Utah Scientific

The Utah-400 XL Digital Routing Switcher

528 and XL Systems

CELEBRATING 30 YEARS OF SERVICE TO THE BROADCAST INDUSTRY

Setup and Operations Guide

The Utah-400 528 and XL Systems - Setup and Operations Guide

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This equipment has been tested and found to comply with the limits for a Class A, digital device, pursuant to Part 15, Subpart B of the FCC Rules and the Canadian EMC Requirement (ICES-003). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at their own expense. Shielded cables must be used to ensure compliance with the FCC Class A limits.

Declaration of Conformity

Utah Scientific, Inc.

4750 Wiley Post Way, Suite 150
Salt Lake City, Utah 84116-2878 U.S.A.

We declare our sole responsibility that the Utah-400 Digital Routing Switcher is in conformance with the following standards:

Emission

- EN55022:1994+A1&A2

Immunity

- EN55024:1998
- EN61000-3-2
- EN61000-3-3

Safety

- IEC 60950-1:2001 /EN 60950-1:2001

Following the provisions of the Directive(s) of the Council of the European Union:

- EMC Directive 89/336/EED
- Low Voltage Electrical Directive 72/23/EEC

Utah Scientific, Inc. hereby declares that the product specified above conforms to the above Directive(s) and Standard(s).

CE

Important Safeguards and Notices

This section provides important safety guidelines for the Operator and Service Personnel. Specific warnings and cautions are found throughout the guide where they apply, but may not appear here. Please read and follow the important safety information, specifically those instructions related to risk of fire, electric shock, or injury to persons.

Safety Symbols

- Hazardous Voltage symbol

- Caution symbol. The product is marked with this symbol when it is necessary to refer to the manual to prevent damage to the product.

Warnings

Please observe the following important warnings:

- Any instructions in this guide that require opening the chassis, changing a power supply, or removing a board, should be performed by qualified personnel only. To reduce the risk of electric shock, do not perform any service unless you are qualified to do so.
- Heed all warnings on the unit and in the operating instructions.
- Do not use this product in or near water. Disconnect AC power before installing any options or servicing the unit unless instructed to do so by this manual.

- This product is grounded through the power cord ground conductor. To avoid electric shock, plug the power cord into a properly wired receptacle before connecting the product inputs or outputs.
- Route power cords and other cables so they won't be damaged.
- The AC receptacle (socket) should be located near the equipment and be easily accessible.
- Disconnect power before cleaning. Do not use any liquid or aerosol cleaner - use only a damp cloth.

- Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed conductors and components while power is on. Do not insert anything into either of the systems two-power supply cavities with power connected.
- Do not wear hand jewelry or watches when troubleshooting high current circuits, such as power supplies. During installation, do not use the door handles or front panels to lift the equipment as they may open abruptly and injure you.
- To avoid fire hazard when replacing fuses, use only the specified correct type, voltage and current rating as referenced in the appropriate parts list for this product. Always refer fuse replacement to qualified service personnel.
- Have qualified personnel perform safety checks after any service.

Cautions

Please observe the following important cautions:

- When installing this equipment do not install power cords to building surfaces. To prevent damage when replacing fuses, locate and correct the problem that caused the fuse to blow, before reconnecting power.
- Use only specified replacement parts

Notices

Please observe the following important notes:

- When the adjacent symbol is indicated on the chassis, please refer to the manual for additional information.
- For the HD-2020 Chassis and Master Control Panel, refer to “Connecting and Disconnecting Power” - Chapter 2 (Hardware Installation).

Company Information

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Utah Scientific, Inc. warrants to the original purchaser that the Utah Scientific hardware is free from defects in materials and workmanship and will perform substantially in accordance with the accompanying written materials under normal use and service for a period of ten (10) years from the date of shipment. Any implied warranties on hardware are limited to ten (10) years. Some states/jurisdictions do not allow limitations on duration of an implied warranty, so the above limitation may not apply to certain specific purchasers.

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For the first one (1) year after purchase of the software and the first ten (10) years after the date of purchase of the hardware, Utah Scientific's and its suppliers' entire liability and purchaser's exclusive remedy shall be, at Utah Scientific's option, either:

- Return of the price paid, or
- Repair or replacement of the software or hardware that does not meet the above warranties and is returned to Utah Scientific under the returned materials authorization (RMA) process with freight and forwarding charges paid.

After the initial warranty periods, purchaser's exclusive remedy is the repair or replacement of the hardware upon payment of a fixed fee to cover handling and service costs based on Utah Scientific's then-current price schedule. The above warranties are void if failure of the software or hardware has resulted from an accident, abuse, or misapplication. Any replacement software or hardware will be warranted for the remainder of the original warranty period or thirty (30) days, whichever is longer.

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Utah Scientific products, even if Utah Scientific has been advised of the possibility of such damages. Because some states/jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply in those circumstances.

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CHAPTER 1

Introduction

In This Guide

This guide provides instruction for the installation, configuration, and operation the Utah Scientific, Utah-400 528 and XL Router Systems. These routers contain redundant crosspoints with 44 to 88 slots for both the input and output and cards, and stand 20 and 40 rack units in height.

The following chapters and appendices are included:

- **Chapter 1**

"Introduction" summarizes the guide, describes basic router operation and describes the hardware and software components of the Utah-400 Digital Routing Switcher.

- **Chapter 2**

"Hardware Installation" provides instructions for installing the Utah-400 Digital Routing Switcher in your facility.

- **Chapter 3**

"Configuration and Operation" provides specific information regarding the configurations of this unit, and necessary equipment handling (operation).

- **Chapter 4**

"Utah-400 Router Components" provides basic information about the Input, Output, Crosspoint, Interface board and Power Supplies. Included is general information about LED indicators and alarms present on each board type.

- **Chapter 5**

"Troubleshooting" looks at some of the common hardware and software problems, diagnostics and solutions available to the user on site. Included in this section is information on the various avenues to contact Utah Scientific Technical Services and tips on discussing equipment problems.

- **Appendix A**

"Specifications" lists all system specifications, including Audio, Video, physical, power, and regulatory.

- **Appendix B**

“The Debug Port” contains information regarding the current Utah 400 firmware, along with setup and use of the system Debug Cable.

- **Appendix C**

“The Utah 400 Digital Audio Breakout Panel” applies to the installation and operation of the AES Digital Audio Break Out Panel, a component designed to simplify the installation of the Utah-400 Balanced Digital Audio Routing System.

Conventions

The following conventions are used throughout this guide:

- Connectors and terminators will be indicated by bold, upper case text in Arial Black font. For example:
    - Connect the **MX-Bus** to **J-1**
- **Operator Actions** will be indicated in Helvetica Bold where a board is inserted, removed and/or an action is required in the Troubleshooting or configuration sections of this manual. There will usually be a graphic to accompany the instruction(s). For example:
    - **Insert** the expansion Input board in slot 6.
    - **Switch** the suspected bad input **to a known good input** to verify output "X".
- The use of bullets indicates a random order of operation or to draw the readers attention to specific items.

1. The use of numbers in specific operations or lists indicates a "**recommended order of operation**" to perform specific tasks. Bulleted items may be below numbered items to highlight tasks or indicate the operation(s) may be performed at random.

Abbreviations

The following abbreviations may be used in this guide: See Appendix A for an additional Glossary of Terms and further definitions.

TABLE 1. Common Abbreviations and Mnemonics

Abbreviation	Description
ATR	Audio Tape Recorder
AES	Audio Engineering Society
CPU	Central Processing Unit
DTR	Digital Tape Recorder
EBU	European Broadcast Union
ENET	Ethernet
HDTV	High Definition Television
I/O	Input / Output
IP	Internet Protocol
JPEG	Joint Photographic Experts Group
M-JPEG	Motion – JPEG
MPEG	Motion Picture Experts Group
MX-Bus	Utah Router Control Comm. Bus
RMS	Router Management System
RU	Rack Unit
SDI	Serial Digital Interface
U-Net	Utah Control Panel Comm. Network
UTP	Unshielded Twisted Pair
VTR	Video Tape Recorder

Terms

The following terms are used throughout the documentation in this guide:

- "**Operator**" and "**User**" refer to the person using or operating the Utah-400 Digital Router System.
- "**System**" refers to the entire interconnected Utah-400 System including control panels, routers, software, and chassis.
- "**Mainframe**" refers to the Utah-400 chassis plus redundancy.
- "**Input**" refers to and audio or video signal source that is connected to the Utah-400 main frame.
    - One video input represents one High Definition or Serial Digital Interface video output signal.
    - One audio input represents a single monophonic track from an analog audio source.
    - One digital audio input represents two tracks (left and right channel) from a digital audio source.
- "**Source**" refers to an audio or video device whose output signals are connected to the Utah-400 mainframe inputs. Examples of audio / video sources are ATR's, VTR's, DTR's, cameras, video / audio routers, audio mixers, graphics systems, and satellite feeds.
- "**Output**" refers to the Utah-400 audio or video signals from the Utah-400 "Outputs", which are connected to the 'destination device'. This term also includes the physical output connectors on the frame.
- "**Destination**" refers to the device, which is receiving the Utah-400 output signal. This could include VTRs, monitors, satellite feeds, or video / audio routers.
- "**Signal Level**" refers to the logical level of the audio / video routers in relation to the entire connected system(s). Typically, the Utah-400 occupies levels above 1, with master control occupying the lowest logical level.
- "**Hot Swappable**" " refers to a printed circuit board, which can be removed or replaced with system power "on".
- "**Control Panel**" refers to the physical human interface used to control the various systems in use.
- "**Display**" is the 'LCD Display' on the panels in use.

- "**Monitor**" refers to the monitor attached to the monitor matrix port of a video or audio router system.
- "**High Definition**" " refers to signals conforming to the SMPTE -292 specification. The typical high definition data rate is 1.485 Gb/sec or 1.483 Gb/sec and a 16:9 Aspect Ratio Picture characterizes this technology.
- "**Serial Digital**" Interface (SDI)" refers to the serial digital video signal operating at either SMPTE -259 in ABCD or SMPTE -344.

Routing Switcher Basics

A routing switcher is a specialized form of broadcast equipment that allows the user to connect large numbers of source and destination devices together electronically – without patching or running cables across floors and without significant signal loss.

The routing switcher solves connectivity problems and increases signal qualities in a wide variety of applications. The technologies of routing switchers now include the standard analogue, digital video, digital audio, and increasingly the high definition formats.

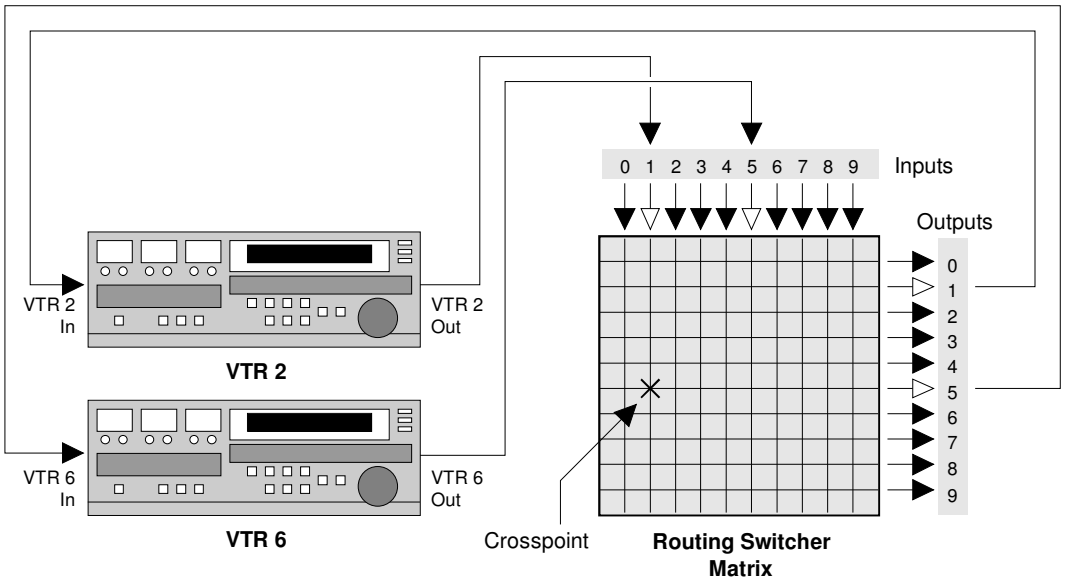
The routing switcher provides the user with the following advantages:

- Many signal levels (determined by the system size) may be switched simultaneously.
    - A simple route connects (switches) one signal level from one source (for example a VTR) to one destination (a monitor).
        - A complex route would connect multiple signal levels from one source to multiple destinations, including tie lines. For example, a satellite feed to a group of VTRs and monitors.
- Audio and video signal levels can be switched in groups (all follow takes) or individually (breakaway takes). Any input can be switched to any output, limited only by the matrix size.
- The Routing Switcher may be controlled manually via control panels, or with computer controlled automation.

Switching Matrix

A switching matrix is the internal array of inputs, crosspoints and outputs that allow a routing switcher to perform the task of routing signals from sources to destinations. The figure below illustrates a simple 10 X 10 switching matrix – with 10 Inputs and 10 Outputs.

Note the following points regarding the illustration:



- Each VTR is fully connected to the matrix – all audio/video inputs and outputs.
- A cross-point (represented by an **X**) is the internal electronic connection of the input to the output – either audio or video.
- When the cross-point is turned "**ON**" the connection is made between the source and destination. The action of turning the cross-point on is known as making a "**Take**".
- When an entire audio/video array is connected in this manner, from all of the devices in your facility, you have full routing flexibility.
- Without re-cabling or re-patching, a device can play back one moment (as a source) and record the next moment (as a destination).

Signal Levels

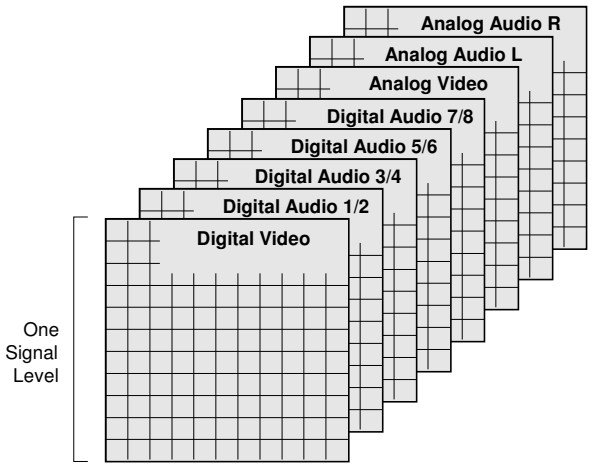
A "signal level" represents one of many specific types of audio or video elements that a routing switcher is capable of handling. The typical signals capable of being switched are:

- Analog Video
- Analog Audio (stereo with left and right channels).
- Digital Video
- Digital Audio (dual channel – stereo pair)
- High Definition Video.

Some systems may be configured with one signal level, while others may be configured with multiple signal levels.

While the diagram in the previous section shows only one signal level, a multi-signal level system is capable of routing any combination up to 32 levels – each with its own matrix and cross-points.

The figure below illustrates ***eight signal levels*** in a 10 X 10 matrix system.



Signal routers are typically much larger than a 10 X 10 matrix, depending on user needs. Each signal level may also have different sizes of matrices and do not all need to be the same size.

The Utah-400 Routing Matrix

The Utah-400 router utilizes a ‘3 board’ architecture that consists of an input-crosspoint-output card combination. This unique 3-board technology allows for a greater flexibility of input and output combinations available to the user. Each input or output board contains twelve signal paths so the user can expand in groups of twelve up to the maximum capacity of the router. These I/O cards can be HD, SD, Analog, Optical, or AES.

Features of this technology include signal presence indicators on both the input and output boards. The status of the router input and output states can be continuously monitored via the debug port (see Appendix B).

The input signal is received and equalized on the input board. A valid input will illuminate the Signal Presence Detector LED and also status at the debug port.

From this point the signal is routed to the crosspoint, where the operator has made a "Take", selecting the routing path of this input to its output.

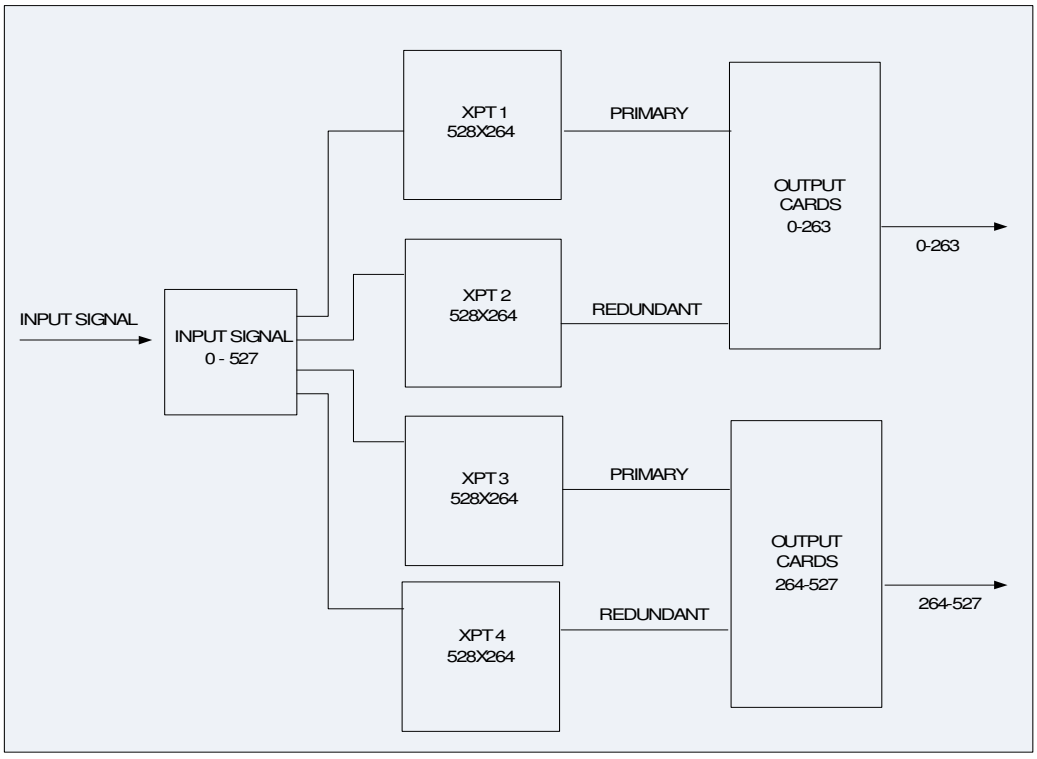


FIGURE 1-1. Matrix Block Diagram

The output from the crosspoint is directed to its proper path on the output bus and the appropriate output board slot. When the output board detects a valid output signal, it will illuminate the appropriate Signal Presence LED. From this point the output signal is sent to its output driver and its BNC.

