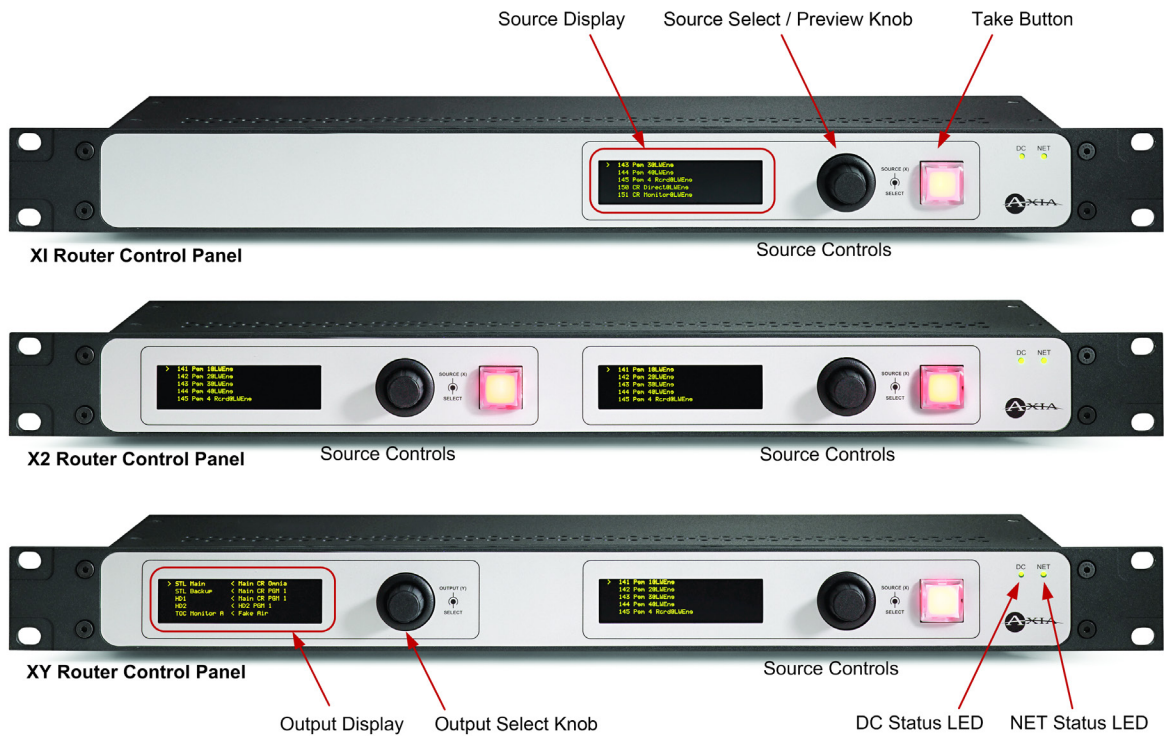


Figure 1-10 Axia Router Control Panels - Front Panel Callouts

Filter applies to both Source Select controllers.

XY Router Control Panel

The XY panel routes permitted sources to any number of pre-configured destinations.

Output Display

This display lists up to 5 destinations (scrolls for longer lists) and includes the following information:

- The Destination label as configured in the XY panel web configuration
- The Livewire Source Channel number that is currently routed to this destination
- The currently assigned source name and origin

Output Select Control

This control is used to scroll through the list of pre-configured Destinations. Once a destination is highlighted, its source may be changed by “taking” a new source as described in the next section.

Source Display

This display lists up to 5 sources that have been

included in the Access Control List for this panel. When the list exceeds five items, it can be scrolled with the Source Select controller.

Source Select Control

This control will permit the user to scroll through the list of permitted sources. The currently selected source is displayed with inverted colors. The user can push the control to make a new selection and “take” a new source. The selected Source will be routed to the currently selected Destination.

Take Button

Pressing the Take button performs the same function as pressing the Source Select control. The selected source will be routed to the panel’s currently selected destination.

What’s Next

Console accessory panels are next. Get control of yourself! 🎮

Chapter Two:

Console Accessory Panels

Console accessory panels are used to remotely control microphone and headphone functions. The four items in this group are shown in Figure 2-1.



Figure 2-1: Console Accessory Panels

The microphone panels that consist of only switches and indicators, such as the two shown on the left of Figure 2-1, connect to the system via GPIO ports. The panels that incorporate headphone level controllers, such as the two shown on the right of Figure 2-1, connect to the console via CANBus.

Panels with a CANBus connection require a cable connection to the nearest Element console. Note that even though CANBus panels use an RJ-45 connector, they are NOT to be connected to your Ethernet switch. These panels are intended ONLY for connection to the CANBus distribution hub that is inside the Element chassis.

Panels equipped with the DB-15 connector are GPIO panels and require only a standard GPIO connection. These include the Mic Control Panel and the Producer's Mic Control Panel.

Installing a CANBus Accessory Panel

Note: Before beginning installation, make certain that you have the latest software installed for your StudioEngine and Element console. The current version software is always available at www.AxiaAudio.com/downloads/.

Pre-installation Hardware Check

Before installing your new panel, we need to perform a quick hardware check.

Open the overbridge panel on your Element and examine the Power Distribution Board (the one in the middle with all the RJ-45 connectors). Does one of the RJ jacks contain an RJ-45 termination device? If so, you are ready to install your accessory panel. Remove the terminator from the distribution board and set it aside for later.

If you do not see this terminator, please contact Axia support for additional assistance.

Installation

User panels that connect via CANBus are much like Element fader modules. Each panel requires a unique ID setting in order for the system to recognize it correctly. Each Element module (and each CANBus accessory panel) has a multi-position rotary switch located on its circuit board; each device attached to an Element's CANBus must have this switch set to a unique position within its device type. To clarify, a fader board and an accessory panel can both be set to ID:1 since they are different device types.

To find out what ID assignments are free, enter Element's diagnostic mode by pressing and holding the * and 2 and # keys on the Monitor Module for five seconds.

Test Mode	
[1:1] FN 4-fader	0.4.11/01
[2:3] FN Europhone	0.4.11/02
[3:2] FN US Phone	0.4.11/03
[5:5] FN User	0.4.11/35
[UP] [DOWN] - Select Module	
[ENTER] - Begin testing	

Figure 2-2: Element diagnostic mode

You'll see a description of each installed module and accessory panel device; preceding the description are a

set of numbers in brackets.

The bracketed numbers refer to device type and ID number, respectively. The first digit identifies the type of device; the second digit the ID (controlled by the rotary switch). Select an ID for your new accessory panel by determining which IDs are not in use.

Now, using a small screwdriver, turn the switch on the bottom of the accessory panel to the ID number you've selected (as shown in Figure 2-3).

Now, connect the panel to the Element CANBus using CAT-5e Shielded cable. Be sure to keep make the cable only as long as is required; 50 feet of cable for a panel located 10 feet from the console is excessive, and can cause problems later! The maximum total length of the CANBus cable is approximately 100 ft (30 M) and this includes the cable between your Element and its power supply chassis.

Shielded category cable is almost never required in an Axia system. However, we highly recommend shielded CAT-5e in this instance in order to prevent the digital control signals present in these circuits from generating RF interference after they exit the containment of the Element chassis. In a pinch, though, regular (unshielded) CAT-5e will work.

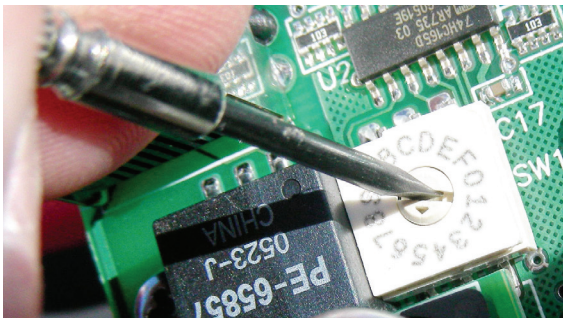


Figure 2-3: Setting the CANBus ID number

Connect one end of the cable to the accessory panel you're installing, and the other end to the Power Distribution Board, using the jack you removed the termination block from.

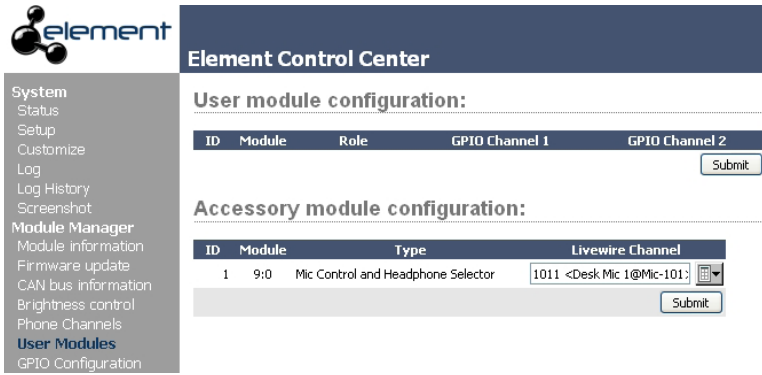


Figure 2-4: Element Setup - CANBus Panel

If you have more than one accessory panel to install, connect it now to the second RJ-45 port on the back of the first accessory panel. More panels can be daisy-chained as needed.