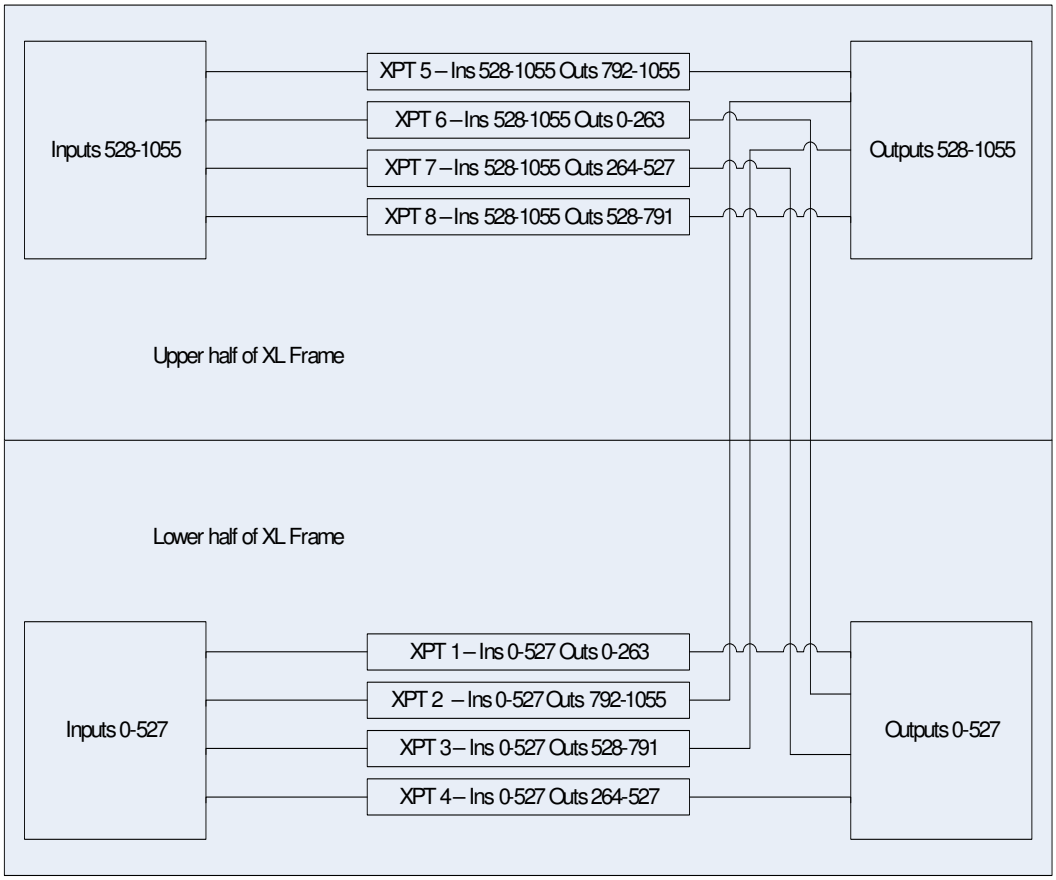


FIGURE 1-2. XL System block diagram

The 528 and XL systems utilize all the same plug-in cards to create their configurations. The 528 frame offers redundant crosspoints and a 528 port input by 528 port output system in 20 RU, while the XL system provides no dedicated cross point redundancy, but a 1056 port router in 40 RU.

The XL system is a combination of two 528 frames, so the power and cooling infrastructure of each frame is preserved.

The two chassis share a motherboard that allows for the sharing of pre-routed output busses from crosspoints in the lower half that drive to the upper half, and from the upper half to the lower half. Please see the IO ranges in the block diagram and the corresponding crosspoint numbers in the component location diagram to determine the IO range of each IO and crosspoint card in the system.

Component Locations

XL Configuration

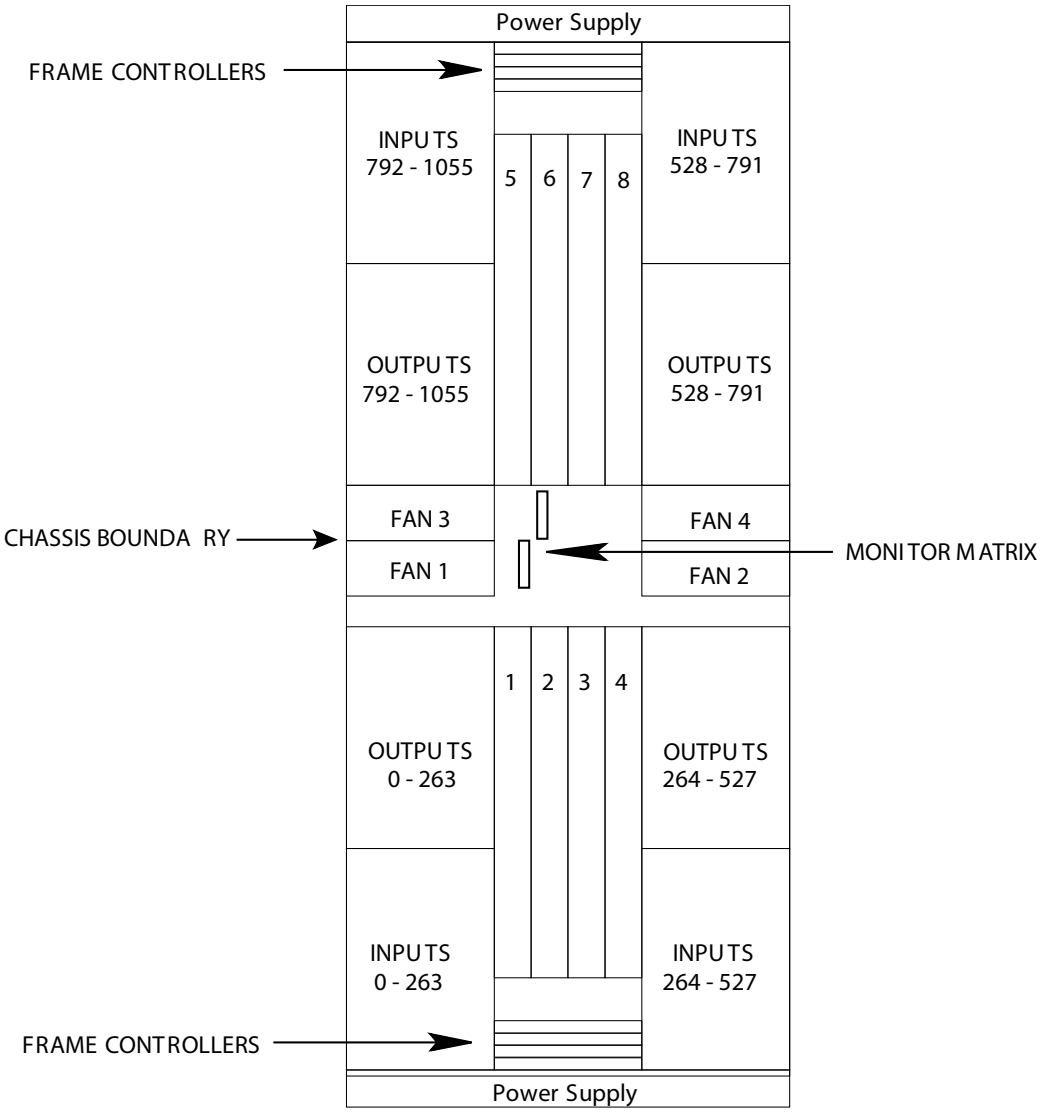


FIGURE 1-3. The Utah-400 XL Configuration

- The XL Router Includes: - *redundant cards optional*
    - (8) Crosspoint Boards
    - (0) Redundant Crosspoint Boards
    - (88) Input Boards
    - (88) Output Boards
    - (2) External Power Supply Frames
    - (4) Frame Controller Modules
    - (4) Fan Modules
    - (2) Monitor Matrix boards

528 Configuration

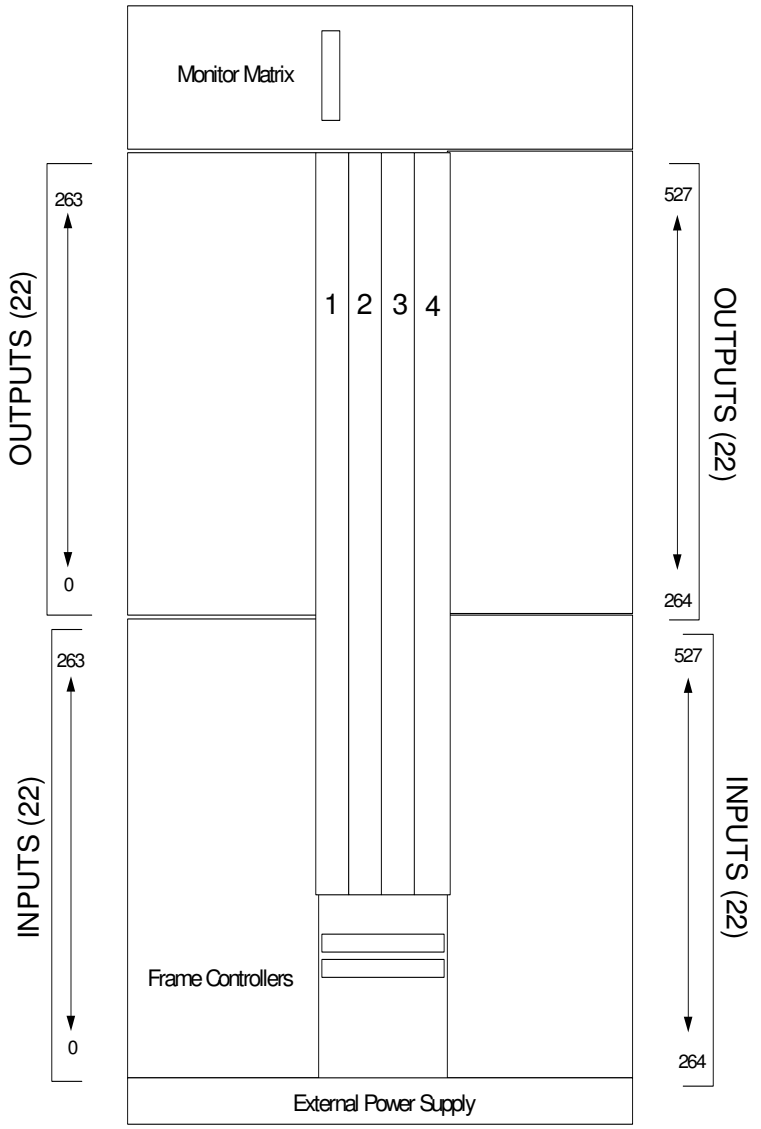


FIGURE 1-4. The Utah-400 528 x 528 Configuration

- The 528 x 528 Router Includes: - *redundant cards optional*
    - (2) Crosspoint Boards (528 x 264)
    - (2) Redundant Crosspoint Boards
    - (44) Input Boards (000 – 527)
    - (44) Output Boards (000 – 527)
    - (1) External Power Supply Frame
    - (2) Frame Controller Modules
    - Fan Modules
    - Monitor Matrix

CHAPTER 2

Hardware Installation

In This Chapter

This chapter provides instructions for installing your Utah-400 router in your facility. The following topics are covered:

> ***Caution:*** *To avoid damage to the system,* ***do not connect AC power until the hardware is fully installed.***

Unpacking and Inspection

528 Systems

When you receive your Utah-400 system, inspect each shipping carton for signs of damage. Contact your dealer and shipper immediately if you suspect any damage has occurred during shipping. Check the contents of each carton against your Utah Scientific order and verify them against the shipping manifest. If any items are missing, contact your dealer or Utah Scientific immediately.

Save the shipping box and material for future use, in case the unit may have to be shipped back to Utah Scientific.

Caution: The Utah-400 528 router system weighs approximately 300 pounds

Each router is wrapped in anti-static plastic prior to boxing up. The following illustration shows the typical packaging of a single Utah-400 router.

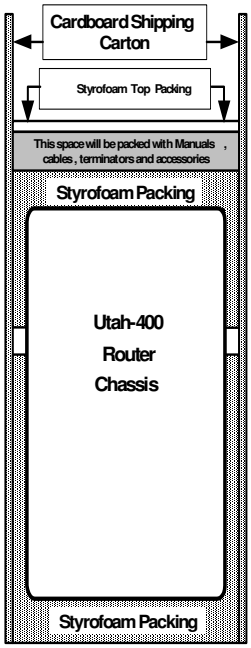


FIGURE 2-1. Utah-400 528 Packaging

Recommended unpacking method:

1. With carton setting upright, open the top.
2. Remove the Styrofoam packing material in the top of the box.
3. Remove the accessories.
4. Remove the Styrofoam packing from the top of the Utah-400.
5. Carefully cut the packaging around the base of the unit (see illustration below), then pull the shipping container away from the chassis.
6. When the Utah-400 is exposed, lift it to a stable bench or cart.
7. With the Utah-400 sitting on a bench or cart, remove the anti-static wrap covering the router and save for future use.
8. Move the router to the installation site.

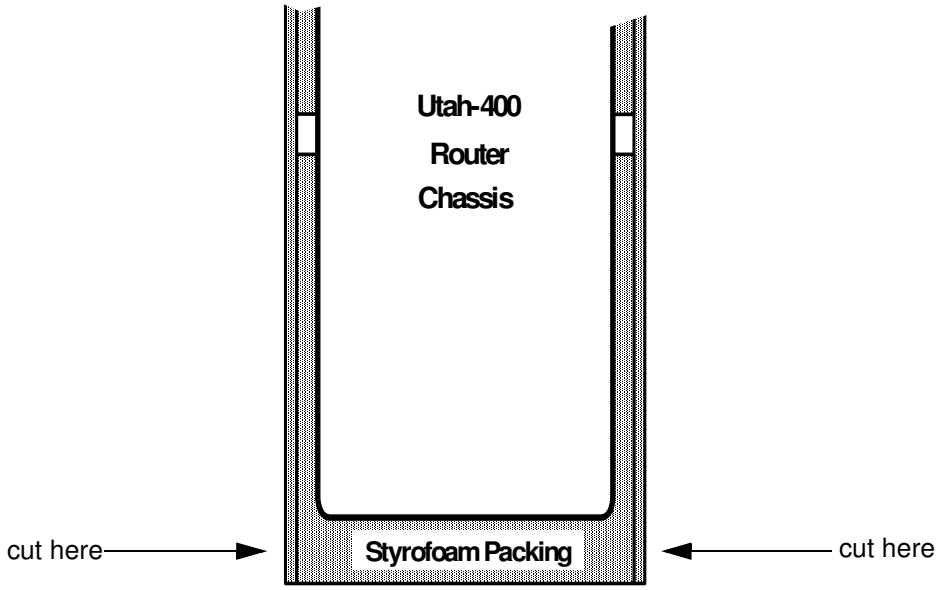


FIGURE 2-2. Chassis removal from carton

XL Systems Carton Handling and Chassis Management

When you receive your Utah-400 system, inspect each shipping carton for signs of damage. Contact your dealer and shipper immediately if you suspect any damage has occurred during shipping. Check the contents of each carton against your Utah Scientific order and verify them against the shipping manifest. If any items are missing, contact your dealer or Utah Scientific immediately.

Save the shipping box and material for future use, in case the unit may have to be shipped back to Utah Scientific.

Caution: The Utah-400 XL router system weighs over 600 pounds

Each router is wrapped in anti-static plastic prior to boxing up. The following image series shows the typical case removal of the Utah-400 XL system.

Please have the necessary tools ready (hammer and crowbar) for the wooden carton disassembly that follows. It is also recommended that six people assist in the rack/chassis removal and placement.

FIGURE 2-3. Carton truck removal - 1

FIGURE 2-4. Carton truck removal - 2

FIGURE 2-5. Carton top removed - 1

FIGURE 2-6. Carton top removed - 2

FIGURE 2-7. Carton housing lifted from base - 1

FIGURE 2-8. Carton housing lifted from base - 2

FIGURE 2-9. Carton housing separated from base

FIGURE 2-10. **Rack lifted off carton base**

FIGURE 2-11. **Rack lifted away from carton base**

FIGURE 2-12. Rack carried to staging area

FIGURE 2-13. Rack brought upright

FIGURE 2-14. Rack upright, ready for final location move

Transferring an XL system between Equipment Racks

In certain instances, a different equipment rack is required other than the one shipped by the Utah Scientific factory. The following description and illustration set will assist you in completing a chassis-to-rack swap when necessary.

IMPORTANT: PLEASE OBSERVE THE FOLLOWING BEFORE LIFTING THE XL CHASSIS

- YOU MUST INCLUDE 8 INDIVIDUALS, EACH CAPABLE OF LIFTING 100 LBS.

- EACH PERSON SHOULD WEAR A BACK BRACE AND GLOVES.

- UTAH SCIENTIFIC INC. ASSUMES NO LIABILITY FOR PERSONAL INJURY OR DAMAGE TO EQUIPMENT.

With the XL chassis completely removed from the container, lift off the panel doors, then carefully lower the chassis to the floor so that it is resting face up, and remove all the front mounting screws (as shown).

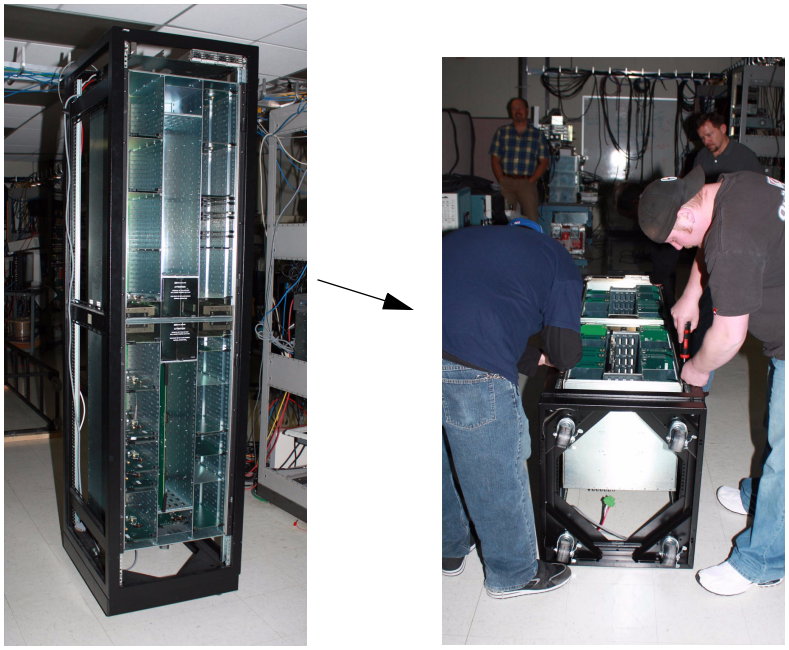
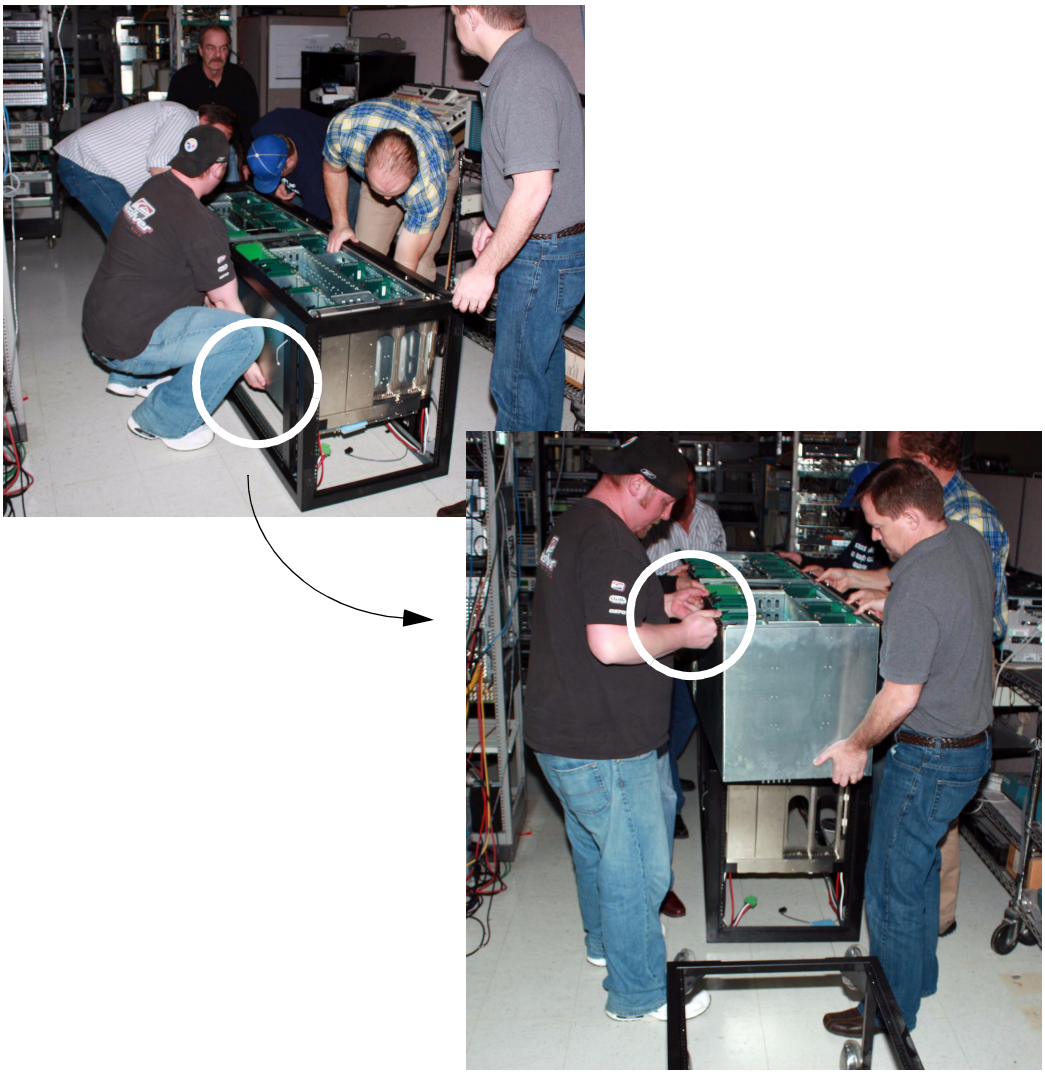


FIGURE 2-15. XL in shipped rack

With all screws removed, begin lifting the chassis from the bottom of the unit.



Once the front of the chassis has cleared the top of the frame (by several centimeters), allow each person to **one-by-one** reposition their hands to the lip on the front of the chassis (as shown).

FIGURE 2-16. Initial chassis lift out procedure

Lifting from the chassis lip, all attendants will carefully walk the router to the replacement rack, which should be positioned lengthwise next to the original rack.

FIGURE 2-17. XL chassis lift and carry

Reverse the lift-out process by lowering the chassis into the new rack, and like before, each individual should shift their hold (**one-by-one**) from the chassis lip to the rack bottom.

FIGURE 2-18. XL placement into the new rack

Once the chassis has been seated in the new rack, replace all front mounting screws and lift the assembly into its original upright position.

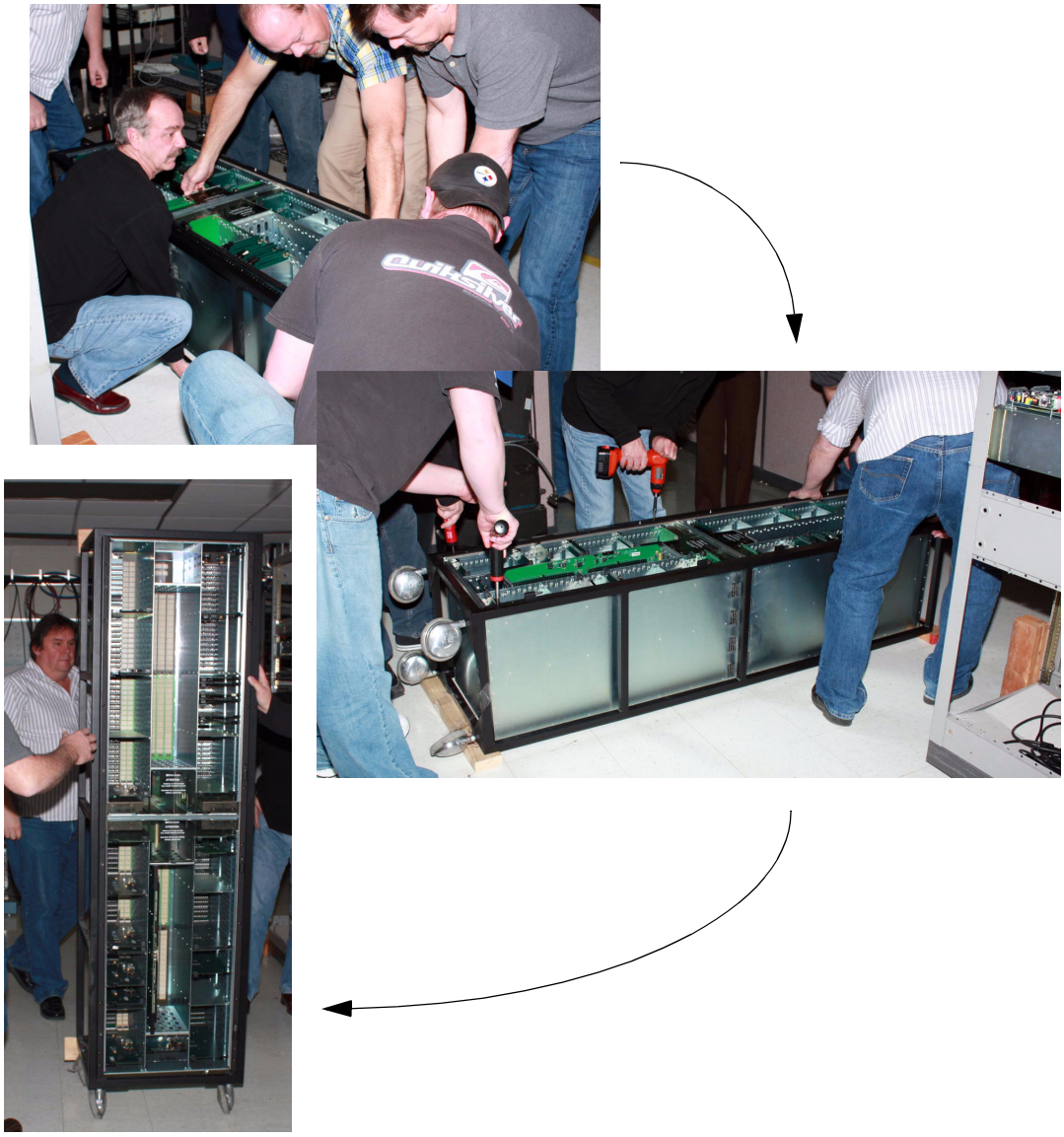


FIGURE 2-19. XL chassis - new rack positioning and upright placement

Installing Physical Equipment - 528 and XL Systems

Installation of your Utah-400 Video and/or Audio router may require some or all of the following steps:

1. Mounting equipment in rack frames.[1]
2. Installing MX-Bus cables.
3. Connecting the AES Reference Signal.
4. Determining and Setting the Router Signal Level(s).
5. Installing Audio/Video signal cables.
6. Connecting power.
7. Connecting the SMPTE alarm port.
8. Hardware checkout.

1. The Utah-400 XL System ships in its own equipment rack

Mounting Equipment in Rack Frames - 528 Systems

Installing the Utah-400 Digital Routing Switcher

Use the following steps to install the Utah-400 Systems into the rack frames:

1. Determine the vertical layout of your frames before you begin the installation. Please note:
   - You may wish to place blank panels between the systems to increase ventilation and make cabling easier.
   - You may wish to install the systems in a way to reflect the priority of audio and video signal levels.
   - *The 1 rack unit power supply frame must be installed directly below the audio or video frame.*
     - **For example**: If digital video is signal level 1 and digital audio is signal level 2, the digital video may occupy a lower position in the rack frame.

   Note: The illustration below is an example of a simple rack frame layout.

2. Once your layout is determined, remove the front cover from the Utah-400 and set it aside.

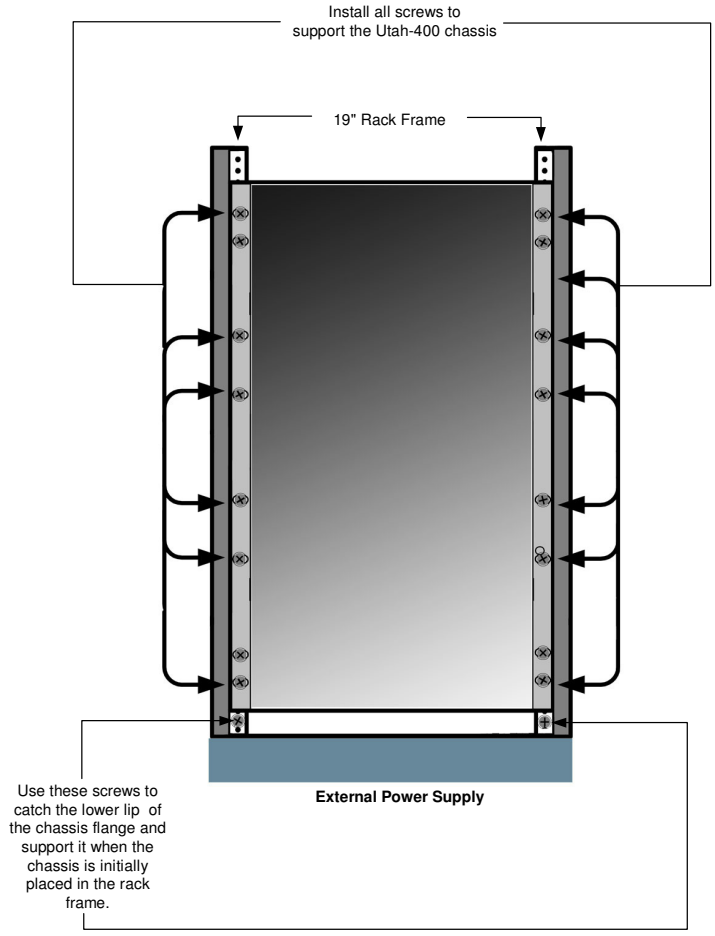


FIGURE 2-20. Utah-400 Chassis Mounted in 19" Rack Frame

3. Remove the shipping braces and set them aside.
4. Install the Utah-400 chassis' in the 19" rack frame.

Note: ***Utah Scientific recommends a minimum of two persons, preferably three, to install the chassis in the rack frame. Install all mounting screws in the front of the chassis; the entire weight of the router and cables are supported by the chassis side-frames.***

a. Determine the height to mount the Utah-400 in the rack frame.

b. Install two rack screws 3/4 of the way into the empty rack frame below the height determined in step a, above (leave a 1/8” gap). These screws will be used to support the weight of the chassis when it is moved into the rack frame. See 2-22 “Lowering the Utah-400 Chassis on the Rack Screw,” on page 2-21.

c. With two persons, pick the chassis up from the shipping carton at the left and right side frames.

d. Move the chassis to the 19" rack frame and carefully slide it into the rack frame, hooking the flange of the chassis above the rack screws installed in step b., above 2-22 “Lowering the Utah-400 Chassis on the Rack Screw,” on page 2-21.

Note: An alternative method is to support the Utah-400 Chassis with a shelf or similar support and align the mounting holes accordingly.

e. With the chassis resting on the lower rack screws, carefully lift the left side frame, align the lowest chassis frame mounting hole with a rack frame threaded hole and start rack screw. Repeat for the right hand side frame.

f. Once the lower chassis rack screws are in place, snug both sides up, but do not tighten.

g. Align remaining mounting holes, install remaining rack screws through mounting holes, then snug them down.

h. Finally, tighten all rack screws installed in the chassis mounting holes.

5. Replace all front covers when the installation is complete.

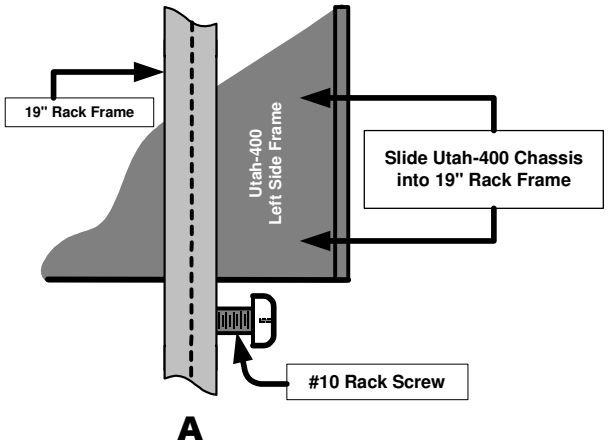


FIGURE 2-21. Sliding the Utah-400 Chassis into Rack Frame

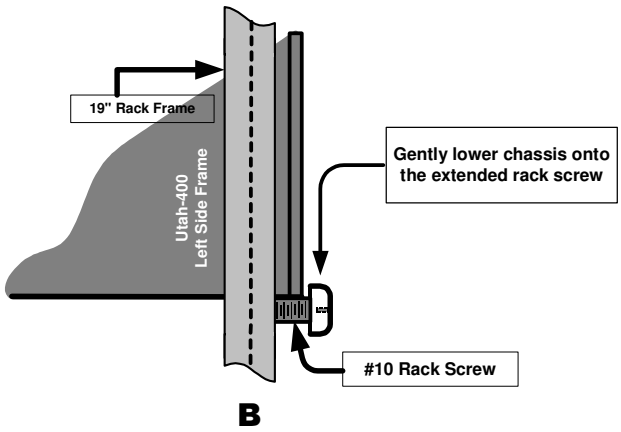


FIGURE 2-22. Lowering the Utah-400 Chassis on the Rack Screw

Installing the MX-Bus Cables

The Utah-400 routing system utilizes the MX-Bus control system. It must be connected to the SC-4 control system to switch its inputs and outputs. In addition, the proper levels and offsets must be set on the Utah-400 routing system(s) so they will operate on the proper signal levels.

The MX-Bus is a daisy chain configuration, must not exceed 300 feet (91.4 meters) in length; and must be terminated at both ends of the daisy chain.

Your Utah-400 router is shipped standard with:

- One MX-Bus Cable – 10 ft. (USI Part Number: 80229-10). Other lengths are available and may be ordered through Utah Scientific sales at 1–800–453–8782.

Interconnecting the SC-4 and Utah-400 Frames

The MX-Bus interconnection to the Utah-400 typically starts at the SC-4 control system and is terminated at the last physical Utah-400 chassis. The actual physical arrangement depends on the site placement of the various physical components.

The following illustration shows a typical MX-Bus installation.

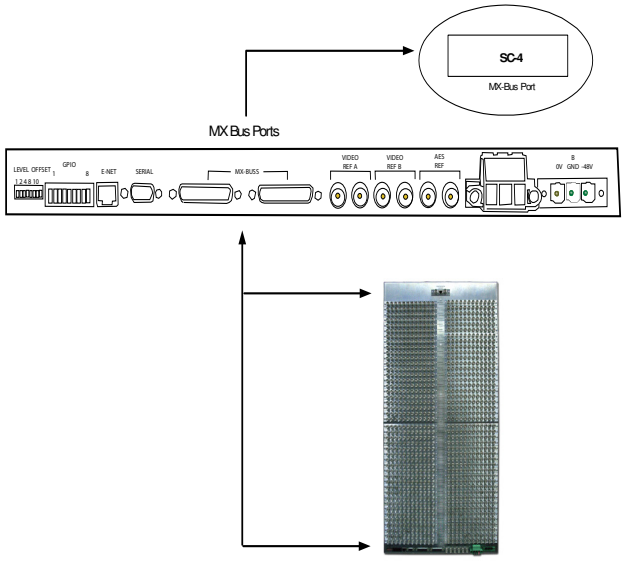


FIGURE 2-23. The MX-Bus Installation to an SC-4 Controller

Note: The XL frame contains two identical connections; top and bottom. Both must be cabled as if they were individual frames.

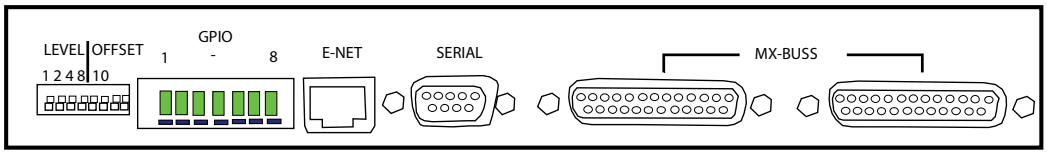


FIGURE 2-24. Control Backplane

The following illustration is a block diagram showing the Utah-400 in an MX-Bus daisy chain with other Utah Scientific equipment.

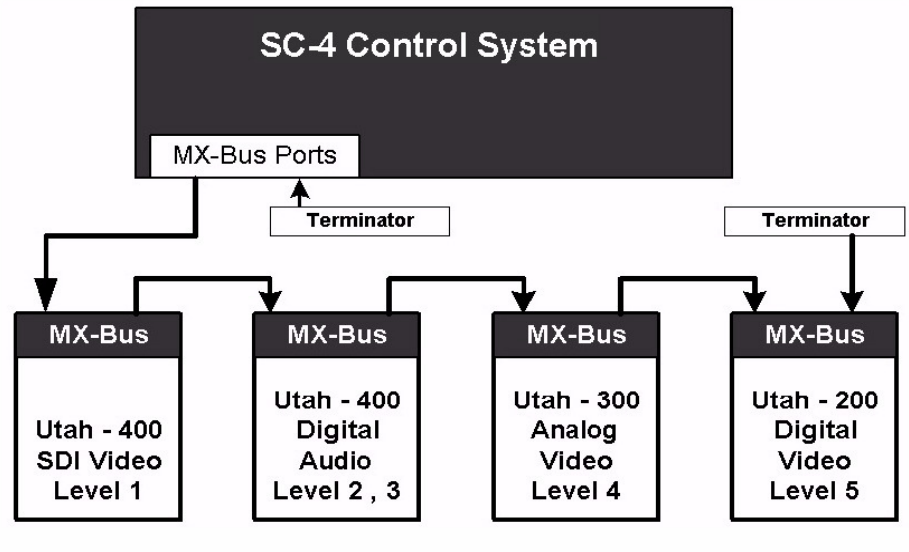


FIGURE 2-25. Block Diagram of the MX-Bus Daisy Chain.

Connecting the AES Reference Signal

The AES Reference input corresponds to the Sync Input BNC on the back of the 528 chassis.

This BNC signal connection is terminated in 75 Ohm.

The Reference signal is required so the Utah-400 Digital Audio Router can switch on the **frame boundary**. Using the Sync signal avoids the possibility of clicks in the digital audio while switching.

The following signal is acceptable to use as the Utah-400 AES Reference:

- AES Sync must be AES-3.

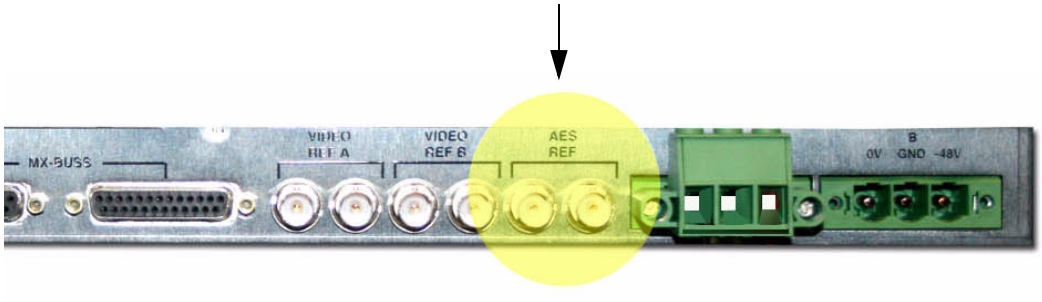


FIGURE 2-26. AES Reference

Determining and Setting Router Signal Levels

Signal levels are preset at the factory and tested during manufacturing, determined by customer input and requirements. The installation of your new Utah-400 Router should not require any signal level changes to operate after the new installation.