On the final accessory panel, place the termination block you removed from the Power Distribution Board into the panel's spare RJ-45 jack.

Once connected, your new accessory panel will be automatically recognized and ready to use. In the rare event it is not, please "capture" the console's new configuration, following the instructions in Chapter 1 of your Element manual. If you don't have that handy - just hold down the * and 2 keys on the Element for several seconds until you see the "capture" prompt on the small displays above your faders. Press the **enter** key and the Element will now know all about the newly connected accessory panel. From the web pages, you can select the **User Modules** option. You will see a display similar to Figure 2-4. It will display all user panels and allow you to associate a panel with a Livewire source. Remember that this source must be applied to a fader before the accessory panel is functional.

Programming

Using a connected computer, log into your Element's configuration web pages and select the **User Modules** page. You'll see your new panel listed there.

- For panels with mic functions, enter the channel number of the mic source you want it to control. You may also use the drop-down menu to find and select that source.

- For panels with headphone functions, enter the channel number (or use drop-down) to select the mic source that the headphone panel is adjacent to. The panel will control the headphone backfeed to that mic position.

Installing a GPIO Accessory Module

Accessory panels using GPIO connections are a straightforward installation using standard multiple-conductor cable and DB-15M connectors. You can fabricate this cable, or purchase one like the Cables To Go #02639, a 10-foot version available from Provantage, Best Buy or online from CablesToGo.com.

Cables between the accessory panels and the Axia GPIO Node are pin-for-pin (thru cable), with male-to-male connections.

Programming a Mic Control Panel connected to an Element GPIO Connection

This section applies when connecting a Mic Control accessory panel to the GPIO port of your Element Power Supply. It assumes you have already made the cable connection described above in “Installation.”

Using a PC connected to the Axia network, enter the configuration page for your Element and select the GPIO Configuration section.

In the GPIO Configuration page, you will see eight listings that correspond to the eight ports that are on the back of the Element Power Supply. Create a name on the listing that corresponds to the port to which you wired your Mic Control Panel, and enter the channel number of the mic source you want it to control.

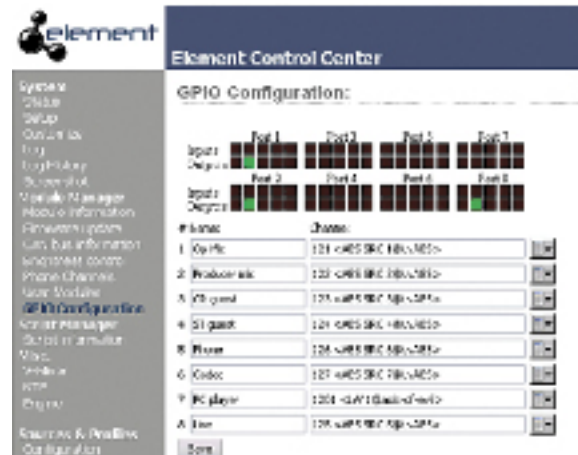


Figure 2-5: GPIO status indications

Now, assign the Mic channel you’re working with to one of the channels of your Element. Navigate to the Element GPIO Configuration page as shown in Figure 2-5 above and observe the status indicators for the lights and input commands on your mic controller as you toggle the accessory panel from **On** to **Off**. Refer to the table in Figure 2-6 for the Mic GPIO profile.

Programming a Mic Control Panel connected to a GPIO Node Connection

This section applies when connecting a Mic Control accessory panel to the GPIO port of an Axia GPIO Node. It assumes you have already made the cable connection described above in “Installation.”

Using a PC connected to the Axia network, enter the configuration page for the GPIO Node to which your accessory panel is connected.

Create a name on the listing that corresponds to the port to which you wired your Mic Control Panel, and

Inputs	Pin	Outputs	Pin	Power/Common	Pin
ON Command	11	ON Lamp	1	Source Common	7
OFF Command	12	OFF Lamp	2	Logic Common	8
TALK Command	13	TALK Lamp	3	+5 VDC	9
MUTE Command	14	MUTE Lamp	4	Input Common	10
not used	15	not used	5	not used	6

Figure 2-6 : GPIO pinout diagram for Mic profile

enter the channel number of the mic source you want it to control.

Now, assign the Mic channel you're working with to one of the channels of your Element. Navigate to the GPIO Node's Configuration page and observe the status indicators for the lights and input commands on your mic controller as you toggle the accessory panel from **On** to **Off**. Refer to the table in Figure 2-6 for the Mic GPIO profile.

Special Programming for Mic Control Panels

It is possible to connect the mic controller to a GPIO port either on a GPIO Node or on the Element Power Supply and program it using PathfinderPC logic control. For more information on this, please refer to the PathfinderPC User's Manual.

Testing GPIO Accessory Panels

Once you have your GPIO panel connected, you can easily test it to be sure it is connected properly. To do this, open your web browser and navigate to the IP address of the GPIO node or control surface to which your GPIO panel is connected. You may simply monitor the status of the pins on your GPIO port and watch the input pins change to Green as you press buttons on the panel. If you associate your panel with a Livewire channel such as a microphone source, you will be able to see the outputs change as well when the ON/OFF status of the channel changes.

In Figure 2-7, we have associated GPIO port one with a control room guest microphone. We can see that

GPIO Configuration:

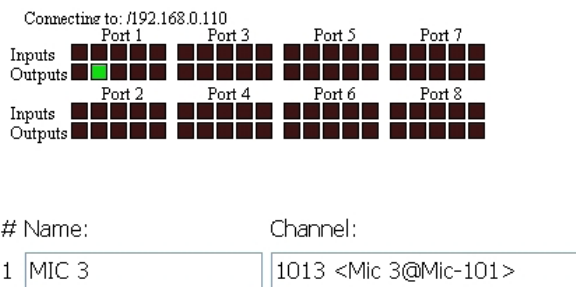


Figure 2-7: Testing GPIO Switch Panels

GPO pin 2 is illuminated which indicates channel OFF status for a CR guest microphone. Refer to your Element manual or Appendix A of the GPIO node manual for a complete listing of GPIO profiles.

Operation of Console Accessory Panels

Operation of these panels is not complicated since they largely duplicate the controls on the console. There are a few unique features that deserve a mention though.

ON

Naturally turns the microphone channel ON and the indicator lamp turns Red.

OFF

As you might expect - this switch turns the channel OFF. The indicator lamp turns Amber when the channel is in the OFF state.

MUTE

This control can be used as a cough or momentary privacy control. It has no local status indicator however the channel on the console will indicate MUTE.

TALKBACK

When pressed, this momentary switch removes the microphone from Program busses and assigns it directly to the operator's headphones or Preview speaker (if not muted).

Talk To Studio

This momentary control on the Producer's Microphone panel permits the Producer to talk to Studio guests and automatically removes the Producer mic from Program busses while pressed.

Talk To Preview

When pressed, this momentary control removes the Producer's microphone from Program busses and assigns it directly to the operator's headphones or Preview speaker (if not muted).

Preset 1 and 2

These buttons allow the talent to select from two pre-configured headphone feeds. The feeds associated with these buttons are configured in the Element Show Profile.

Headphone Control

- Rotating this control adjusts the level of the channel's backfeed which is connected to a dedicated headphone amplifier.
- Push and turn this control to select the signal being delivered to the headphones. Options include:
 - » Program 1
 - » Program 2
 - » Program 3
 - » Program 4
 - » Ext 1
 - » Ext 2

What's Next?

In the next chapter we will discuss the various switch panels that can be used to give you customized control of many different functions within your Livewire network. ↻

World, now digital

Analog memories fade.

The future beckons!

Chapter Three:

Switch Panels

Switch panels come in various button configurations and communications interfaces. There is a wide variety of products to meet your specific requirements.

All switch panels use Axia's PathfinderPC or PathfinderPC Pro software. The power of that software provides endless flexibility and advanced features. Pathfinder can perform many logic-based actions related to routing audio, alarms, console control and much more. Pathfinder has many other uses as well including the ability to create software router control panels and to emulate some types of hardware audio routers.

The different types of LCD SmartSwitch and Film-Cap switch panels are listed in the table below.

Description	Mount	Connection
5-Button Film-Cap	Console	CANBus
10-Button Film Cap	Console	CANBus
5-Button LCD SmartSwitch	Console	CANBus
10-Button LCD SmartSwitch	Console	CANBus
5-Button Film-Cap	Turret	GPIO
4-Button LCD SmartSwitch	Turret	CANBus
5-Button Film-Cap	1U Rack	GPIO
10-Button Film-Cap	1U Rack	GPIO
15-Button Film-Cap	1U Rack	GPIO
9-Button LCD SmartSwitch	1U Rack	Ethernet
17-Button LCD SmartSwitch	1U Rack	Ethernet
8-Button OLED SmartSwitch	1U Rack	Ethernet

The following sections will discuss installation and operation of the three different types of panels that use these different communications methods:

- CANBus
- GPIO
- Ethernet

Installing a CANBus Switch Panel

Note: Before beginning installation, make certain that you have the latest software installed for your StudioEngine and Element console. The current version software is always available at www.AxiaAudio.com/downloads/.