By definition, a signal level represents distinct elements of the broadcast system. These individual elements include, but are not limited to, High Definition Video, SDI Video, Digital Audio, Analog Video, Analog Audio and Data Routers. For additional information relating to signal levels, refer to “Signal Levels,” on page 1-8.

Switch Settings

Should you ever need to change the signal level of your router it is useful to determine:

- What new signal level is required.
- If other signal levels will have to be modified to accommodate the new signal level.
- Additional encoding requirements necessitated by the change.
  1. Locate the dip switch on the control I/O panel at the rear of the chassis.
  2. The four level bits work in a binary addition mode. Possible values range from 0 (all down) to 15 (all up). 0 is level 1 in an SC-4 control system, and 15 is level 16.
  3. Set the switches to the level you have chosen according to the following table.

Switch	1	2	4	8	Binary Value	SC-4 Level
	OFF	OFF	OFF	OFF	0	1
	ON	OFF	OFF	OFF	1	2
	OFF	ON	OFF	OFF	2	3
	ON	ON	OFF	OFF	3	4
	OFF	OFF	ON	OFF	4	5
	ON	OFF	ON	OFF	5	6
	...	...	...	...	...	...
	ON	ON	ON	ON	15	16

Offset Switch

The offset switch allows you to provide a base offset to the router; containing inputs, outputs, or both. This applies when multiple routers are to be ‘stacked’ on the same level, or when multiple router frames are placed in a larger matrix.

To offset the inputs by 528 inputs, move the ‘I” dipswitch up. To offset the outputs by 528, move the ‘0” dipswitch up. The figure below displays the settings within a 1056 router.

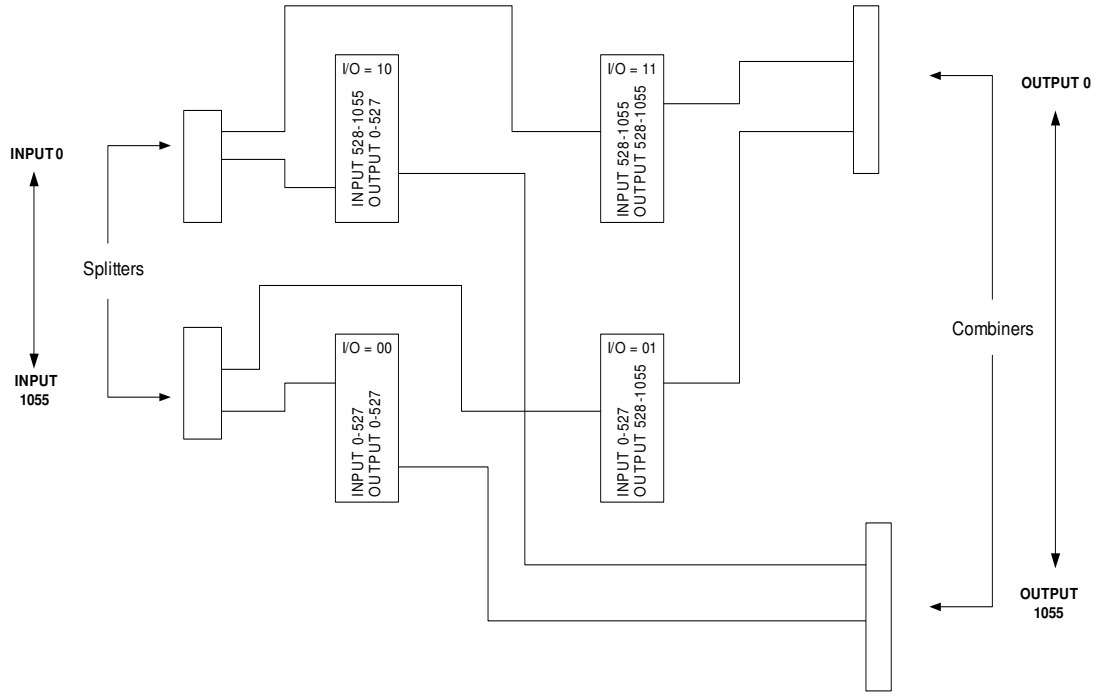
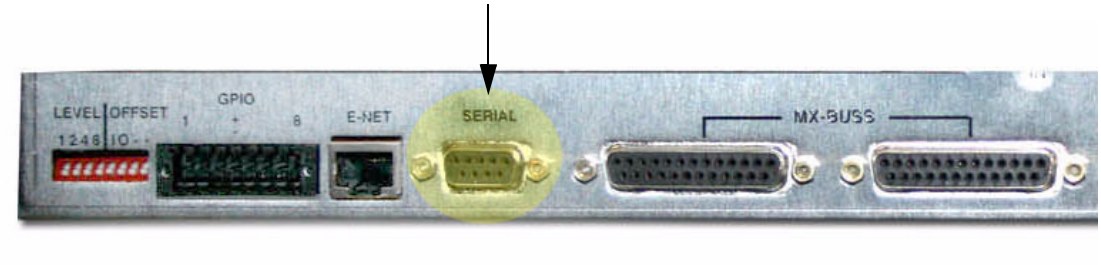


FIGURE 2-27. Offset switch configuration

Serial Port

This is a RS-232 DTE port, and is used as for diagnostic purposes. A terminal emulation program such as Tera Term is used for communication.



Baud Rate Information

Baud	38,4000
Data Bits	8
Stop Bits	1
Parity Bits	N
Handshake	XON/XOFF
Output Translation	CR = CR/LF

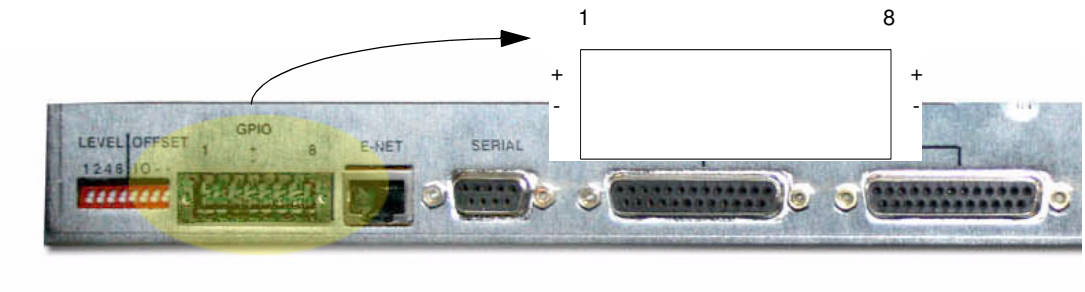
Pinout Information

Pin	Signal Name	Direction
2	Receive Data	In
3	Transmit Data	Out
7	RTS	Out
8	CTS	In
5	Ground	

Ethernet Port

The 10/100 ethernet port is used as a diagnostic and monitoring port. Connect this to a standard ethernet network.

GPIO Port



The GPIO block provides the following functions:

GPIO#	Direction	Function
1	INPUT	Indicate Power Supply Failure
2	INPUT	Unconnected (TBD)
3	INPUT	Controller Changeover
4	INPUT	Crosspoint Changeover
5	OUT	SMPTE Alarm
6	OUT	TBD
7	OUT	TBD
8	OUT	TBD

To activate a GPI input, short the + and - leads together.

When the SMPTE Alarm is active, there will be a short circuit across the + and - pins.

Installing the Video/Unbalanced Digital Audio Input & Output

This section provides guidelines for installing the Utah-400 Video Inputs and Outputs on the backplane connectors. Serial Digital Video and Audio cable specifications are listed below.

Input Signal	Recommended Cable Type	Maximum Cable Length	Termination Method
Digital Video and Unbal. Digital Audio	Belden 8281	300 M. / 1000’	Internal - 75 Ohm
High Definition Digital Video	Belden 8281	100 M. / 300’	Internal - 75 Ohm
	Belden 1694A	150 M. / 500’	Internal - 75 Ohm
	Belden 7731	200 M. / 600’	Internal - 75 Ohm
3G Digital Video	Belden 1694A	100M	Internal - 75 Ohm
	Belden 7731	120M	Internal - 75 Ohm

The following recommendations are made regarding cable connections:

- Ensure the router frames are installed securely in the equipment racks.
- Due to the compactness of the Utah-400 rear panel BNC's, it may be useful to have a connector chart next to the backplane.
- The use of a BNC insertion / extraction tool is recommended.
- Label the Input and Output cables coming into the rear panel – for example:
- VTR1 – Video Out or Out 0 – VTR1.
- All Utah-400 Digital Video/Unbalanced Audio BNC's use 75-Ohm single ended connectors.
- Avoid stress on the lower backplane BNC connections by providing proper strain relief on all cables.
- The Utah-400 Input matrix starts with Input 0 at the top right of the backplane.
- The Utah-400 Output matrix starts with Output 0 at the bottom right.
- Due to the 75 Ohm internal termination, do not use BNC "T" connectors to loop an input signal. This will result in serious signal degradation.

Figure 2-28 on page 2 -33 shows the entire Utah-400 528 x 528 Matrix rear panels. (Video or unbalanced digital audio.)

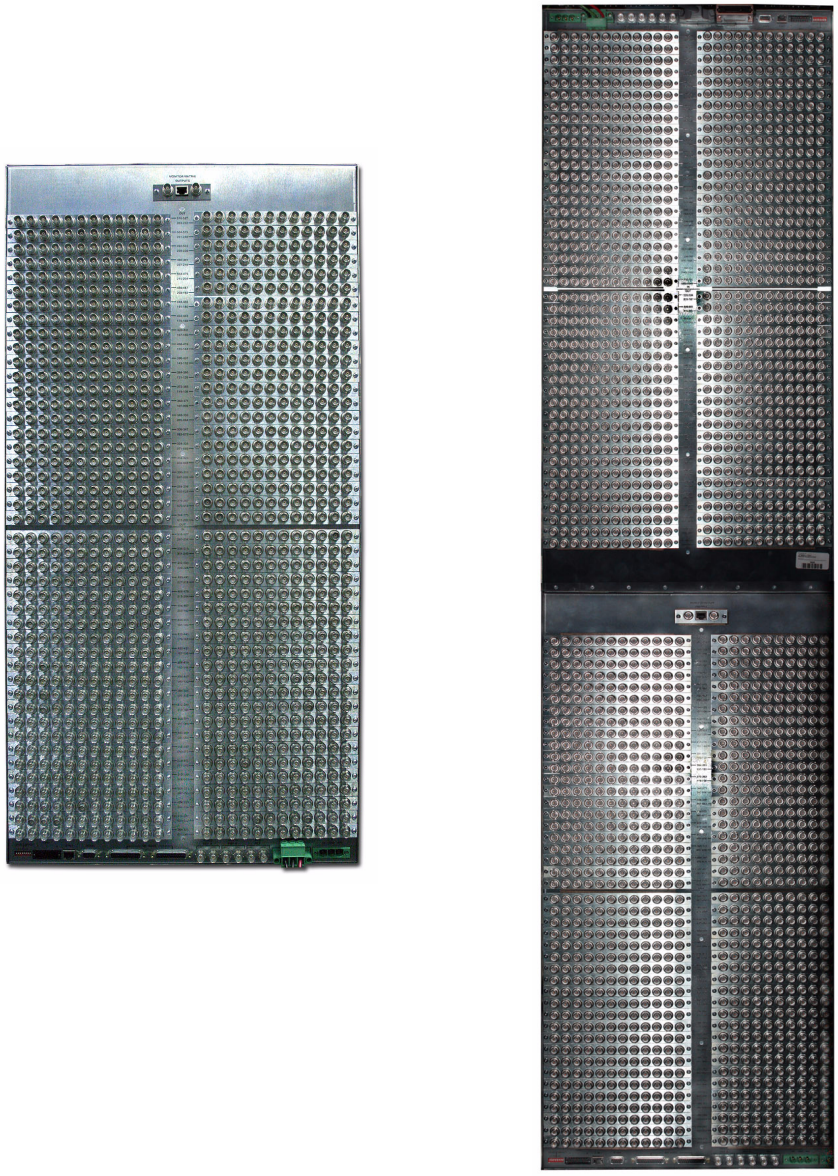


FIGURE 2-28. Utah-400 528[2] and XL Video Unbalanced, or Audio Rear Panel

Installing the Audio Input and Output Cables

The following recommendations are suggested for installing the Analog Audio Inputs and Outputs.

- Ensure the Utah-400 Chassis are installed securely to the equipment rack.
- Label all cables going to the Inputs and Outputs, for example:
    - **Inputs 0-7: VTR1 – 0, VTR2 – 1, SAT –4 …**
    - **Cable-1; Inputs 0-7, see Chart 1….**
- Pre-wired cables are available from Utah Scientific.
- D-connector to terminal block. Breakout panels are available from USI.
- Inputs and Outputs can be connected directly to the backplane using 37 pin high-density "D" connectors and back shells. Contact Utah Scientific sales for more information.
- Additional strain relief should be provided for each "D" connector, in addition to the connector screws.

Refer to Appendix A for a list of audio connector suppliers.

Table 1 on page 2 -36 shows the connector pin-out for the 37 pin connectors.

Figure 2-29 on page 2 -38 shows a blown up view of the Male 37 pin connector.

Figure 2-30 on page 2 -38 shows a blown up view of the Female 37 pin connector.

The standard configuration for the Utah-400 Audio Input and Output using DB-37 connectors.

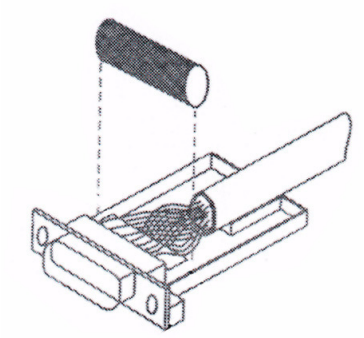
The DB-37 connector used on the backplane has the same wiring format for the input and outputs. Although any wiring scheme may be used, Utah Scientific makes the following recommendations:

- Use a high quality shielded cable for the Digital Audio. See the chart below.

Recommended Cable	Maximum Cable Length	Physical Characteristics	Shielding
Belden 9993 (or better)	100 M. / 300’	12 pair / 24 AWG / Stranded	Individual Shields and Drain wires
Belden 1800A (or better)	100 M. / 300’	1 pair / 24 AWG / Stranded	Shield with Drain Wire

Note: The cable shield should be grounded on the chassis end only; this prevents ground loops from occurring.

- Use shrink tubing around the end of the wires and cups on the 37-pin male connector when assembling. This process helps prevent any shorting between adjacent wires.
- Tie all grounds together inside the connector shell. Use an EMI Gasket for this application.



- Provide proper strain relief for the cable ends; use tie-wraps to anchor the cables as they are installed.
- Avoid running Digital Audio cables across or adjacent to AC power sources where possible.
- Do not bundle wires close to chassis backplane, this increases connector stresses.

TABLE 2-1. Utah-400 Balanced Digital Audio/Analog Audio (Pinout Connections)

DB-37 (Female)

DB-37 (Male)

Pair	Pin Number	Signal	Drain Wire (GND)
1	25	Input/Output 0 +	27
	26	Input/Output 0 -	
2	21	Input/Output 1 +	20
	22	Input/Output 1 -	
3	3	Input/Output 2 +	1
	2	Input/Output 2 -	
4	5	Input/Output 3 +	23
	4	Input/Output 3 -	
5	7	Input/Output 4 +	24
	6	Input/Output 4 -	
6	9	Input/Output 5 +	28
	8	Input/Output 5 -	
7	11	Input/Output 6 +	29
	10	Input/Output 6 -	
8	13	Input/Output 7 +	30
	12	Input/Output 7 -	
9	15		34
	14		
10	17	Input/Output 7 +	18
	16	Input/Output 7 -	
11	35		37
	36		

DB-37 (Female)

DB-37 (Male)

12	31	Input/Output 7 +	33
	32	Input/Output 7 -	
N/A	19	Isolated Chassis Ground	N/A

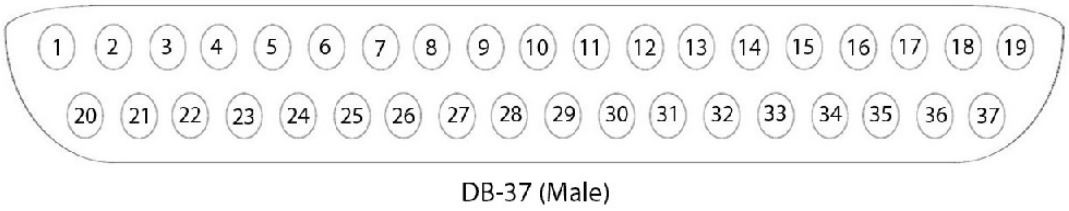


FIGURE 2-29. DB-26 High-Density Male Connector

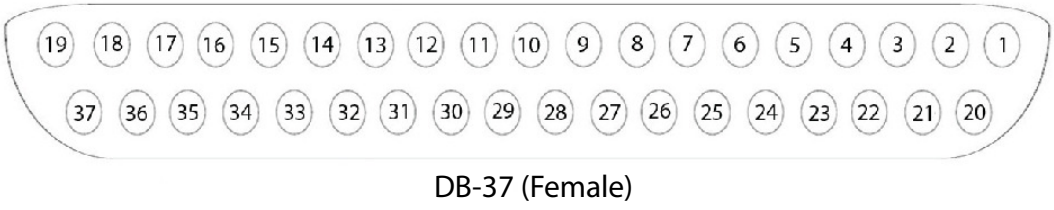


FIGURE 2-30. DB-26 High-Density Female Connector

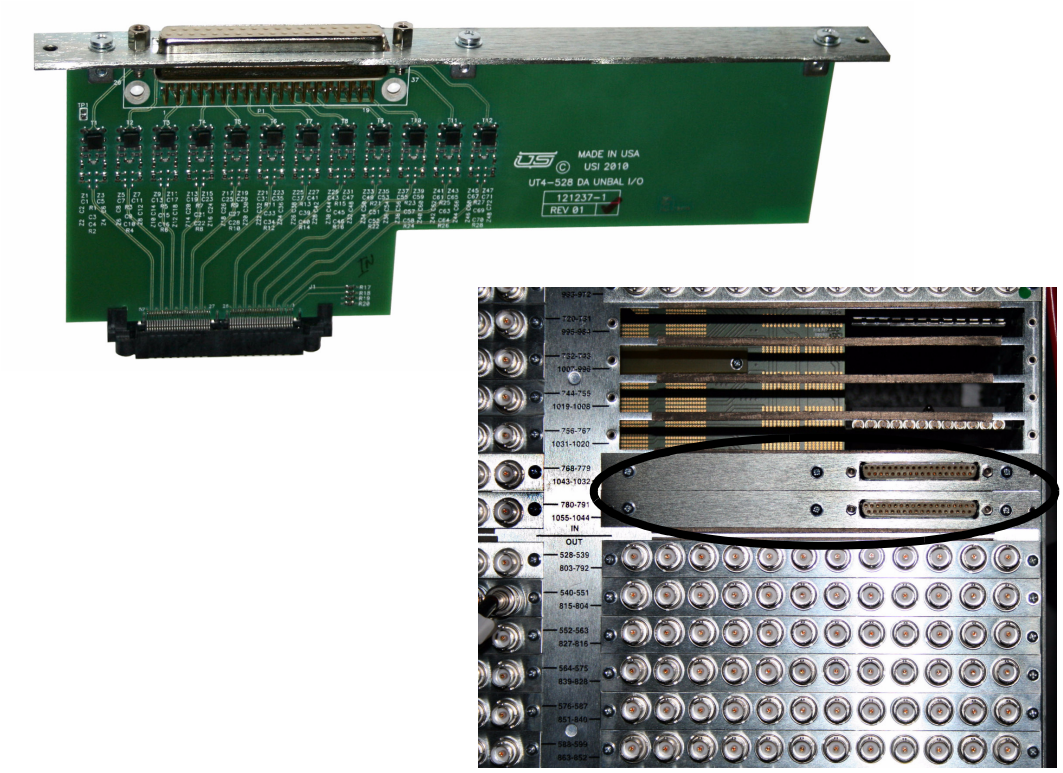


FIGURE 2-31. 121237 - Card Displayed

I/O Card Replacement - Rear Panel

The following process applies to all Utah-400 routers containing 12 I/O ports on the rear panel. These card components will occasionally require removal (during fiber card replacement for example), and in this case special care should be given to proper guide alignment during the alternate component's re-installation.

The front attaching I/O card (as shown in the following figure) must be completely detached before the rear component is removed.

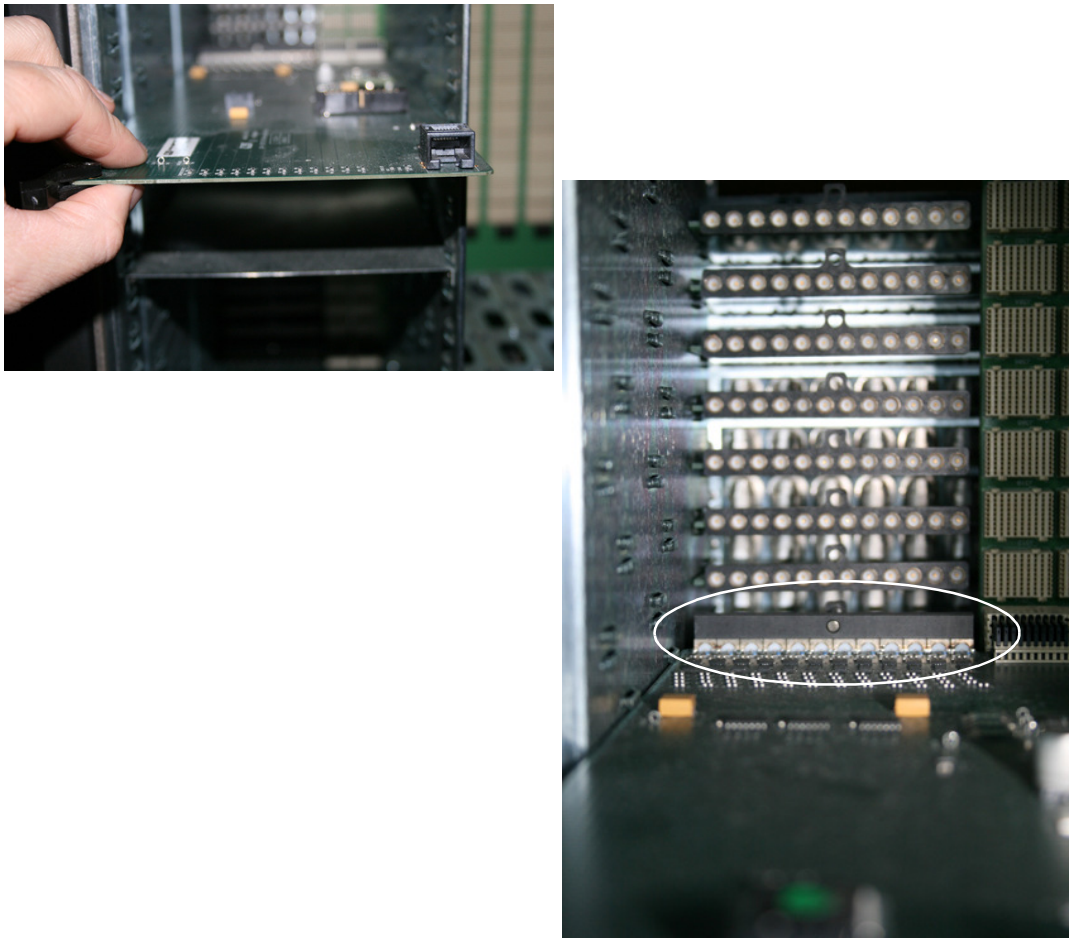


FIGURE 2-32. I/O card removal - rear component unlocking and slide out

Next, both mounting screws are removed from the rear section, then the component is pulled away and lifted upward to clear the frame.

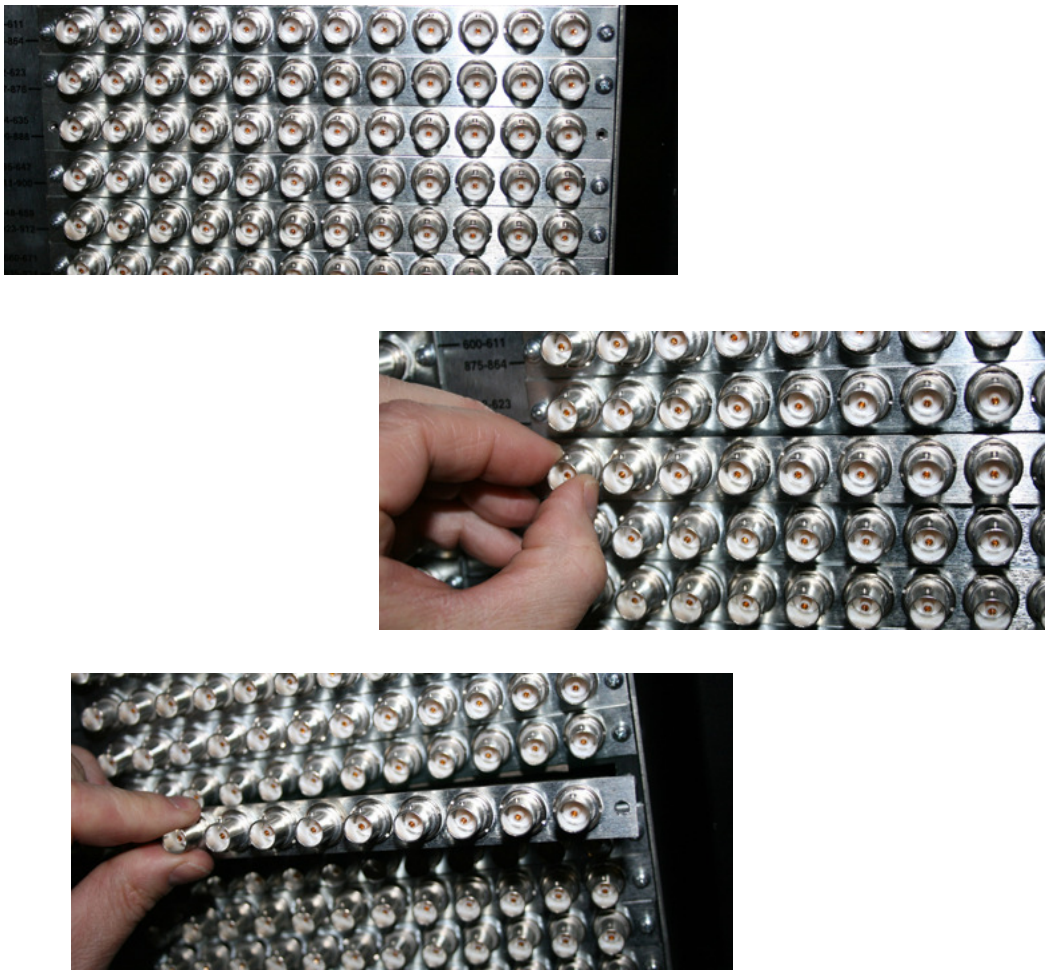


FIGURE 2-33. Rear Component removal

During component insertion, reverse the removal process by lifting the component upward, and carefully follow the card guide as the part is secured in place.

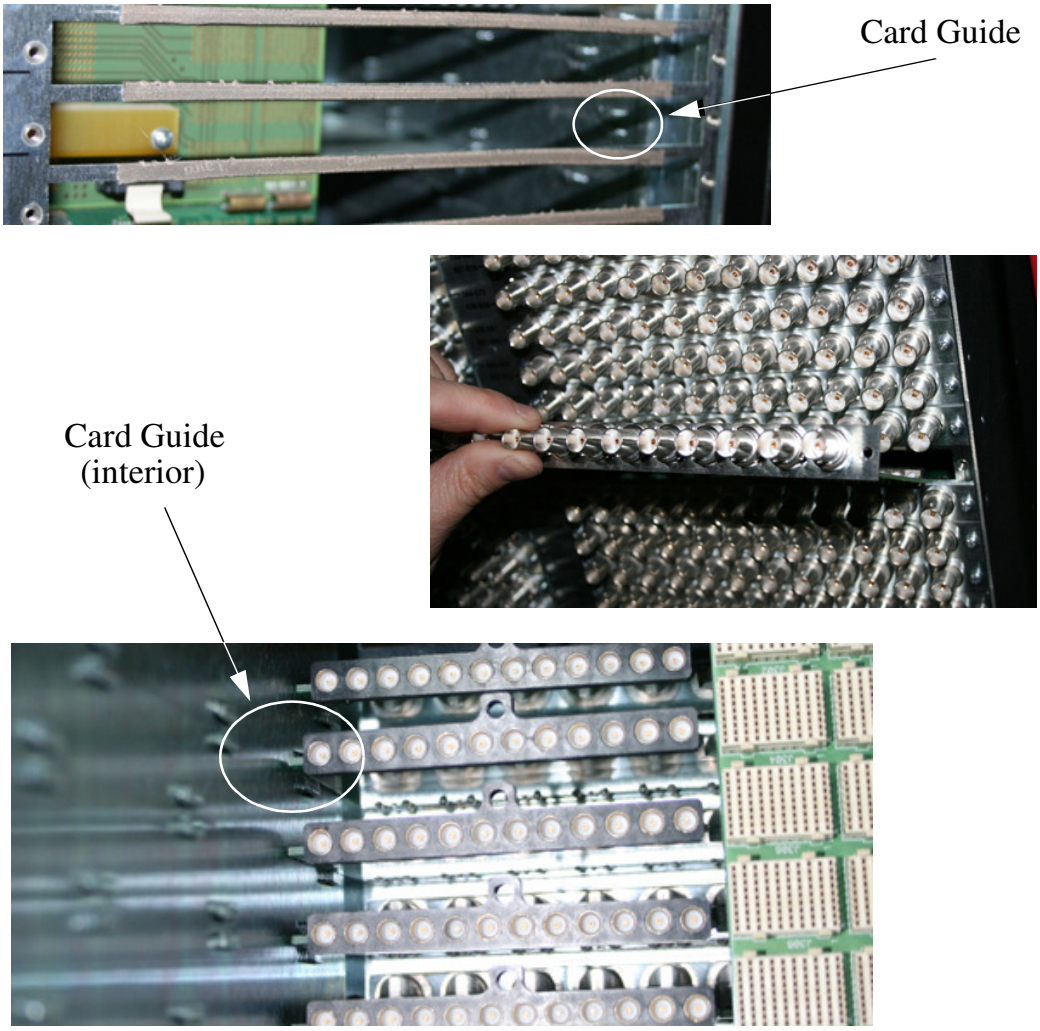


FIGURE 2-34. I/O card insertion

Mate the component back to the the larger I/O card, then re-insert the rear component's mounting screws to complete the installation.

Connecting and Disconnecting Power

The UT-400 528x frame receives 48 volts from an external 1 rack unit power supply chassis, except in the case where it is to be supplied 48 volts directly from the facilities power distribution system. This applies to all installations where 48V reception is the requirement.

The default configuration includes four power supply modules.

FIGURE 2-35. Power Supply (front view)

Double check the installation before applying AC power to ensure proper cable orientation.

The following diagram contains the connection detail for AC power between the power supply chassis and the router frame. (UTSCI cable assembly - **Part # 140023-0001**)

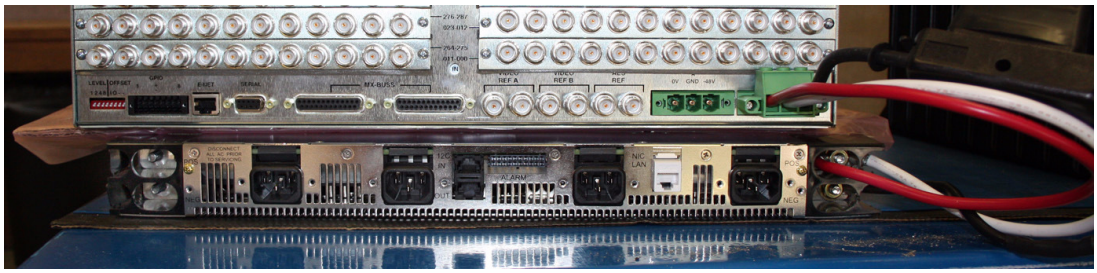


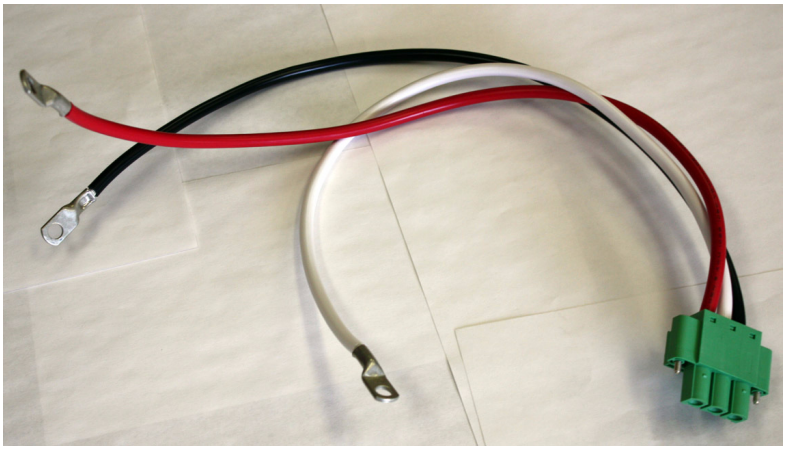
FIGURE 2-36. Power Supply cable assembly (rear view)

The UT-400 528x router contains two discreet DC power busses in the system. These ports accept 48V DC signals at a maximum of 35 amps. The system can run with supplies connected to either input, or both inputs if a redundant system is desired.

DC Connectivity

The 528 and XL routers do not contain internal power supplies or AC connections. Each card in the system receives 48 VDC from two external video connections.

- Ground - Frame or chassis grounding point
- 0V - Most positive leg of -48V DC connection.
- -48V - Most negative leg of -48V DC connection.



Note that this configuration is a DC-I or DC isolated connection.

The terminal strip is a small bracket containing three screws (see 1). Loosen the screws to remove the terminal from the back. This will expose the strip of wire (aprox. 1/4 of an inch).

Proper wire insertion into the removable terminal block

- Turn the screws counter clockwise to allow wire insertion (3 screws on block top).
- Strip 1/4” of the insulation from the new wires.
- Insert wire, then turn screw clockwise to tighten

When installing the cable, the white and red wire connect to lugs on the Positive (upper) connector on the rear of the Valere chassis, and the black wire connects to the negative (lower) connector. On the rear of the UT4-528 or XL, the red wire connects to 0V, the white to ground, and the black to -48V.

Use 10 AWG wire (minimum)

The maximum current required for the branch circuit feeding the UT-400 XL and UT-400 528 is 35 Amps. An XL system requires two external power supplies, one for each half of the system.

Pre Power-Up Checks

Before applying power to the router, check the following:

- All boards within the router must be fully seated; not crooked or outside the card guides.

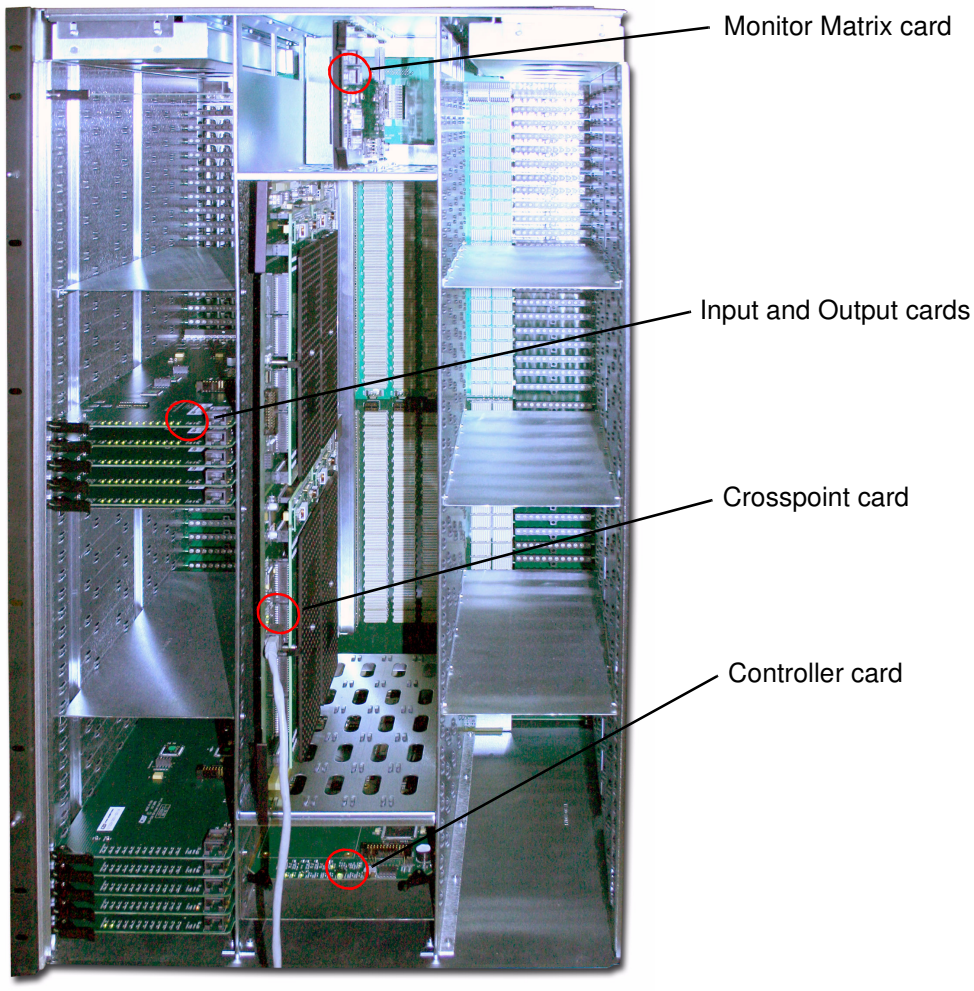


FIGURE 2-37. Power On LEDs

Initial System Power-Up

After verifying AC and DC power connections, apply power to the system. Verify that the following system indications are present.