Pre-installation Hardware Check

Before installing your new panel, we need to perform a quick hardware check.

Open the overbridge panel on your Element and examine the Power Distribution Board (the one in the middle with all the RJ-45 connectors). Does one of the RJ jacks contain an RJ-45 termination device? If so, you are ready to install your accessory panel. Remove the terminator from the distribution board and set it aside for later.

If you do not see this terminator, please contact Axia support for additional assistance.

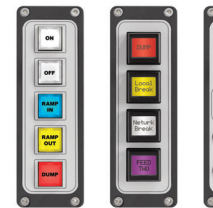


Figure 3-1: 5-Button Film-Cap and 4-Button LCD SmartSwitch Modules (Turret Mount)

Installation

Switch panels that connect via CANBus are much like Element fader modules. They require a unique ID setting in order for the system to recognize them correctly. Each Element module (and each CANBus accessory panel) has a multi-position rotary switch located on its circuit board; each device attached to an Element's CANBus must have this switch set to a unique position within its device type. To clarify, a fader board and a switch panel can both be set to ID:1 since they are different device types.

To find out what ID assignments are free, enter Element's diagnostic mode by pressing and holding the * and 2 and # keys on the Monitor Module for five seconds.

You'll see a description of each installed module and CANBus accessory panel device; preceding the description are a set of numbers in brackets. The bracketed numbers refer to device type and ID number, respectively. The first digit identifies the type of device; the second digit the ID (controlled by the rotary switch). Select an ID for your new accessory panel by determining which IDs are not in use.

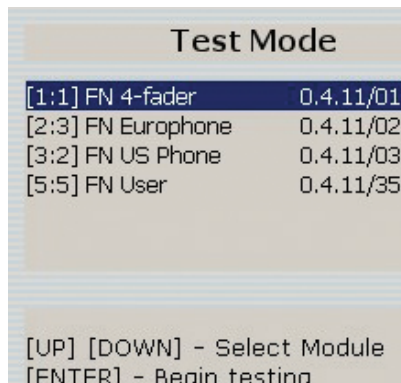


Figure 3-2: Element diagnostic mode

Now, using a small screwdriver, turn the switch on the back of the switch panel to the ID number you've selected (as shown in Figure 3-3).

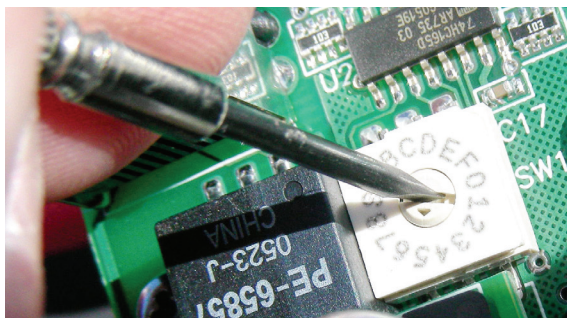


Figure 3-3: Setting the CANBus ID number

Now, connect the panel to the Element CANBus using CAT-5e Shielded cable. Be sure to keep make the cable only as long as is required; 50 feet of cable for a panel located 10 feet from the console is excessive, and can cause problems later! The maximum total length of the CANBus cable is approximately 100 ft (30 M) and this includes the cable between your Element and its power supply chassis.

Connect one end of the cable to the switch panel

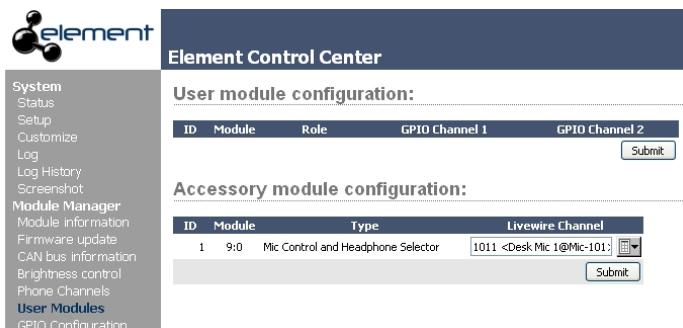


Figure 3-4: Element Setup - CANBus Panel

you're installing, and the other end to the Power Distribution Board, using the jack you removed the termination block from.

If you have more than one accessory panel to install, connect it now to the second RJ-45 port on the back of the first accessory panel. More panels can be daisy-chained as needed.

Shielded category cable is almost never required in an Axia system. However, we highly recommend shielded CAT-5e in this instance in order to prevent the digital control signals present in these circuits from generating RF interference after they exit the containment of the Element chassis. In a pinch, though, regular (unshielded) CAT-5e will work.

On the last accessory panel in your chain, place the termination block you removed from the Power Distribution Board into that panel's spare RJ-45 jack.

Once connected, your new CANBus switch panel will be automatically recognized and ready to use. In the rare event it is not, please "capture" the console's new configuration, following the instructions in Chapter 1 of your Element manual. As outlined in the manual, press and hold down the * and 2 keys on the Element for several seconds until you see the **CAPTURE** prompt on the channel displays above your faders. Press the **Enter** key and the Element will now recognize the newly connected accessory panel. You can now monitor and control the switch panel with PathfinderPC software.

The 5-button and 10-button film-cap CANBus switch panels can function as switch panels that are monitored

and controlled by Pathfinder or they may functions as simple GPIO panels that may be used without Pathfinder. This setting is found in the Element's User Module configuration shown in Figure 3-4. The setting for **Role** will determine the function as either a GPIO or Switch panel.

Installing a GPIO Switch Panel

Switch panels using GPIO connections are a straightforward installation using standard multiple-conductor cable with DB-15M connectors. You can fabricate this cable, or purchase one like the Cables To Go #02639, a 10-foot version available from Provantage, Best Buy or online from CablesToGo.com.



Figure 3-5: Axia rackount Switch Panels connect via GPIO ports

Cables between the GPIO switch panels and the Axia GPIO Node are pin-for-pin (thru cable), with male gender connectors on both ends of the cable. Each group of 5 buttons will be associated with a single GPIO port and will require a connection as described above.

In order to verify basic connectivity of a GPIO panel, you may simply use your web browser to view the GPIO configuration page of the Element or GPIO node to which your GPIO panel is connected. When you press a button on the panel, you will see the corresponding activity indicator turn Green.

GPIO panels can be used to monitor and control the logic functions of a Livewire source or they may be monitored and controlled by Pathfinder.

Please refer to the manual for your Element console or GPIO node for more information on the built-in functions associated with GPIO ports.

Installing an Ethernet Button Panel

Ethernet panels are fundamentally different from our other two types of panels in that they require no connection to your control surface or GPIO nodes. These panels are standalone devices that are not dependent on any other hardware for installation or configuration. There are currently three items in this product group. They are the 9 and 17-button LCD SmartSwitch Panels and the 8-button OLED switch panel.

Ethernet panels require only a network connection to your Ethernet switch. Once you have connected a new Ethernet accessory panel to your network, it will need an IP address. These panels support the standard Axia "manual BOOTP" configuration. A new address can be configured using Axia's iProbe management software or the bootps.exe utility. Each unit has a "paper clip" button at the back, near the Ethernet controller. Pressing the button puts the unit in IP configuration mode whereby a BOOTP request is sent. Figure 3-6 shows the iProbe pop-up that is triggered by the BOOTP request. Simply enter the desired IP address and network mask in the boxes and click OK. The new panel will now acquire the desired IP address

Once the panel has an IP address, it may be used as an logic control device in a Livewire network.

The 8-Button OLED panel has a slightly different setup than the 7 and 9-button panels. With the 8-button OLED panel, a single press of the ID button will enter setup mode. The front panel displays will indicate IP ADDR CHANGE and the BOOTP server will prompt you for a new IP address. Once the desired address has been entered, press the ID switch a second time to exit setup mode.

Ethernet accessory panels can be used for many different purposes. Each panel consists of either 9 or 17 buttons with backlit LCD displays. The OLED switch panel features eight displays and a button that is associated with each display.

The primary tool used for monitor and control of the

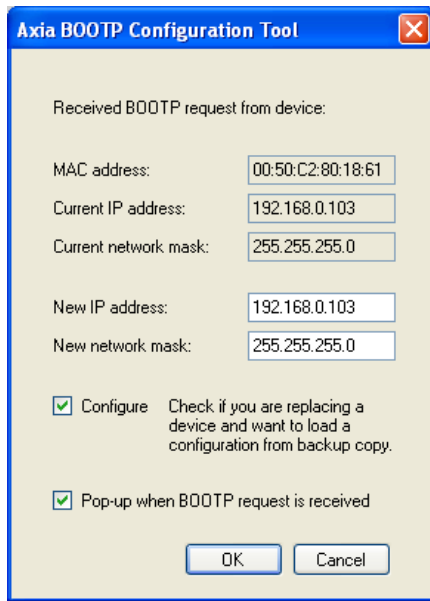


Figure 3-6: iProbe's BOOTP Pop-UP

switches and indicators in an Ethernet switch panel is Axia's PathfinderPC software. These buttons are programmed in a manner similar to other LCD panels and can be used for many different purposes. Please refer to the PathfinderPC manual which discusses PathfinderPC and how it is used to program accessory panels. Appendix A of this manual provides some background and a couple of examples to help you understand how PathfinderPC is used in conjunction with all types of button panels.

Testing Accessory Panels

Before going to all of the work of programming complex functions to your switch panels, it will be useful to check that they are properly connected and recognized by their associated hardware. This section describes some basic tests to ensure your panels are alive and ready for use.

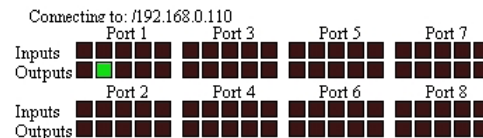
GPIO Panels

Once you have your GPIO panel connected, you can easily test it to be sure it is connected properly. To do this, open your web browser and navigate to the IP address of the GPIO node or control surface to which your GPIO panel is connected. You may simply monitor the status of the pins on your GPIO port and watch the input pins change to Green as you press corresponding buttons

on the panel. If you associate your panel with a Livewire channel such as a microphone source, you will be able to see the outputs change as well when the ON/OFF status of the channel changes.

In this example, we have associated GPIO port one with a control room guest microphone. We can see that GPO pin 2 is illuminated which indicates channel OFF status for a CR guest microphone. Refer to your Element manual or Appendix A of the GPIO node manual for a complete listing of GPIO profiles.

GPIO Configuration:



Name: _____ Channel: _____

Figure 3-7: Testing GPIO Switch Panels

Testing CANBus and Ethernet Panels

Once you have your CANBus or Ethernet panel connected, you can run a simple test to be sure you are properly configured. To do this, use Telnet or other communication software such as PuTTY to communicate directly with the panel.

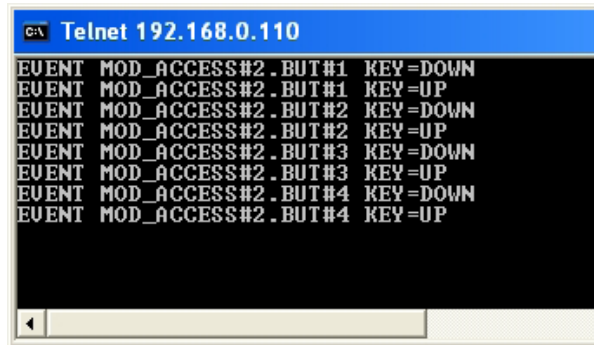
If using Telnet, open up a command prompt. Then use Telnet directed at the IP address of the Element console or the Ethernet panel and specify port 4010. The Telnet syntax from a command prompt for the example in Figure 3-8 is:

```
telnet 192.168.0.110 4010
```

Figure 3-8 shows a Telnet session and the results for one press on each of the four buttons of a 4-button CAN-Bus LCD switch panel that is connected to an Element control surface with the IP address of 192.168.0.110. The results are similar for other types of CANBus and Ethernet switch panels.

In addition to the button activity, you will also note

the type of panel and the button numbers. In this example, we see the device identified as an Accessory Panel #2. The buttons are buttons #1 through 4. You will need this information when programming button functions in the Stacking Event section of PathfinderPC .

A screenshot of a Telnet window titled "C:\ Telnet 192.168.0.110". The window displays a list of eight events in a monospaced font. Each event line follows the format "EVENT MOD_ACCESS#2.BUT#N KEY=DOWN" or "EVENT MOD_ACCESS#2.BUT#N KEY=UP", where N is a number from 1 to 4. The events alternate between DOWN and UP states for each button. The background of the window is black, and the text is white. A scroll bar is visible at the bottom of the window.

```
C:\ Telnet 192.168.0.110
EVENT MOD_ACCESS#2.BUT#1 KEY=DOWN
EVENT MOD_ACCESS#2.BUT#1 KEY=UP
EVENT MOD_ACCESS#2.BUT#2 KEY=DOWN
EVENT MOD_ACCESS#2.BUT#2 KEY=UP
EVENT MOD_ACCESS#2.BUT#3 KEY=DOWN
EVENT MOD_ACCESS#2.BUT#3 KEY=UP
EVENT MOD_ACCESS#2.BUT#4 KEY=DOWN
EVENT MOD_ACCESS#2.BUT#4 KEY=UP
```

Figure 3-8: Telnet Monitor of LCD Switch Panel

As a matter of general interest, you can also see other messages when connected to port 4010 of an Element. All channel ON/OFF activity, MUTE functions (and lots more) can be monitored on port 4010 of an Element console.

What's Next?

Now your switch panels are installed and ready for action. This is where it gets really interesting! You may take a look at Appendix A for an overview of Pathfinder and a couple of examples. We also encourage you to refer to the Pathfinder manual for a full description of Pathfinder and its applications using Stacking Events and Mini Panels. 🌀

TCP/IP,

How did we live without thee?

Analogically.

Appendix A: Pathfinder and Switch Panels

What is Pathfinder?

PathfinderPC and PathfinderPro are Axia's Client/Server router control software that are designed to provide facility-wide control over any number of Axia Livewire products including our accessory panels. Pathfinder allows us to monitor and control many aspects of a Livewire system.

Some accessory panels have dedicated functions and Pathfinder is not required for their operation. Microphone and headphone control panels are a couple of examples. They are normally associated with faders on your control surface and they perform predetermined tasks.

Some accessory panels are just a collection of electronic parts; they are nothing without software support. These accessory panels become extremely flexible when combined with the power of Pathfinder. They can be used for a multitude of tasks. Pathfinder can monitor the accessory panels for button presses and perform many different types of actions as programmed within Pathfinder's event system. It is also possible to use a combination of software control panels and hardware accessory panels. Software panels can also be "mapped" to hardware accessory panels making it possible to use hardware and software to simultaneously control your Livewire system.

This chapter is intended to provide an overview of the possibilities when using accessory panels and Pathfinder together. We will also provide a few examples to illustrate some of the common procedures. This is not intended to be a complete reference on Pathfinder. For more details, please refer the Pathfinder manual which was provided with your Pathfinder software. Updates may be found at:

<http://www.PathfinderPC.com/PathfinderPC Help.pdf>

Please visit <http://www.axiaaudio.com> regularly for updated tech notes on many topics including PathfinderPC and PathfinderPRO.

Overview

Accessory switch panels can be utilized by Pathfinder in a couple of different ways:

1. Monitor accessory panels and directly change audio routes or other system parameters
2. Utilize logic functions to monitor accessory panels and make changes to audio routes or other system parameters that may be dependent on the button presses and many other factors.

The difference between these two methods is subtle but very important. Since life is not always simple - there are often conditions attached to the tasks we wish to perform. Here is a simple example as an illustration. Let's assume we want to use an LCD panel to control an audio route.

Logic Control

Using the logic control method, Pathfinder can "watch" for a button press. On detecting that press, an audio route could be established, the button color changed and some text displayed on the LCD panel such as "REMOTE ON". A second press could restore a different audio route and change the button color and text again. This is great for some basic control but often our needs are more complex. Suppose we also wanted to give others the ability to change this route? And of course, we'd want confirmation that something actually happened when the button was pressed. This can be accomplished by using the Stacking Events section of Pathfinder (described later).

Software-Hardware Mapping

As described above, we can use a switch panel, either software or hardware, to control switching of audio routes and control other parameters in a Livewire network. A variation on this scheme is to design a software panel to do what we want and then map hardware buttons to buttons on that software panel. For many situations this is all you need. Some of the advantages of this technique are:

- No Pathfinder stacking events required
- Permits simultaneous control from hardware and software panels
- Time saved due to the ease of creating similar panels in Panel Designer software

Logic Control Method (Stacking Events)

Pathfinder has extensive logic control capabilities that reside in the tab labelled Stacking Events. For those of you who are familiar with industrial PLCs (Programmable Logic Controllers), think of Pathfinder's Stacking Event system as a PLC for Livewire. Stacking Events give us the ability to perform logic controlled actions that are dependent on one or more qualifiers (conditions). It is very powerful.

To continue using our previous example of a simple audio route change, we might do something a bit more complex that would involve Stacking Events and a set of three qualifiers and actions. Here is what the logic might look like:

Qualifier A:

- Detect press of button 2 on LCD panel in Production A *or*
- Detect press of button 4 on LCD panel in Production B *or*
- Detect a GPI state change on a GPIO node

Action A

- If *any* of these qualifiers are detected (due to the "*or*" condition), we will write a value to a memory slot – call it REMOTE1. That value would be used to indicate that some further action could be taken since it can be used as a qualifier for subsequent actions.