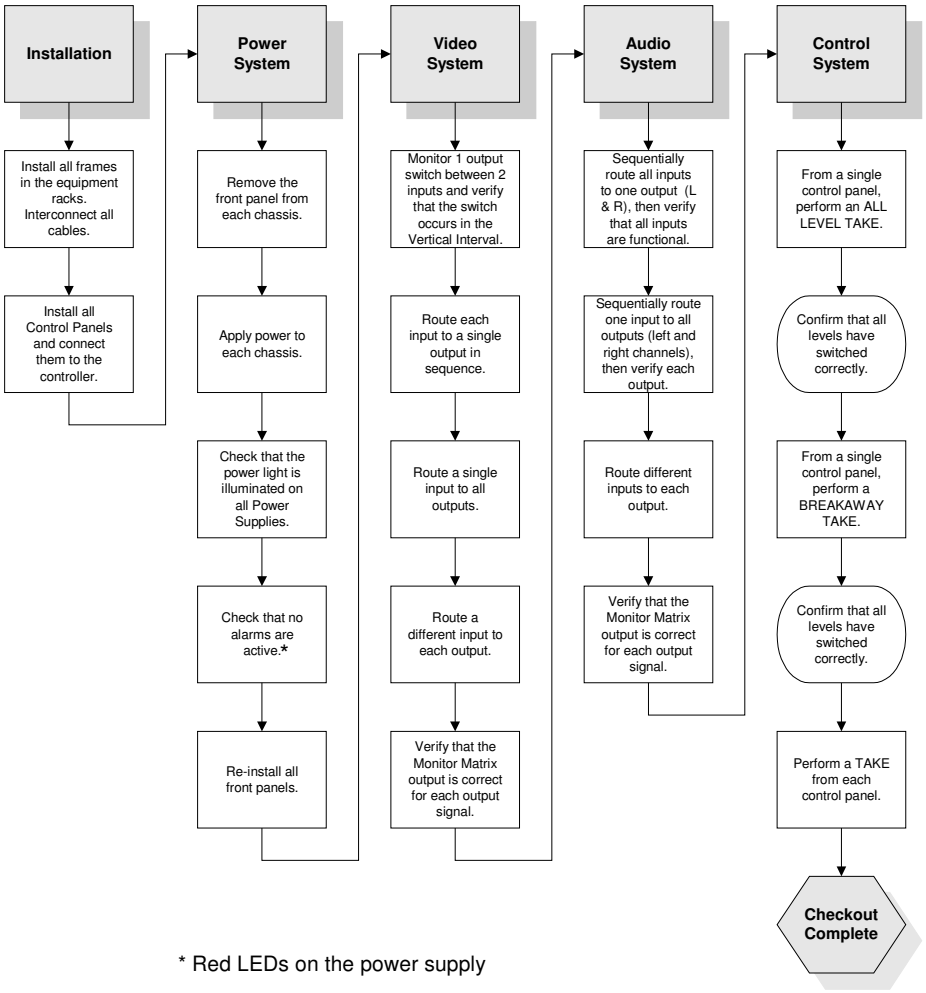
1. All Chassis fans are turning, and all eight LEDs are green.
2. The AC and DC power OK LEDs on the external power supply are on.
3. The green Power OK LEDs on the crosspoint cards are on.
4. No red LEDs are present on the I/O cards.
5. The large green LED on the Frame Communication module is on.

If one of more of the indicators are not present, remove power and re-check the connections. If the problem persists, contact customer service.

Hardware Checkout

Use the following flow chart to check out your Utah-400 System. Note the following important points:

- For the Video and Audio System columns may be switched numerically if encoding is not required.
- For the System Control column, the SC-4 Control system may require some configuration in order to perform all functions.



* Red LEDs on the power supply

CHAPTER 3

Configuration and Operation

This chapter provides an explanation for specific Utah-400 configurations, and basic instruction for the handling and operation of your Utah-400 system.

In This Chapter

Utah 400 SC-4 Control

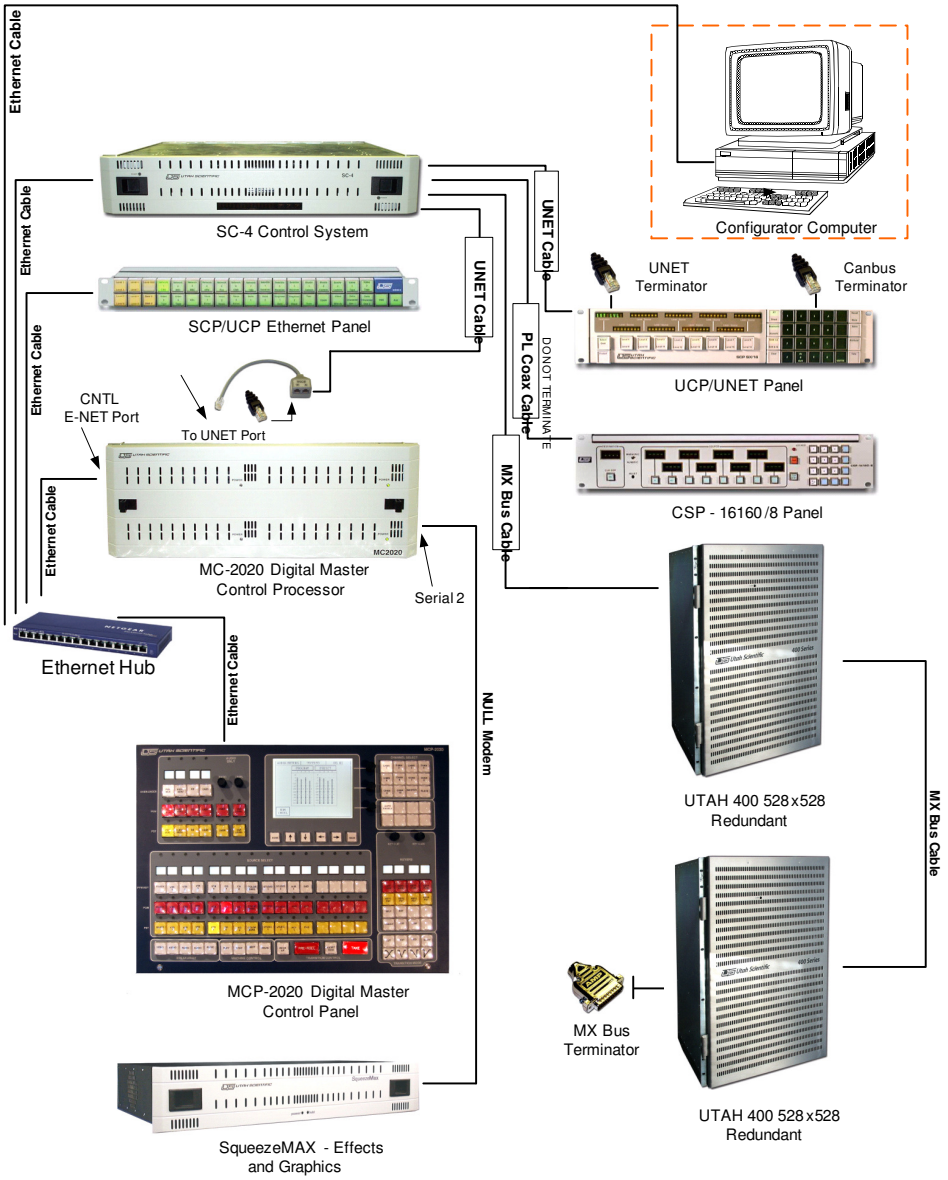


FIGURE 3-1. Utah 400 SC-4 for Utah-400 and MC/MCP-2020

TABLE 2-1. **SC-4 Configuration for the Utah-400 and MC/MCP-2020**

SC-3/4 System Cable / Termination Table			
Part Name	**Part Number**	**Description**	**Comments**
UNET Terminator	65324-04	8 RJ-45	Supplied by USI
MX-Bus Terminator	70797-1	DB-25P Module	Supplied by USI
MX-Bus Cable	80229-010	Parallel / DB-25P	Supplied by USI
UNET Cable	N/A	UTP/RJ-45	Not Supplied
Ethernet Cable	N/A	UTP/RJ-45	Not Supplied
Party Line Coax Cable	N/A	**Belden RG-59/U; 9209 or 8281**	Not Supplied

Module Array – Panel Front

There are 22 slots containing the input modules within the router's lower left and right sides. Input 0 is located at the bottom, while inputs 263 and 527 are at the top of the array. The 22 output slots are placed on the upper left and right, with outputs 0 and 264 located at the bottom, and outputs 263 and 527 positioned at the top (upper array).

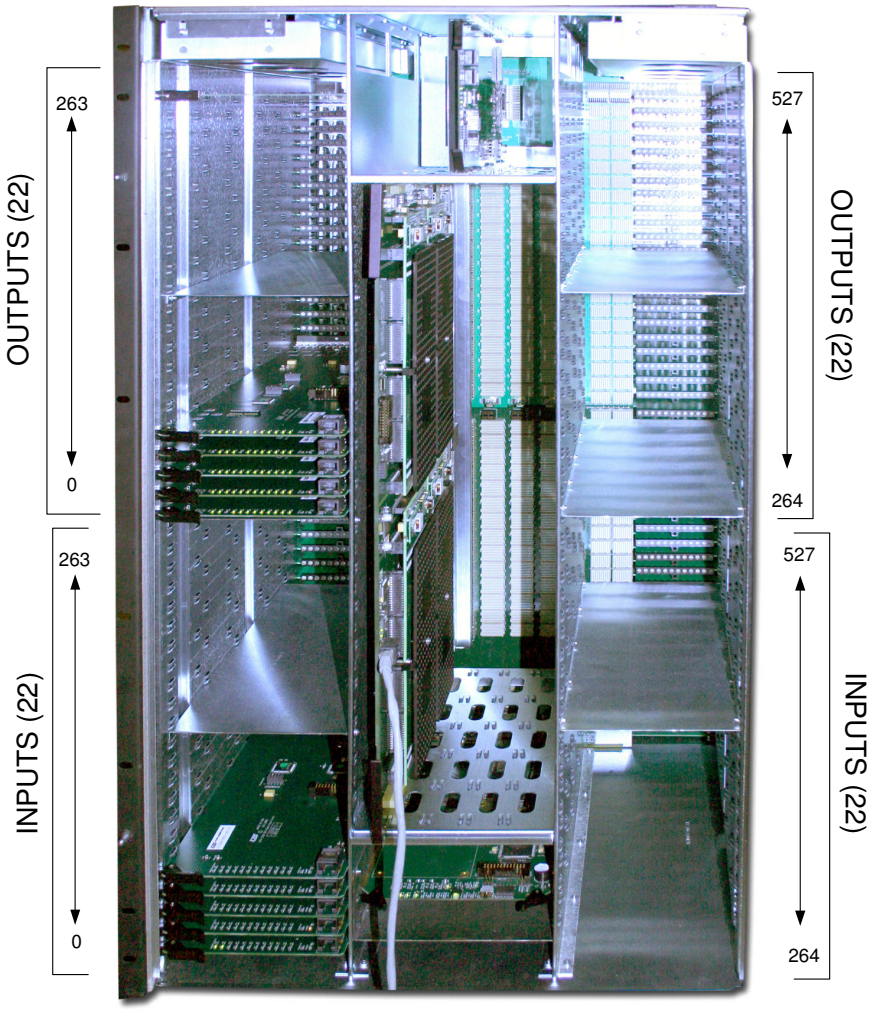


FIGURE 3-2. Module Array - 528 System

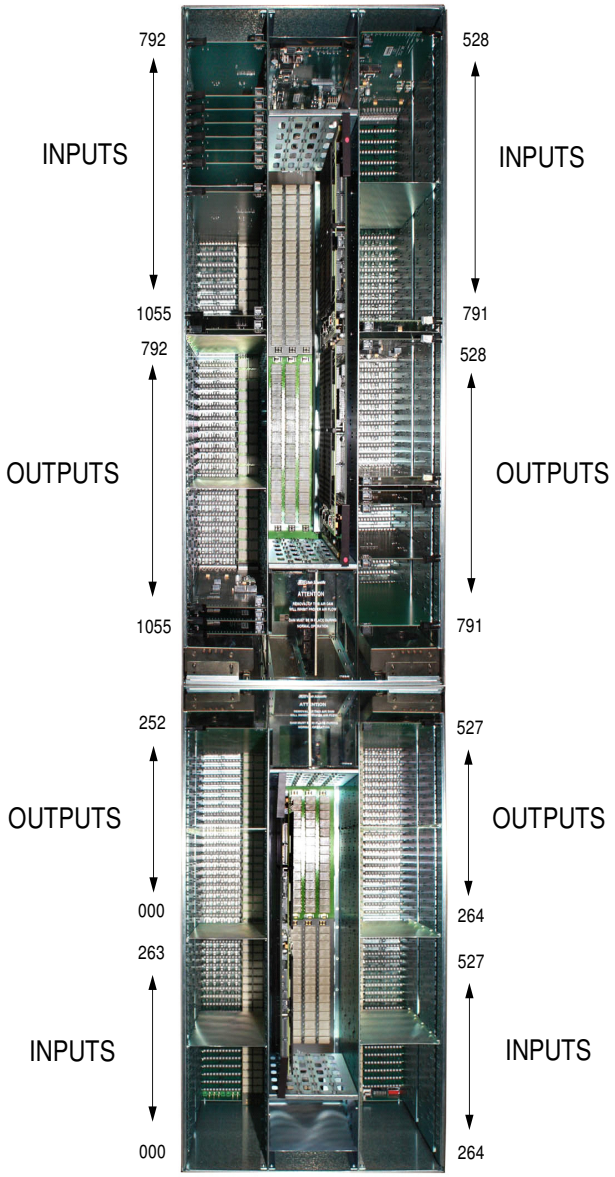


FIGURE 3-3. Module Array - XL System

Operation

Alarm Indication

The alarm LED located on the front of the UT-400 chassis is a universal indicator, and will illuminate when any alarm condition is sensed.

FIGURE 3-4. Router Alarm Indication - 528 and XL chassis

The SMPTE alarm port is used to generate contact closures indicating a problem within the system.

Ethernet and RS-422 Connection

The Ethernet and RS-422 connections are diagnostic.

Crosspoint Cards Maintenance

The UT-400 chassis contains two vertical crosspoint cards at the center of the chassis; the leftmost being the primary card, while the card on the right is redundant.

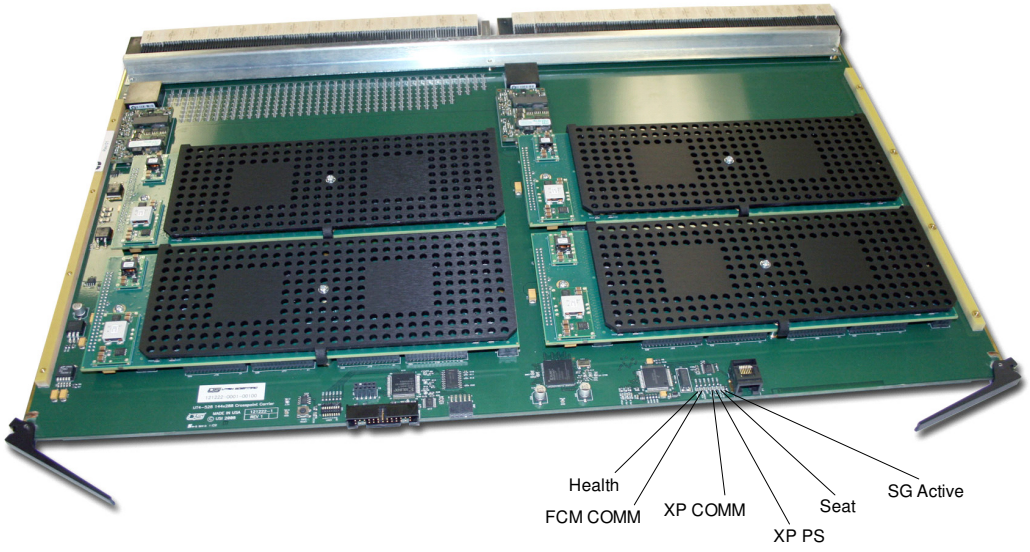


FIGURE 3-5. Crosspoints LEDs

The crosspoint card's voltage LEDs behave like other UT-400 series displays, with green indicating normal activity and red signaling a problem condition.

The Scangate Activity LED will flash to indicate normal activity.

Debug Port

The software utility associated with the crosspoint card's debug port is currently under development. Please check back.

Input and Output Card Removal and Replacement

To correctly remove and replace the individual input and output cards, always make sure the guides are located (inside the chassis) and the card slides all the way in before the ejector is locked in place. The card ejectors are pressed inward and down from the card when locking, and pulled outward from the card when removing.

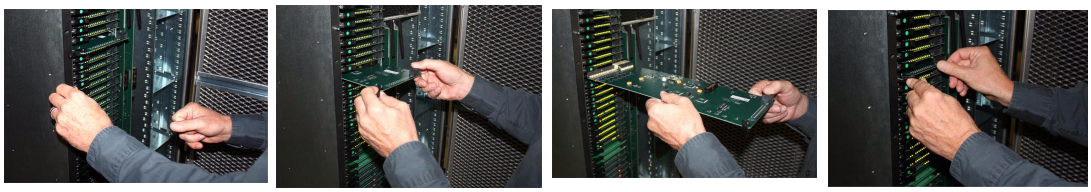


FIGURE 3-6. Input/Output Board Replacement and Removal

All boards within the Utah-400 system are hot-plug capable.

Crosspoint Card Removal and Replacement

The Crosspoint card uses a slightly different version of the locking and unlocking mechanism. The board is removed by gently pulling the ejector tabs outward, and locked into place by pressing the two tabs inward.

FIGURE 3-7. Crosspoint Board Removal

Air Dam Removal and Maintenance

The Plexiglas air dam covers the fan controllers and monitor matrix cards. It is critical that these components receive proper cooling during normal operation. Make sure the air dam is removed only during periods of needed maintenance.

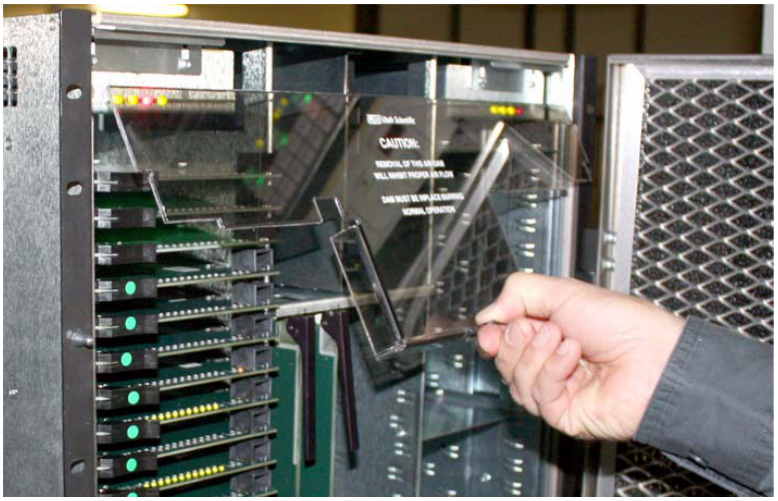


FIGURE 3-8. Air Dam removal/replacement

In addition to the plexiglass air dam, the IO cards in the uppermost slots on the left hand and right hand side of the chassis are a critical element in the cooling design of the chassis.

Cards MUST be installed in these slots. If your system did not have IO cards purchased for these positions, blanks will have been placed in those slots. Ensure that they are not removed for long periods of time.

Fan Service

Alarm indicators on the crosspoint control card and power supplies will indicate any fan problems.

Individual fan modules can be lifted out by removing the two top screws that hold each in place. The new module is connected by simply aligning each and pushing it in place, then reattaching the two screws.

FIGURE 3-9. Fan location and removal

Power Supply

External Power Supply

The power supply interconnects with the router at the bottom of the assembly using a cabled interface. Using Utah Scientific's pre-molded cable assembly, the ground signal and 48 volt conversion are carried to the UT-400 router. You will also see an additional cable assembly that is used for the micro controller inside the router that communicates with the alarm circuitry inside router.