Now let's look at a second set of qualifiers and actions.

Qualifier B:

- Check for memory value of REMOTE1 *and*
- Check for status of one other pre-existing audio route (possibly as a safeguard or lockout)

Action B

If both B Qualifiers are met (due to the "*and*" con-

dition), then we can ask Pathfinder to change an audio route that might direct a Remote 1 feed to our on-air studio. We would also do a few more things. Here is a summary of possible actions

- Establish an audio route for Remote 1 as desired
- Clear the REMOTE1 memory value or write a different value to indicate that the request has been made.

And finally, let's look at the third set of qualifiers and actions.

Qualifier C

- Check for the status of the REMOTE1 audio route

Action C

- change the status of button 2 on LCD panel in Production A to ON and change the label to "REMOTE1"
- change the status of button 4 on LCD panel in Production B to ON and change the label to "REMOTE1"

In this example, we have outlined how we can accomplish multiple location control of a specific audio route and the status of that route is displayed in two different locations. It is important to note that the color and label on the LCD buttons is dependent on the action of completing the desired audio route change, not simply on the detection of a button press. This technique actually provides a confirmation that the requested action has been completed.

Stacking Events

Now that we have had a bit of exposure to the concept of stacking events, let's look at them in a bit more detail. If you think of Stacking Events as a stack of *qualifiers* (or conditions) and a stack of resultant *actions*, you will have grasped the fundamental concept. We can apply logical *OR* and *AND* operators to the qualifiers. We can also have immediate or delayed actions. Stacking Events also include inverted logic whereby actions can be triggered if the qualifiers are *NOT* met. It is an extremely flexible and powerful system.

Qualifiers

Here is a list of the *Qualifiers* currently supported by Pathfinder Stacking Events.

- Route Status (checking for one specific audio route)
- Audio Level Trigger (detecting the presence or absence of audio)
- GPI State Change
- GPO State Change
- User Button Press (the focus of this chapter)
- Time/Date range
- Memory Value
- Event Engine Start (Pathfinder boot-up)
- Element Profile Change
- VMIX Change
- Console Status (Element)

Actions

Here is a list of the *Actions* currently supported by Pathfinder Stacking Events.

- Activate Route
- Activate Scene
- GPIO State Change
- User Button Property (our focus for this example - includes button state, text and color)
- Send E-mail
- Run Script (custom function)
- Send User Command
- Write a Memory Value
- SA Command (proprietary command)
- Element Profile Change
- VMIX Change
- Execute Shell Command
- Console Control (Element)
- Play Audio

By now the wheels should be turning and you will have at least 1x10⁶ brilliant ideas about what you can do with your new button panels and Pathfinder. We apologize in advance for any resulting loss of sleep.

Software Panels and Hardware Panels

It was mentioned earlier that Pathfinder has software panels that may be used in conjunction with our hardware accessory switch panels. Let's spend a few mo-

ments examining the software and hardware we have, and their interaction.

Pathfinder Software Panels

Software mini panels are created by a Pathfinder companion application called Panel Designer. These panels, in the same manner as our hardware switch panels, are capable of direct control of our Livewire system however they also become much more powerful when used in conjunction with Pathfinder's Stacking Events. Software panels can also include meters and labels as well as background graphics. They can be quite aesthetically pleasing as well as functional.

Software panels can be used as stand-alone control panels however they can also be used in conjunction with hardware panels. Using our Panel Designer software, it is possible to map the functions of software buttons to actual hardware controls such as the LCD switches on our accessory panels. In this case, the mapped hardware controls will perform exactly the same functions as the software buttons. We will show a simple example of mapping in a later section of this document.

Film-Cap Switch Panels

The Film-Cap switch panels are typically connected to your Livewire network via GPIO ports. Think of these panels as simply a bank of five switches and lights for each GPIO port. Sets of three jumpers on the rear of the panel allows you to set the color on each of the LED lamps.



Figure A-1: Film-Cap Switch Panels

Figure A-1 shows three models of rack-mounted film-cap switch panels.

LCD SmartSwitch Panels

CANBus and Ethernet switch panels have some additional capability in addition to that provided by the film-cap switch panels. The LCD switch panels can

change their color through software as well as change the text displayed on the LCD switch. Figure A-2 shows an example of a 4-button LCD panel with various colors and button legends.



Figure A-2: 4-Button LCD Switch Panel

Both types of switch panels, GPIO and CANBus, are controlled in a similar manner by Pathfinder. Let's go through an example with lots of pictures that will illustrate what we have been talking about.

Hardware Panel - Stacking Event Control

This rather long-winded example shows you how we might control our system using a hardware panel like the one shown in Figure A-2 and a Pathfinder Stacking Event. Since audio routing is something we might do frequently, let's use that as an example. We are going to use three buttons as selectors for three different audio sources that might feed a Preview speaker.

Keep in mind, this is an example only - you can do lots more than switch audio and your qualifiers can be as complex as you wish. The intent here is to give you a very simple example to illustrate the principles. So - here we go.

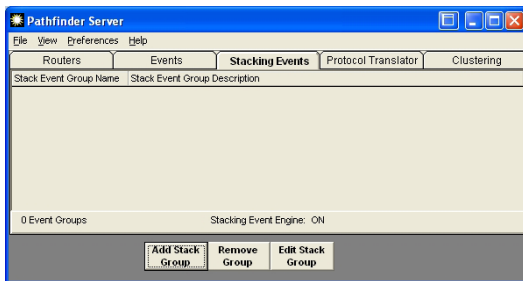


Figure A-3: Pathfinder - New Stacking Event

First, let's get to Pathfinder and create a new stack event that will be used to "connect" Pathfinder to a 4-button LCD panel. Figure A-3 shows the Stacking Events tab where we will create a new event.

To create new Stacking Event - click on **Add Stack Group** and you will be presented with the window shown in Figure A-4 where you can enter a description of your new event. We encourage you to avoid being too brief in your description. A few months from now you will be glad you provided a clear description here. In this example, we have decided that we need to route a few different audio sources to our Preview speaker.

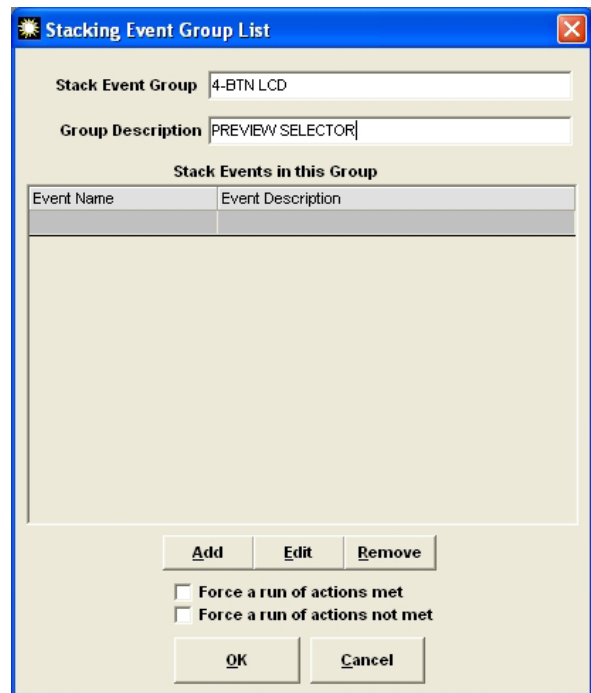


Figure A-4: New Event Description

We now have a new Stacking Event Group with a description. Next we need to add some individual events. We can have many related events in each group to keep them organized however each of these events is independent of the others in terms of its logic functions. Click **Add** to create the first one.

This action will take us to a window that looks like Figure A-5. Before we go any further, let's take a closer look at this window. Each Stacking Event has five sections. We rarely use all of them but we will always

The screenshot shows the 'StackLists' window with the following sections:

- Event Name:** Default
- Event Description:** (empty text box)
- Qualifiers:** A table with columns 'Qualifier Name', 'Qualifier Description', and 'Qualifier Type'. Below it are 'Add', 'Edit', and 'Remove' buttons.
- Run actions if ALL qualifiers are Met** (selected radio button) or **Run actions if ANY qualifiers are met** (radio button).
- Actions if all Qualifiers are met:** A table with columns 'Action Name', 'Action Description', and 'Action Type'. Below it are 'Add', 'Edit', and 'Remove' buttons.
- Actions if All Qualifiers are NOT met:** A table with columns 'Action Name', 'Action Description', and 'Action Type'. Below it are 'Add', 'Edit', and 'Remove' buttons.
- Stack Event Name:** (empty text box)
- Run Actions On Startup:** (unchecked checkbox)
- Delayed action if all Qualifiers are met:** A table with columns 'Action Name', 'Action Description', and 'Action Type'. Below it is a 'Delay Time in Milliseconds' field set to 5000 (range 0 to 60000) and 'Add', 'Edit', 'Remove' buttons.
- Delayed action if all Qualifiers are NOT met:** A table with columns 'Action Name', 'Action Description', and 'Action Type'. Below it is a 'Delay Time in Milliseconds' field set to 5000 (range 0 to 60000) and 'Add', 'Edit', 'Remove' buttons.
- OK** and **Cancel** buttons at the bottom right.

Figure A-5: Stack List Window

have at least one Qualifier and one Action.

In the top-left area of the StackLists window, we see the section for Qualifiers. This is where we will list all of the qualifiers that we want to consider. There are many types of qualifiers and we can decide if we want OR or AND logic to apply by selecting the appropriate radio button - either “Run actions if ALL qualifiers are met” or “Run actions if ANY qualifiers are met”.

The next area of the StackLists Window is where we will list the Actions that we want to perform if our Actions are met. This can be a list of several actions if desired. All of these actions are dependent on the conditions or qualifiers listed in the area above. If none of the qualifiers are satisfied, none of the actions will occur. Note that if the qualifier(s) are met, these actions will occur immediately.

Below the section for “Actions if Qualifiers are met”, in the lower left corner, is an area where we can list Ac-

tions to be performed if the qualifiers are NOT met. We will show you later in this example how this NOT logic can be applied.

On the right side of the StackLists window are two boxes for Delayed Actions, both for when Qualifiers are met or NOT met. These delayed actions very are handy however they are not used as often as the immediate actions.

Now we can proceed by creating Qualifiers. There are many types of qualifiers to choose from. We will focus on those related to your accessory panels. Click **Add** in the Qualifiers section to create our first Qualifier. You will see a pop-up window as shown in Figure A-6.

Here is where we will decide what type of Qualifier to specify and also provide some descriptive information about our qualifier. We are looking for a User Button Press so we will select that option.

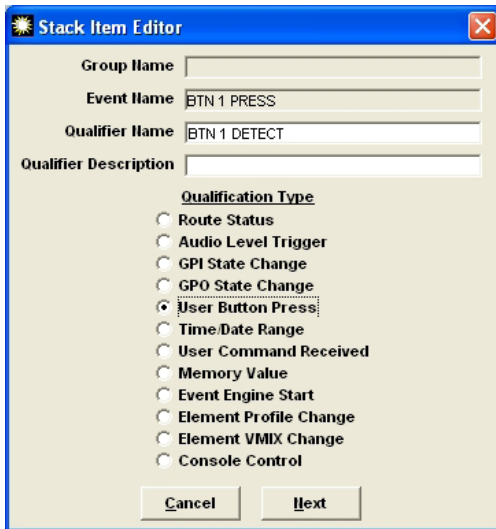


Figure A-6: New Qualifier

Now we will fill in the parameters for our accessory panel - IP address, module type, and button number.

If you are not sure of the type of your accessory module, you can determine that by a simple Telnet session

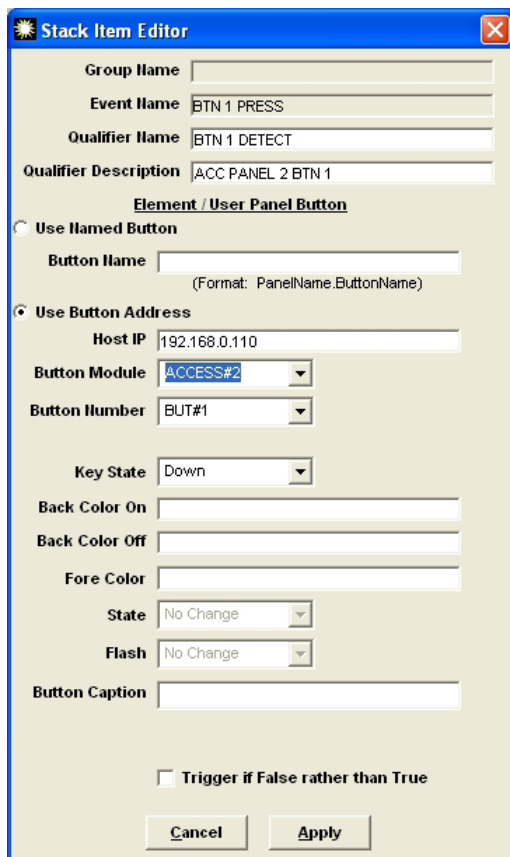


Figure A-7: Accessory Panel Definition

directed at the IP address of the panel and port 4010 as described in Chapter 3.

We are looking for a button press so that means that our qualifier will be met if the key state is “down”. Click **Apply** and you will return to the StackLists window shown in Figure A-5 however you will now see one Qualifier listed

Now, let’s add an action. Click **Add** in the Actions section. You will be presented with a list of the types of actions that are possible. We have decided to change an audio route when the button is pressed so we will select **Activate Route**. Again - provide a description that is complete. In this example, we have an audio feed from a TV that we want to route to the Preview speaker when this button is pressed.

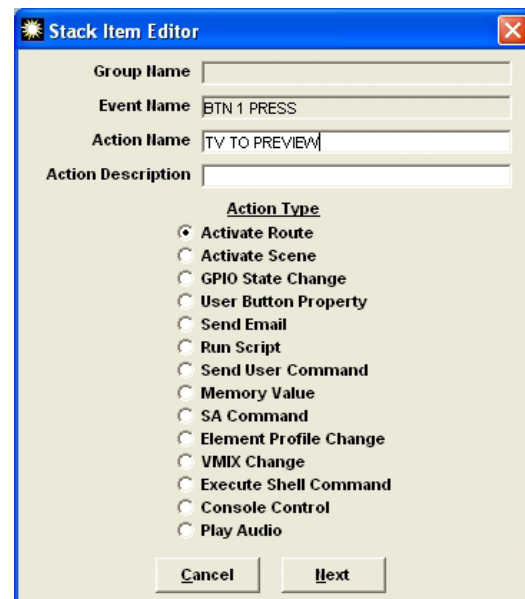


Figure A-8: Select New Action Type

Now that the action type **Activate Route** has been selected, we will need to define the specific audio route that will be established. Click **Next** to bring up the window where we can select the source and destination.

We have selected the router - in this example “audio Jan 2009”, the source of “TV” and the destination of “Preview Speaker”. The selection buttons to the right of the Source and Destination boxes are useful for this pur-

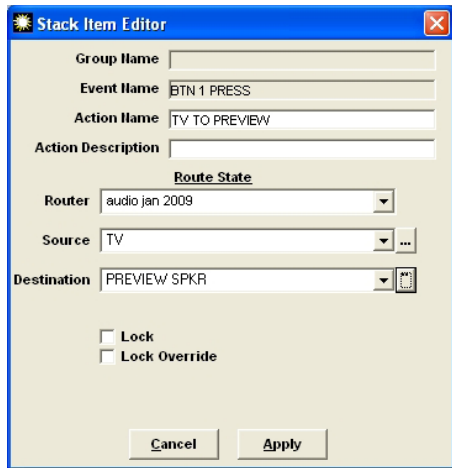


Figure A-9: Define Audio Route

pose. Every Pathfinder installation will have a different scheme so in your case, the options will be different than those illustrated here. Click **Apply** once you have made the appropriate selection.

A similar process will be followed for other sources that we want to control by using some of the other buttons on our accessory panel. In each case, we setup the qualifier of a button press and the action of activating an audio route. The results are shown in Figure A-10.

We have now accomplished the desired audio routing control and any one of three sources can be delivered to our Preview speaker. This is good, but not good enough.

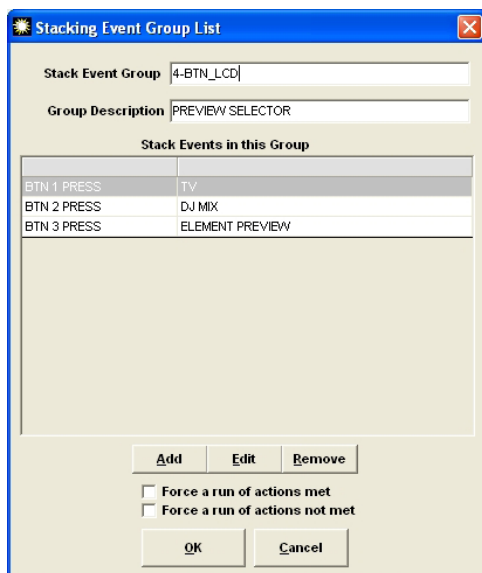


Figure A-10: Stacking Event Group - 3 Buttons

It was stated that we needed some confirmation that the audio routes had been established. Pathfinder can help us out with that too. We will setup some more Stacking Events that will use the audio route as a qualifier and specify some button properties as actions. This will provide some useful feedback to the user since the button color and caption text will actually be determined by the audio route status. We promised lots of pictures - so here we go. The descriptions will be brief.

First - a new Qualifier for button 1. We will verify that the TV-to-Preview audio route exists.