For mounting and connectivity considerations, the power supply is most appropriately located beneath the UT-400 router.

CHAPTER 4

Utah-400 Components

In This Chapter

This chapter contains descriptions of each video and audio board type contained within the Utah-400; including Input, Output, Crosspoint and Interface (midplane) cards, and Power Supplies. Information regarding LED indications and alarms is also provided.

Video Input

Video connectivity on the back of the router is handled through BNC or Fiber (optional). The primary connection to the outside environment occurs via the MX bus. There are two MX bus connectors, with the second one terminated if no connection is to be made to another router.

Multi-rate

Part # 121229-1, the Multi-rate SDI Input Card is designed to receive 12 individual single ended data streams at data rates between 3 Megabits per second to 3 Gigabits per second. This range allows the card to receive SMPTE SDI signals in the 259, 292 and 424 standards, as well as non SMPTE standards like DVB-ASI, AES-3 audio, and SMPTE-310 signals.

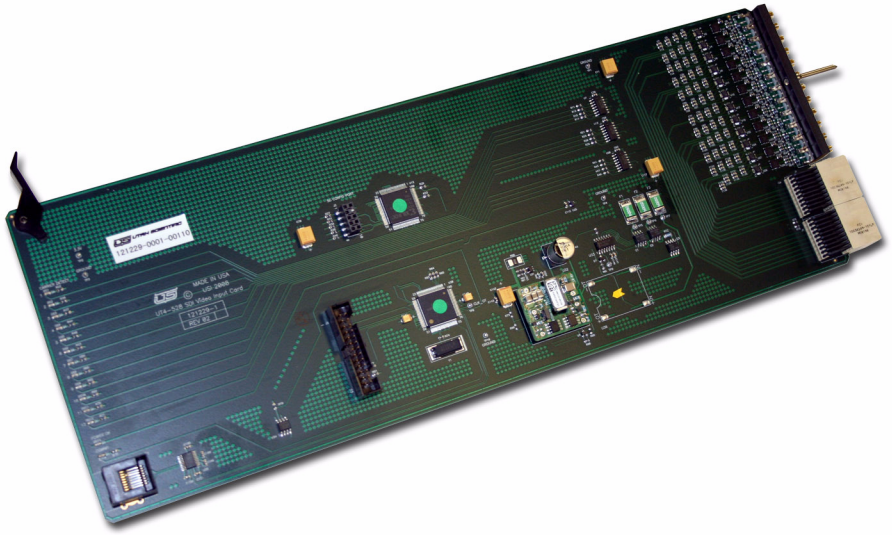


FIGURE 4-1. Multi-rate Video Input Board

Circuit Description

The first stage of the card equalizes the signal to remove deterministic cable rolloff. It is capable of the following cable lengths for some standard SDI data rates –

- SMPTE-259C – 270 Mb/Sec – 350 Meter equalization capability
- SMPTE-292 – 1.485 Gb/Sec – 150 Meter equalization capability

- SMPTE-424 – 2.970 Gb/Sec- 100 Meter equalization capability

The equalization stage also provides an indication that the equalizer has detected and is equalizing a signal.

After the cable equalization stage, the signal enters a 1x4 fanout distribution stage. One of these four signals is driven to each individual crosspoint in the system. In this fashion, every crosspoint card has an identical copy of each input signal in the system.

Controls And Indicators

There are no controls on this card, other than P1 which is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are three types of indicators on this card –

1. Communications indicator – yellow. Illuminated when the card has been addressed by the Frame Controller Module.
2. PS Fail Led. – Red – Illuminated when the 3.3V power supply falls out of +- 5% tolerance.
3. Signal Present Detection LED's (12), Green. One of these LEDS is present on the front edge of the card for each input signal. They are labeled as 'Carrier Detect' 1-12. To use the Carrier detect numbering to help identify whether or not an input is present in the router, the CD1-12 must be translated to the particular router slot the card is inserted in. If the card is installed in the input 24-35 slot, for example, CD1 refers to input 24 of the system, and CD12 refers to input 35 of the system.

Video Output Boards

The Utah-400's Video Output cards receive signals from the Crosspoint card, where user specified switching takes place. All three card types (below) perform a signal presence detection, while the SD and HD Output cards contain a re-clocking stage.

Multi-rate

Part # 121230-1, the Multi-rate Output card is used to drive single ended data signals out of the router. It has integral Clock and Data Recovery circuits that operate on standard SMPTE Video frequencies and work to remove jitter from the signal. The cards also contain high quality, high capability cable driver components that allow them to drive long lengths of coax cable.

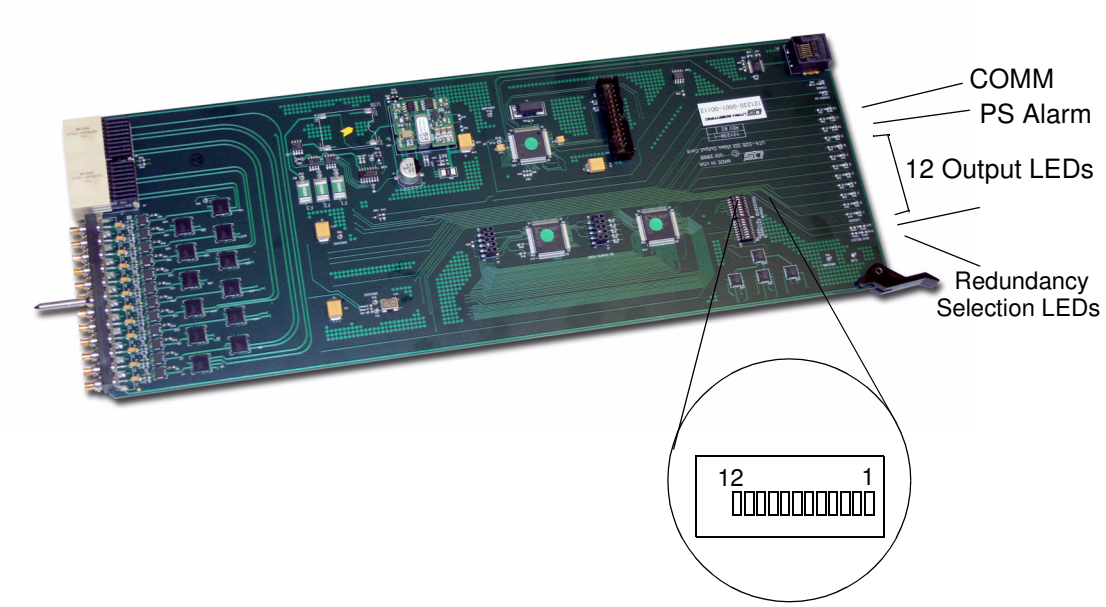


FIGURE 4-2. Multi-rate Output Board

Circuit Description

Signals enter this card from multiple crosspoint cards. The control signals from the Frame Communication module determine whether the output stage selects signals from the Primary or Redundant Crosspoint cards.

Once an input is selected, the output stage typically reclocks it, unless the signal is not a standard SMPTE video frequency, and then the signal is bypassed.

After the signal passes thru the reclocker stage, it is presented to the cable driver stage which generates signal centered around 0V with an amplitude of 800mV. The rise and fall time of these signals will adhere to the SMPTE specification for the signal type, or default to a 200pSec risetime if the signal type is non-standard.

Controls and Indicators

This card has a two bank dipswitch with 16 total switches. 12 of them are used to force a bypass condition on each of the 12 individual outputs (Labeled as P1-P12). To force a bypass condition on an individual port, move the dipswitch towards the word 'BYPASS'

On the PCB. TO allow it to automatically select the proper mode, move it away from the bypass indication on the PCB. The other four dipswitch locations should remain placed toward their labeling on the PCB. P1 is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are Four types of indicators on this card –

1. Communications indicator – yellow. Illuminated when the card has been addressed by the Frame Controller Module.
2. PS Fail Led. – Red – Illuminated when the 3.3V power supply falls out of +- 5% tolerance.
3. Reclocker Locked LED's (12), Green. One of these LEDS is present on the front edge of the card for each input signal. They are labeled as 'Locked' 1-12. To use the Carrier detect numbering to help identify whether or not an input is present in the router, the CD1-12 must be translated to the particular router slot the card is inserted in. If the card is installed in the input 24-35 slot, for example, CD1 refers to input 24 of the system, and CD12 refers to input 35 of the system. It is important to note that if the reclocker is bypassed, either manually or automatically, signal could still be passing thru the output if the LED is OFF.
4. Redundancy selection LED's. These are two LEDS nearest the edge connector of the card that indicate which crosspoint the card is getting signal from. DS15 is labeled P/R and indicates that the card is receiving signals from its redundant crosspoint when it is illuminated. DS16, labeled as N/I, indicates that output 0 of the card is receiving signals from its Mezzanine Level redundancy crosspoint card.

Multirate Fiber Input Card - 121234-1

General

This card is designed to receive 12 individual differential pair data streams at data rates between 3 megabits per second to 3 gigabits per second. This range allows the card to receive SMPTE SDI signals in the 259, 292, and 424 standards as well as non SMPTE standards like DVB-ASI, AES-3 audio, and SMPTE-310 signals.

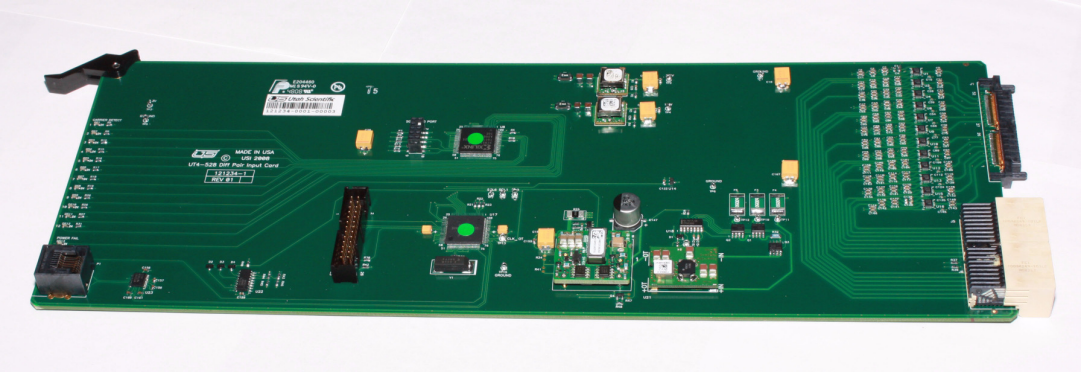


FIGURE 4-3. 121234-1

This card is to be plugged into a rear panel slot that is occupied with either an 121232-2 fiber optic input rear panel or a 121246-1 Differential Pair IO rear panel. The 121232-2-1 Fiber Optic rear panel can be fitted with fiber optic transceivers and used to receive signals over single mode fiber. The 121246-1 differential pair input rear panel is used when the router system is fed with DA's from the UT100/3 series.

Circuit Description

After the 12 differential pairs ether this card from edge connector J1, the signal enters a 1x4 fanout distribution stage. One of these four signals is driven to each individual crosspoint in the system. In this fashion, every crosspoint card has an identical copy of each input signal in the system.

Controls and Indicators

There are no controls on this card, other than P1 which is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are three types of indicators on this card –

1. Communications indicator – yellow. Illuminated when the card has been addressed by the Frame Controller Module.
2. PS Fail LED. – Red – Illuminated when the 3.3V power supply falls out of + - 5% tolerance.
3. Signal Present Detection LED's (12), Green. One of these LEDs is present on the front edge of the card for each input signal. They are labeled as 'Carrier Detect' 1-12. these LED's are only illuminated if a Fiber IO rear panel is fitted, and the Fiber SFP modules report that they are receiving an optical carrier. If no carrier is present, or in the case of a Differential pair input signal from a DA, these LEDs will never be let.

Multirate Differential Pair Output Card – 121235-1

General

This card is used to drive differential pair signals out of the router to either Multi-Viewer systems of Fiber Optic SFPs on the rear panel of the router. It has integral Clock and Data Recovery circuits that operate on standard SMPTE Video frequencies and work to remove jitter from the signal.

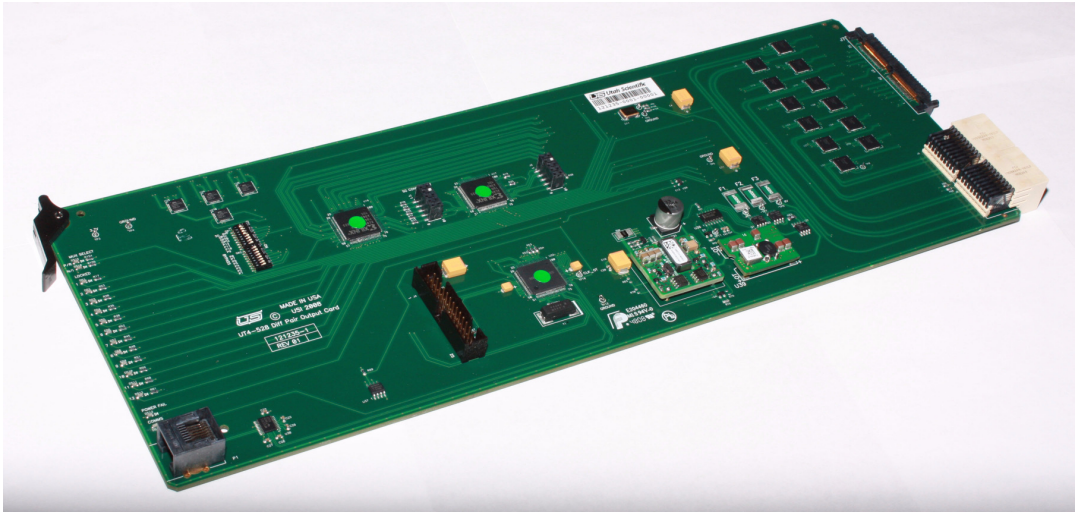


FIGURE 4-4. 121235-1

Circuit Description

Signals enter this card from multiple crosspoint cards. The control signals from the Frame Communications module determine whether he output stage selects signals from the Primary or Redundant Crosspoint cards.

Once an input is selected, the output stage typically reclocks it, unless the signal is not a standard SMPTE video frequency, and the signal is bypassed.

After the signal passes thru the reclocker stage, it is presented to the rear panel where it may be connected to either an 121232-1 Fiber Optic Output Rear panel or an 121246-1 Differential Pair rear panel.

Controls and Indicators

This card has a two bank dipswitch with 16 total switches. 12 of them are used to force a bypass condition on each of the 12 individual outputs (Labeled as P1-P12). To force a bypass condition on an individual port, move the dipswitch towards the word ‘BYPASS’ on the PCB. To allow it to automatically select the proper mode, move it away from the bypass indication on the PCB. The other four dipswitch locations should remain placed toward their labeling on the PCB. P1 is a standard Ut400 diagnostic port that provides detailed operational status and control for this card.

There are four types of indicators on this card –

1. Communications indicator – yellow, Illuminated when the card has been addressed by the Frame Controller Module.
2. PS fail LED – Red – Illuminated when the 3.3V power supply falls out of + - 5% tolerance.
3. Reclocker Locked LEDs (12), Green. One of these LEDs is present on the front edge of the card for each input signal. They are labeled as 'Locked' 1 – 12. To use the 'Locked' numbering to help identify whether or not an input is present in the router, the Locked 1-12 must be translated to the particular router slot the card is inserted in. If the card is installed in the input 24-35 slot, for example, Locked 1 refers to input 24 of the system, and Locked 12 refers to input 35 of the system. It is important to note that if the reclclocker is bypassed, either manually or automatically, signal could still be passing through the output if the LED is off.
4. Redundancy selection LEDs. These are two LEDs nearest the edge connector of the card that indicate which crosspoint the card is getting the signal from. DS15 is labeled P/R and indicates that the card is receiving signals from its redundant crosspoint when it is illuminated. DS16, labeled as N/I, indicates that output 0 of the card is receiving signals from its Mezzanine Level redundancy crosspoint card.

Fiber Interface - (Optional)

Utah 400 systems with fiber connectivity will contain dedicated input and output boards for this purpose. Instead of using BNCs for the physical connection, the system utilizes small modules that plug directly into the rear of the UT-400 chassis.

The Input and Output board's LEDs are identical in functionality to their Multi-Rate Input and Output counterparts.

The small modules are responsible for the electrical-optical conversion, and are removable if service is required.

FIGURE 4-5. SP2T - Transmitter module

The SP2R is the receiver module, and is a part of the larger Input card assembly. The SP2T is the transmitter module, and makes up the Output card assembly. These modules are removed and replaced by moving the swinging bale (at the end) out of, and back in to the locked position.

The system's input and output *totals* are typically defined prior to equipment setup and operation. This is based on the number of total fiber inputs.

Specification Detail

- Optical Fiber Output – 1310 nm class 1 laser.
- Optical Output Power - -12dB minimum
- Optical Fiber Type – 9/125 uM Single Mode Fiber
- Connector Type - LC
- Typical Cable Length – 18 Miles SD, 10 Miles HD

- Optical Fiber Input – 1310 nm Class1 laser
- Optical Input Power - -20dB min
- Optical Fiber Type – 9/125 uM Single Mode Fiber
- Connector Type - LC

Typical Cable Length – 18 Miles SD, 10 Miles HD

Standard Digital Audio Input Card – 121243-1

General

The Standard Digital Audio Input Board (121243-1) receives 12 AES3 audio signals. These signals are received and individually analyzed to see if they qualify for synchronization to the digital audio reference (DARS). In its standard form DARS is an AES, 48kHz signal with sample and frame rate information. Any signals that do not qualify for synchronization and will be passed through the router asynchronously.

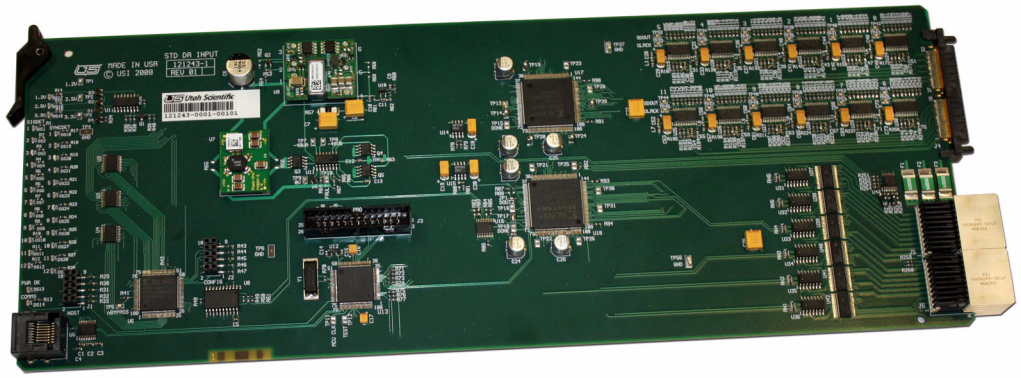


FIGURE 4-6. Standard Digital Audio Input Board 121243-1

Circuit Description

The digital audio input signal arrives at the AES receiver where it is pulled apart and separated into clocks, data, and status bit information. This audio payload is evaluated and if it qualifies for synchronization, it is realigned with clock and sync signals derived from the DARS input. If the audio payload has a substantial offset in frequency from the DARS input, it will be passed through the router asynchronously. Separated signals are converted back into an AES3 signal that is differentially distributed to the router xpoint boards.