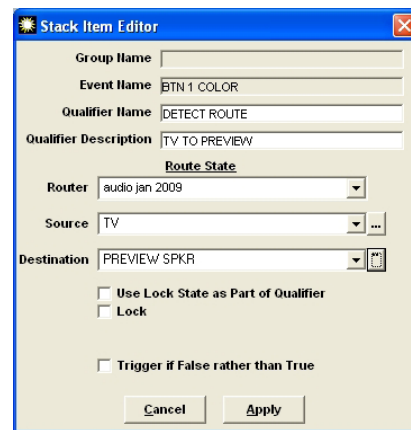


Figure A-11: Audio Route as Qualifier

Once the audio route qualifier is defined, we will want to define two actions - one that determines our button properties if the qualifier is met (our desired audio route exists) and another that will define the button prop-

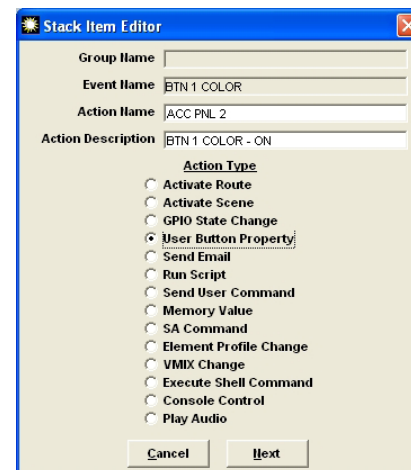


Figure A-12: Action - Button Properties

erties if the qualifier is NOT met (some other audio route exists).

Action if qualifiers ARE met - Here we will specify the button properties if qualifiers are met:

- Color - RED
- State - ON
- Caption - TV

Now we need to create another New Action in the Qualifiers NOT met area. This will be used to specify the button properties if qualifiers are NOT met - when something other than TV routed to Preview speaker.

Figure A-13: Action for Qualifiers Met

Our action is simply a different set of properties for the same button as above. The properties will be:

- Color - BLUE
- State - OFF
- Caption TV

Here is our completed stacking event for the properties of Button 1. Only one side of this window is shown in Figure A-15 since no Delayed Actions were required.

Figure A-14: Action for Qualifiers NOT Met

Figure A-15: Button 1 - Qualifiers and Actions

When we complete similar steps for the other two buttons, we will have a list of six Stack Events in this group - three of them perform the audio switching and the other three provide our verification in the form of button color and caption. Here is what that list looks like.

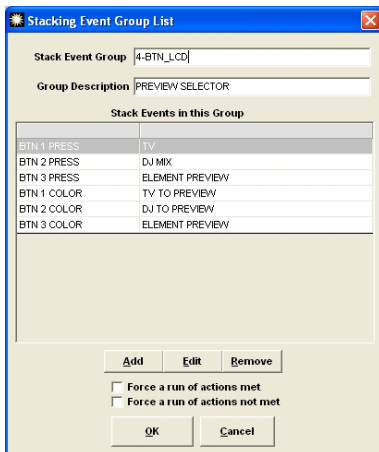


Figure A-16: Completed Stacking Event Group

We have now accomplished the task. An LCD accessory panel has been configured to switch three audio routes and verification has been provided. If any other external factor was to interfere with these audio routes and none of them was assigned to our Preview Speaker, all three buttons would turn BLUE since none of the qualifiers for any of the buttons would be met; that is until we pressed one of those buttons.

This is a complicated way to interface LCD buttons however it is an illustration using an example we all understand. The qualifiers could be a combination of button presses and other conditions. The actions can be any of those in the Action list. You could have buttons to send e-mail to various friends every time a button is pressed; you can turn on the coffee if a button is pressed during certain time ranges on specific days; you could open an electric lock by pressing a specific combination and sequence of buttons. There are endless possibilities.

Next, we will look at an easier way to do the task we have just completed by mapping hardware LCD switches to buttons in a software panel. Pathfinder Stacking Events are not required. In this simple case, it is a LOT easier to create this functionality and it is useful to use the same example.

Mapping Hardware to Software Panels

As previously discussed, there are benefits to creating software panels and map hardware to the software buttons. When used as standalone panels, software panels are somewhat limited but remember that they can also be used in conjunction with stacking events.

In this section, we will provide an example of mapping three of the buttons on an LCD panel to three corresponding buttons on a software panel. No stacking event is required and the complexity of this task is greatly reduced as compared with using solely Stacking Events. Our Panel Designer tool is used to create a software mini panel. The operation of Panel Designer is well covered in the Pathfinder manual so we will not discuss general Panel Designer operation but only the topics related to hardware mapping.

What is Hardware Mapping?

Hardware mapping is the ability to “map” or link a switch on an Axia accessory panel to a specific button on a software mini panel. Mapping allows us to duplicate the functionality of a software button on an accessory panel. Note that the software panel does not have to be active for the mapped hardware to be functional but Pathfinder Server must be running since it is required for the required audio switching and any associated logic.

Creating a Software Panel with Mapping

Panel Designer is the tool we use to create a software panel. Buttons can be dragged into a new panel form. Labels can also be dragged into the new form in a similar manner. You can choose background colors and control the size and layout of your panels.

Once we have created a new panel with a few buttons and a label, we can specify button captions and colors for ON and OFF states. We will use the example of the “Preview Selector” that we worked with in the previous example. We will need three buttons.

Once we have used Panel Designer to create a basic panel with a few buttons, we will have something similar to the panel shown in Figure A-17.

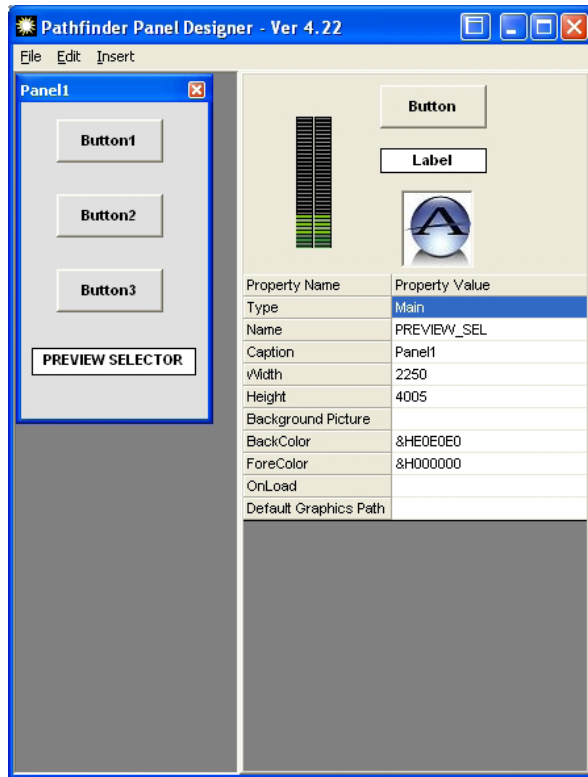


Figure A-17: Panel Designer Main Form

We can give our panel a name such as PREVIEW_SEL and set the overall panel caption to something like “Studio 4”.

Once we highlight a button on the panel form, we are able to fill in the parameters associated with that button. We will specify:

- Button Name - user defined as Button3
- Caption - user defined as PREVIEW
- MapRouter - select the PathfinderPC audio router you want to use for the source and destination specified below; router 1 in example
- MapSource - source 33 corresponds to the Mix Engine Preview stream in this case.
- MapDestination - destination 16 corresponds to the Preview Speaker
- HWMMapHostIP - the IP address of the Element to which the LCD panel is connected:

192.168.0.110

- UserPanelModule - select the user panel type and number; ACCESS#2 in this example
- UserPanelButton - the button number which is BUTTON#3 in this case.

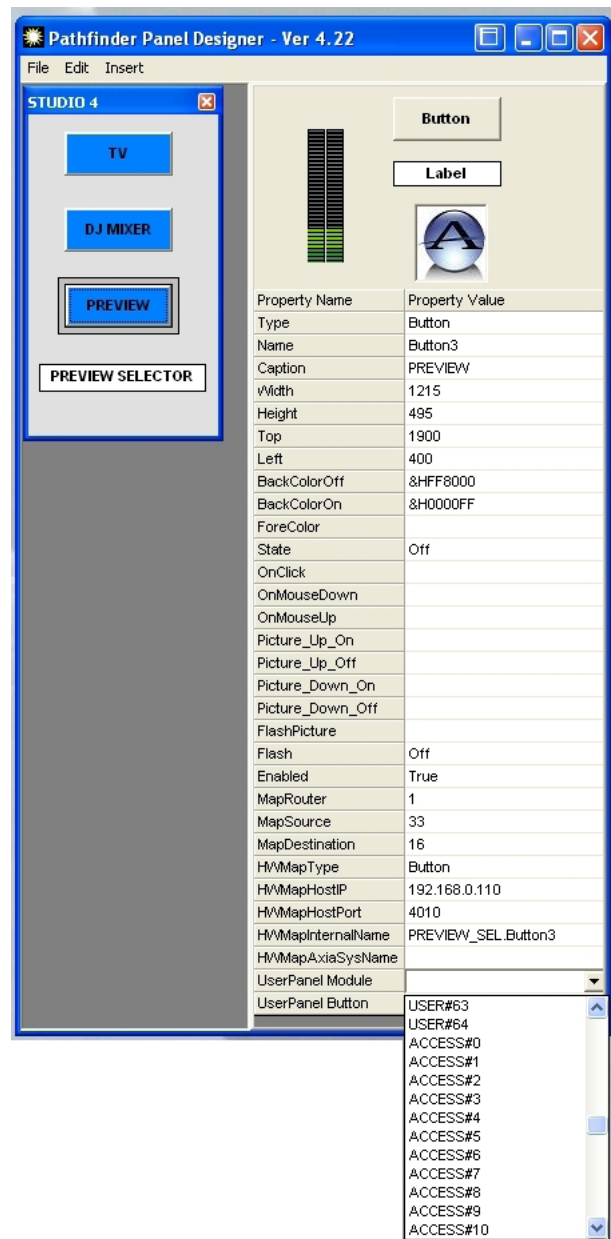


Figure A-18: Mapping the Hardware

Once the remaining buttons have been mapped in a similar manner, we are done! As you can see, this is much easier than relying on Stacking Events and, in this simple example, the results are identical.

Remember that if you want to use the power of Stacking Events, you can still do that since it is possible to use software button presses as qualifiers for stacking events.

Finished Panel

Figure A-19 shows the finished mini panel with a couple of enhancements. We have changed the background color and added an audio level meter just to give you a peek at some other capabilities.

Note that Pathfinder supports multiple instances of the same software mini panel as well as simultaneous control of the same audio route on different panels.

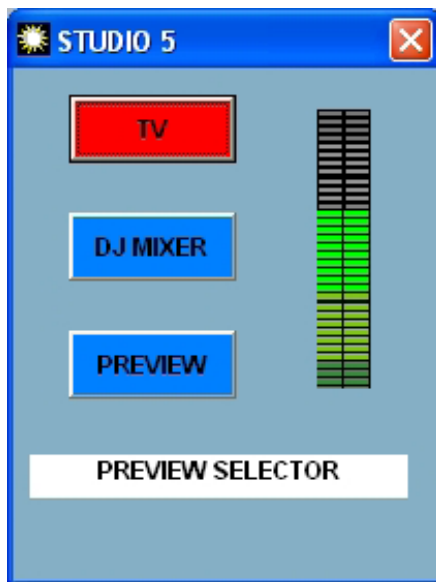


Figure A-19: 3-Button Software Panel

Stay Tuned!

We are continuously adding features to our Pathfinder software. As its capabilities expand, the tools used to accomplish some of the tasks we have discussed here will evolve as well.

Please visit our web site regularly for software updates and for tech notes that will provide some other specific examples.

Thanks for choosing Axia!

splicing blocks and blades

Noisy gray Audiopaks

Seems so long ago.

Appendix B: Livewire Ports

Standard ports are used for specific functions within the Livewire system. Here is a summary of the ports and their use. If you have installed an Axia application with your Windows firewall enabled, the applications and ports will be automatically added to your Windows firewall exceptions. If your installation has been performed with the Windows firewall disabled and you have subsequently enable the firewall, you may have to perform some tweaking of the firewall to get things operating normally. This information will be helpful in that case or in the event that you are using some other firewall.

Port	Protocol	Use
67,68	UDP	BOOTP Server/Client - Remote IP address assignment
93	TCP	Livewire Routing Protocol
123	UDP	NTP
514	UDP	Syslog logging
2055	UDP	Multicast based GPIO (CMsg2 protocol) (mcast on 239.192.255.4) - GPIO commands from GPIO node to console-type endpoint
2060	UDP	Multicast based GPIO (CMsg2 protocol) (mcast on 239.192.255.4) - GPIO commands from console-type endpoint to GPIO node
4000	UDP	Livewire Advertisement and Source Allocation Protocol - Full info advertisement requests and source allocation requests
4001	UDP	Livewire Advertisement and Source Allocation Protocol (mcast on 239.192.255.3) - Periodic announcements and full info advertisements - Source allocation state announcements and responses
4002	UDP	Engine supervision protocol (mcast on 239.192.255.3)
4010	TCP	Livewire Control Protocol
4011	UDP	LWCP for Accessory Modules (from module to console) (mcast on 239.192.255.4)
4012	UDP	LWCP for Accessory Modules (from console to module) (mcast on 239.192.255.4)
5004	UDP	RTP Livewire Audio
7000	UDP	Livewire Clock
9997	TCP	Protocol logging (for debug) in Element

Phone rings, 3AM

Damn transmitter's off again.

"Push 'raise', you dimwit."

Appendix C: Warranty

Telos Alliance Limited Warranty

This Warranty covers “the Products,” which are defined as the various audio equipment, parts, software and accessories manufactured, sold and/or distributed by or on behalf of TLS Corp. and its affiliated companies, collectively doing business as The Telos Alliance (hereinafter “Telos”).

With the exception of software-only items, the Products are warranted to be free from defects in material and workmanship for a period of five (5) years from the date of receipt of such Product by the end-user (such date of receipt the “Receipt Date”). Software-only items are warranted to be free from defects in material and workmanship for a period of 90 days from the Receipt Date. Telos will repair or replace (in its discretion) defective Products returned to Telos within the warranty period, subject to the provisions and limitations set forth herein.

This warranty will be void if the Product: (i) has been subjected, directly or indirectly, to Acts of God, including (without limitation) lightning strikes or resultant power surges; (ii) has been improperly installed or misused, including (without limitation) the failure to use telephone and power line surge protection devices; (iii) has been damaged by accident or neglect. As with all sensitive electronic equipment, to help prevent damage and or loss of data, we strongly recommend the use of an uninterruptible power supply (UPS) with all of our Products. Telos products are to be used with registered protective interface devices which satisfy regulatory requirements in their country of use.

This Warranty is void if the associated equipment was purchased or otherwise obtained through sales channels not authorized by Telos.

EXCEPT FOR THE ABOVE-STATED EXPRESS WARRANTY, TELOS MAKES NO WARRANTIES, EXPRESS OR IMPLIED (INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE).

In no event will Telos, its directors, officers, employees, agents, owners, consultants or advisors (its “Affiliates”), or authorized dealers or their respective Affiliates, be liable for incidental or consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of any Product or the inability to use any Product either separately or in combination with other equipment or materials, or from any other cause.

In order to invoke this Warranty, the Product must be registered via Telos’ website (found at: <http://telosalliance.com/legal/warranty>) at time of receipt by end-user and notice of a warranty claim must be received by Telos within the above stated warranty period and warranty coverage must be authorized by Telos. Contact may be made via email: support@telosalliance.com or via telephone: (+1) 216-241-7225. If Telos authorizes the performance of warranty service, the defective Product must be delivered to: Telos, 1241 Superior Avenue, Cleveland, Ohio 44114 or other company repair center as may be specified by Telos at the time of claim.

Shipping Costs and Warranty Service:

If the date the customer's notice of warranty claim is received by Telos (such date the "Warranty Claim Notice Date") is within the first 90 days following the Receipt Date, Telos will pay the costs of shipping such warranted Product to and from the end user's location, and the cost of repair or replacement of such warranted Product.

If the Warranty Claim Notice Date occurs after the first 90 days following the Receipt Date and before the end of the second (2nd) year, the customer will pay the freight to return the warranted Product to Telos. Telos will then, at its sole discretion, repair or replace the warranted Product and return it to the end user at Telos' expense.

If the Warranty Claim Notice Date occurs between the end of the second (2nd) year following the Receipt Date and the completion of the fifth (5th) year, the customer will pay the costs of shipping such warranted Product to and from the end user's location. Telos will then, in its sole discretion, repair or replace the warranted Product at Telos' expense. Telos also reserves the right, if it is not economically justifiable to repair the warranted Product, to offer a replacement product of comparable performance and condition direct to the customer at a discounted price, accepting the failed warranted Product as a trade-in.

The end user will in all cases be responsible for all duties and taxes associated with the shipment, return and servicing of the warranted Product.

No distributor, dealer, or reseller of Telos products is authorized under any circumstances to extend, expand or otherwise modify in any way the warranty provided by Telos, and any attempt to do so is null and void and shall not be effective as against Telos or its Affiliates.

Out of warranty units returned to the factory for repair may be subject to a \$500 evaluation fee, which fee must be prepaid prior to shipping the unit to Telos. If no repairs are required, the \$500 fee will be retained by Telos as an evaluation charge. If repairs are required, the \$500 fee will be applied to the total cost of the repair.



Axia Audio, a Telos Alliance Company • 1241 Superior Ave. • Cleveland, Ohio, 44114, USA • +1.216.241.7225 • www.AxiaAudio.com