Controls And Indicators

There are no controls on this card, other than P1. This is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are five types of LED indicators present on the front edge on this card

1. COMMS -> Communications indicator (yellow). Illuminated when the Frame Controller Module addresses this card.
2. PWR OK -> Power supply indicator (green). Illuminated when the local power supplies are within tolerance.
3. 1.2V, 2.5V, and 3.3V -> Power supply fail indicators (red). Illuminated when local voltages fall out of 5% tolerance.
4. SIGDET1-12 -> Signal detection LEDs (green). Illuminated when a valid digital audio signal is detected on the associated receiver input.
5. SYNCDET1-12 -> Sync detection LEDs (yellow). Illuminated when a valid input signal is found to be in sync with the router reference and is being processed accordingly.

Standard Digital Audio Output Card – 121244-1

General

The Standard Digital Audio Output Board (121244-1) receives 12 AES3 digital audio signals from the appropriate xpoint boards. These signals are individually driven to the monitor matrix module and router output BNCs. These signals pass through the output card as unmanipulated AES3 digital audio.

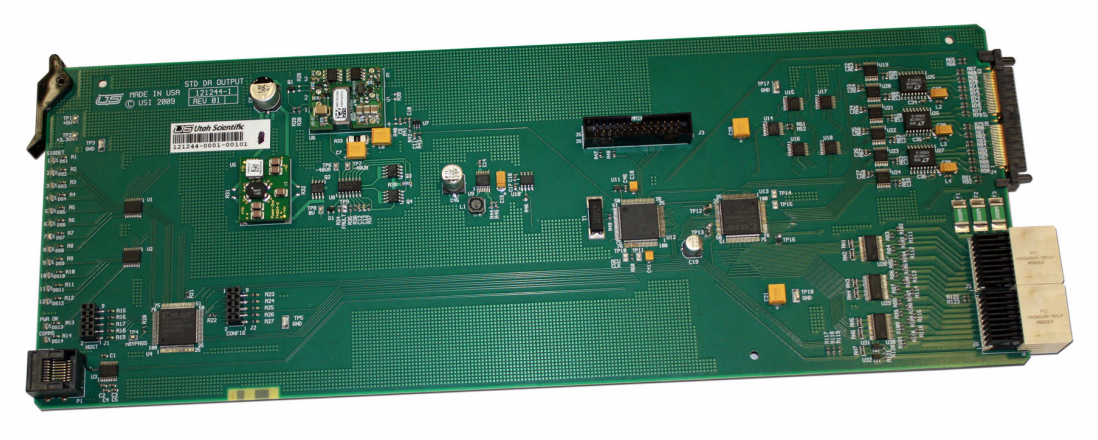


FIGURE 4-7. Standard Digital Audio Output Board - 121244-1

Circuit Description

The digital audio signals arrive at the output card from corresponding xpoint boards as differential signals. These are converted into single ended signals where depending on the selected output, the appropriate signal is sent to the output driver. There it is converted into two differential pairs. One pair is passed to the monitor matrix circuit where one of the twelve outputs is routed to the monitor matrix output. The second pair is driven to the output BNC.

Controls And Indicators

There are no controls on this card, other than P1. This is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are four types of LED indicators present on the front edge on this card

1. COMMS -> Communications indicator (yellow). Illuminated when the Frame Controller Module addresses this card.
2. PWR OK -> Power supply indicator (green). Illuminated when the local power supplies are within tolerance.
3. 5V and 3.3V -> Power supply fail indicators (red). Illuminated when local voltages fall out of 10% tolerance.
4. SIGDET1-12 -> Signal detection LEDs (green). Illuminated when a valid digital signal (relatively close to 48kHz frame rate) is detected on the associated output driver.

Frame Controller

Overview

Part # 121228-1, the Frame Controller Module has the system function of coordinating all switching and reporting functions from the control system and applying them to the router hardware. It has several communications busses, including the Utah Scientific MX-Bus which carries crosspoint switches and general status to and from the control system, a diagnostic serial port, and an Ethernet port for more detailed status and control.

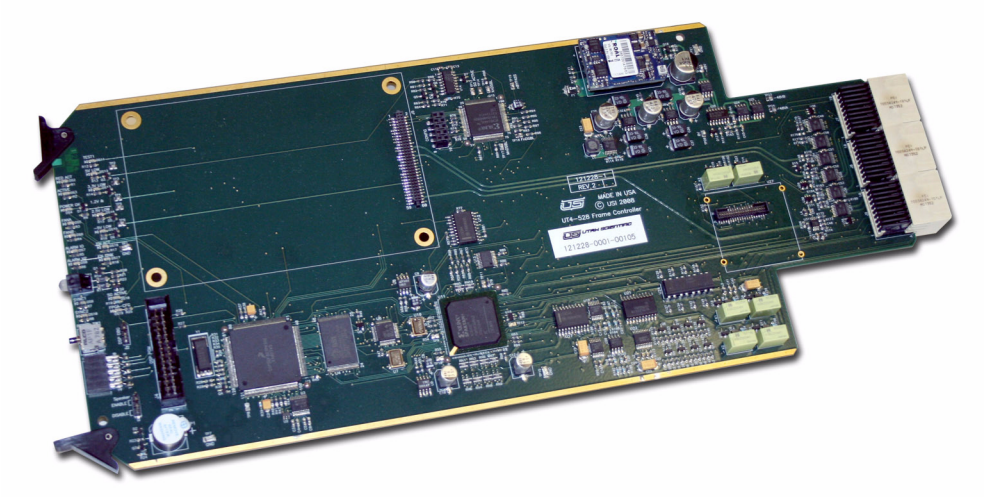


FIGURE 4-8. Frame Controller card

Circuit Description

The heart of the FCM is a DSP / FPGA combination that allows the FCM to process the large amount of switches required for this system.

Dedicated high speed control and status busses to each crosspoint and 12 busses that communicate to the total 88 IO cards make up the interconnect between the FCM and the other boards in the system. The FCM operates as a redundant pair with an identical card in the adjacent slot.

In UT400-528 systems that include discrete AES IO cards, the FCM has a submodule that generates AES frame sync and word clocks for distribution to the AES Input Cards

Controls and Indicators

Controls for this card are concentrated on the router rear panel, in the Ethernet and Diagnostic serial ports. The only board level control is the Speaker Enable or Disable jumper, J3, that allows the audible alarm to be turned off. The audible alarm sounds any time that the SMPTE alarm is on.

The following LED's indicate different board conditions:

- DS1 – SMPTE Alarm – RED/GREEN – Red when any error condition exists, green otherwise.
- DS2 – Redundant Active – Green – When illuminated indicates that this card is the redundant card in the pair and is actively monitoring the primary card.
- DS3 – Active – Green – When illuminated indicates that this is the Active card in the pair and is currently managing the system.
- DS4 – Power OK – Green – Illuminated when all on board power supplies are OK.
- DS5 – DS6 – FANA, FANB - Green – Indicates the health of the fan modules in the system.
- DS7 – ALARM IO – RED – Indicates that an alarm condition exists on one or more of the IO modules when illuminated.
- DS8 – ALARM XP - Indicates that an alarm condition exists on one or more of the XP modules when illuminated.
- DS9, DS10 - SYNC – GREEN – Indicates presence of reference for the Sync1 and Sync2 ports.
- DS12 – 5V LOW - RED - Indicates an alarm condition for the on board 5V power supply.
- DS13 – 3.3V LOW - RED - Indicates an alarm condition for the on board 3.3V power supply.
- DS14 – 1.2V & 2.5V LOW - RED - Indicates an alarm condition for the on board 1.2V and 2.5V power supply.
- DS15 – -5V LOW - RED - Indicates an alarm condition for the on board -5V power supply.

Monitor Matrix Module

Overview

Part # 121227-1, the Monitor Matrix module is a standard system component that allows for all input and output signals of the router to be presented to a single port. It allows for two copper and one streaming Ethernet signal from the router core to be monitored at the users discretion.

No other system operation is dependant on the Monitor Matrix module.

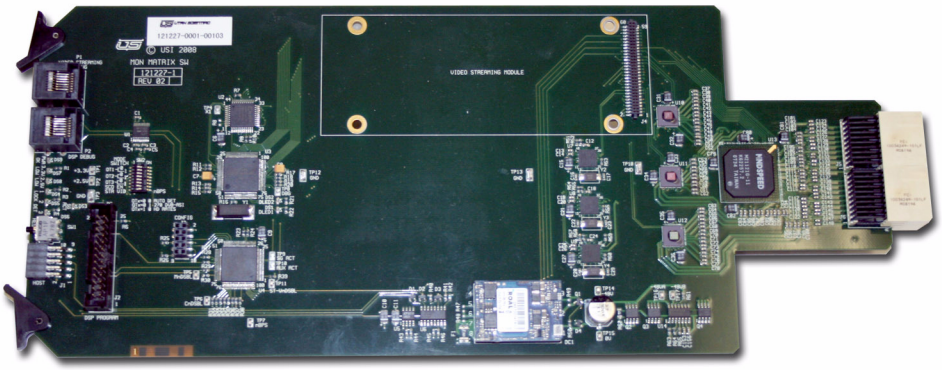


FIGURE 4-9. Monitor Matrix card

Circuit Description

The monitor matrix resides on the same control bus from the FCM that other system components do. This allows Monitor Matrix commands sent to the FCM by the MX Bus based control system to be communicated to the Monitor Matrix card.

The card consists of a 46x3 crosspoint array that is fully capable of SMPTE-424 and lower data rates. This crosspoint array allows for one signal from each output card, one signal from the crosspoint card for input signals, and one signal from a partner matrix to allow for expansion. Each of the three outputs can be selected independently, with the limitation that each output card can only provide a single signal at a time to the Monitor Matrix.

Once the signal has been selected, the crosspoint passes that signal to a reclocker where the signal is re-timed. It is then presented to a Cable driver and BNC in the case of the two electrical signals, or to the baseband to streaming submodule board. This board is discussed separately.

Controls and Indicators

SW1 is a board reset switch, which will restart all card functions when pressed.

SW2 allows some manual control over the behavior of the output reclocking parts for the MMX outputs.Normally, all switches in the SW2 switch bank should be set in the off position.

P1 is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

Indicators.

The following LED's reflect system status:

- DS9 – Green – Indicates power supplies are healthy when illuminated.
- DS7 and DS8 – Red – Indicate that either the 2.5V or 3.3V circuits have voltage problems. DS9 will be out if either of these LED's is on.
- DS4, DS5 and DS6 – Green – When illuminated, provide an indication that output 1, 2 and 3 respectively is active and is being reclocked.
- DS1, DS2 – Green – These LED's indicate communication with the system FCM when they are flashing.

Video Crosspoint Board

Overview

Part # 121222-1, the Video Crosspoint Card is the central component in the UT400 528 routing switcher. The same card can be placed in any one of the four crosspoint card slots in the system without changing any configuration settings on the card.

FIGURE 4-10. Video Crosspoint Card

The card uses four discrete 144 in x 288 out crosspoint sub-modules installed on a carrier card to comprise a 576 in x 288 out fully differential crosspoint array that is capable of signal from DC to 3.2Gb/Sec.

The card also contains voltage regulation circuitry that converts the two possible 48 volt inputs to 3.3V, which is used by the carrier and further regulated to 1.2V and 1.8V on the crosspoint sub modules. Switching is controlled via two discrete control busses from the Frame Control Module.

Circuit Description

Each of the 576 input signals differential input signals is carried to a single crosspoint module, where it is resistively split and applied to two different 144x144 crosspoint chips.

The outputs of the four crosspoint modules are passively combined, and coupled with the proper switching commands from the Frame Controller Module, allow for the large crosspoint array size.

The control circuitry that decodes the control bus's from the Frame Control Modules is made up of an FPGA and a DSP co-processor that monitors critical crosspoint functions as well as implementing the switch commands sent to the card by the FCM.

Controls and Indicators

Controls on this card are limited to a reset switch (SW2), which resets and restarts all processing activity on the card, and the factory set dipswitch SW1, which will not require any user adjustments. P1 is a standard UT400 diagnostic port that provides detailed operational status and control for this card.

There are several LED's on this card that indicate operational status. Their behavior is defined below:

- DS1 – FPGA Load – Green - Illuminated when the FPGA is configured. If it is off, the card is not functional.
- DS2 – PSA FAIL – RED - Illuminated when the 'A' 48V to 3.3V converter is non-functional.
- DS3 – PSBA FAIL – RED - Illuminated when the 'B' 48V to 3.3V converter is non-functional.
- DS4 – Health – RED – Illuminated when the internal monitoring circuit detects ANY non-ideal conditions on the card.
- DS5 – FCM COM – Yellow – Illuminated when this card is selected by the Frame Communication Module
- DS6 – Undefined
- DS7 – Undefined
- DS8 – XP-PSOK – Green – Illuminated when all 8 PS sub module power supplies are OK.
- DS9 – SEAT – Green – Illuminated when all rear panel sampling points are satisfied, indicating that the crosspoint card is seated properly.
- DS10 – SG Activity – Indicates that the local Scangate part is active.

Crosspoint LEDs (Active)

The yellow LED pulses continuously when conditions are normal. A solid LED indicates the ‘standby’ crosspoint in a redundant system.

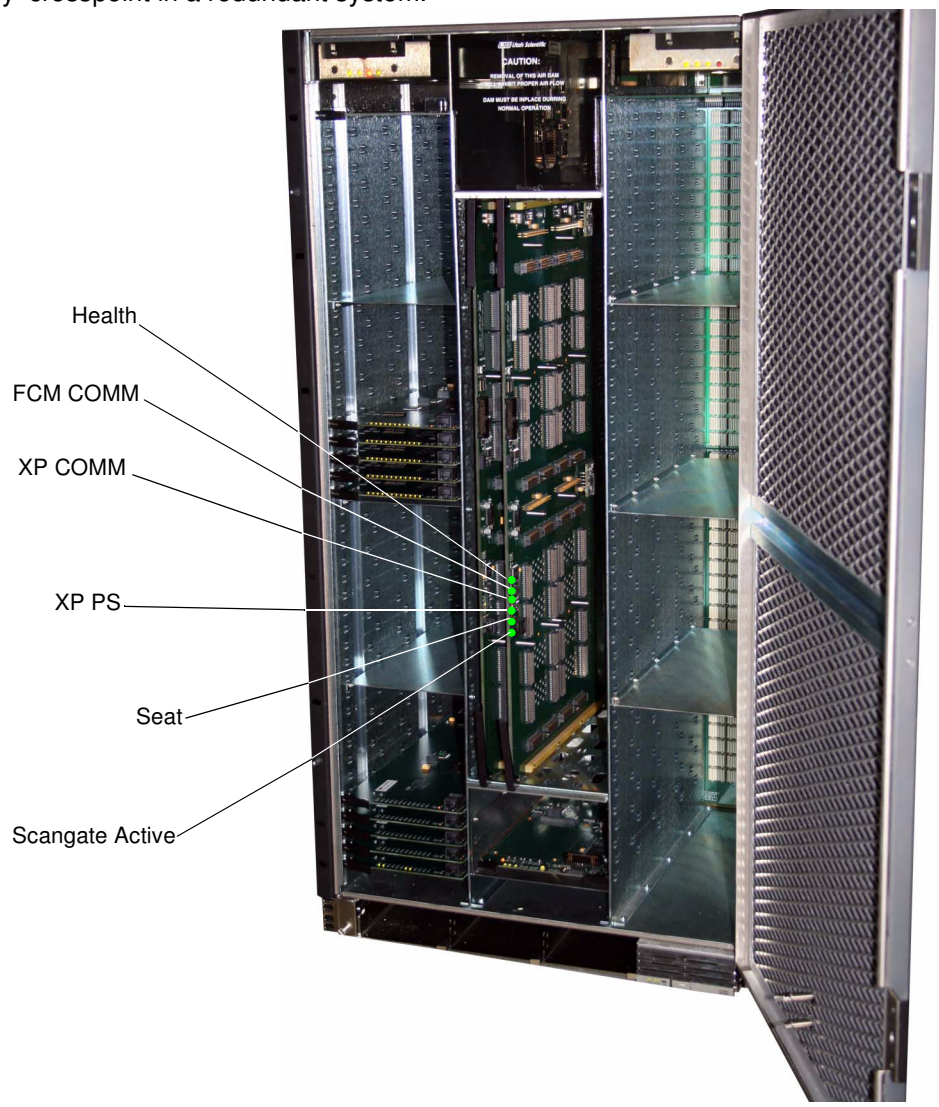


FIGURE 4-11. Video Crosspoint LEDs

Rear Panel Considerations

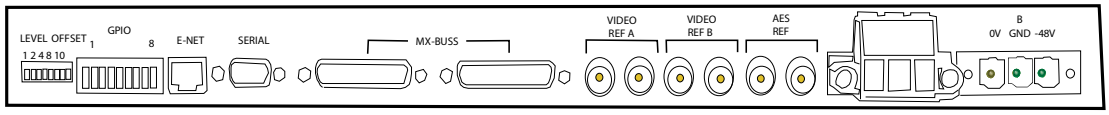


FIGURE 4-12.

MX Bus

This is the control bus between the UT-400 and an SC-3/4 controller. Each chassis contains two connectors, fed through either side, then distributed to the next piece of equipment from either side.

If this router is at the end of the run (cable), a termination is inserted at the unused side.

Dip Switches

The dip switches are used to set the location of the router within the MX-Bus system. Usage example: A first level, binary setting would require all switches to be placed in the down position. For additional detail, please see “Switch Settings,” on page 2-27.

Video Ref A, Video Ref B

Used as a switching reference. Provides analog blackburst or tri-level sync. This port is a loop thru, and the unused BNC must be terminated in 75 Ohms.

AES Ref

Requires an AES, DARS signal if any synchronous AES routing is operated within the frame.

Power supplies

External Power Supply

The additional power supply assembly is a 1 rack unit chassis fed by AC, converting the signal to 48 volts DC.

FIGURE 4-13. External Power Supply

The power supply interconnects with the router at the bottom of the assembly using a cabled interface. Using Utah Scientific's pre-molded cable assembly, the ground signal and 48 volt conversion are carried to the UT-400 router. You will also see an additional cable assembly that is used for the micro controller inside the router that communicates with the alarm circuitry inside router.

The power supply module contains two redundant card pairs, which convert the 48 volts to 5 volts and 3.3 volts for the router's I/O card.

For mounting and connectivity considerations, the power supply is most appropriately located beneath the UT-400 router.

The unique cable assembly allows the micro controller to efficiently communicate, sending accurate alarm signals any time an issue arises.

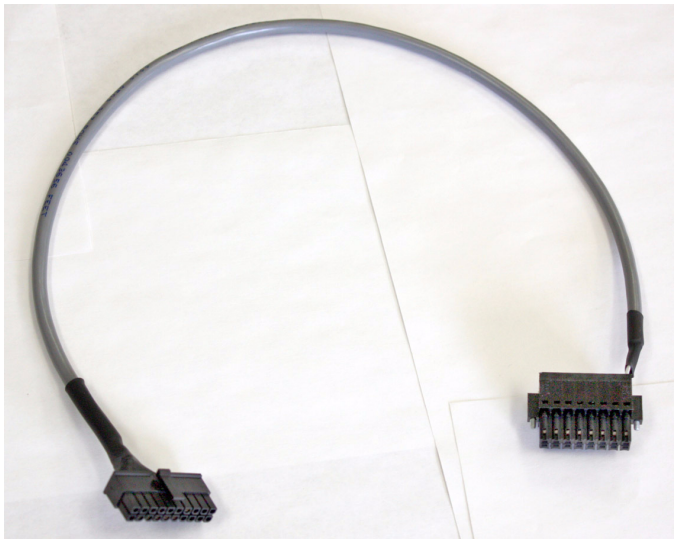


FIGURE 4-14. Cable Assembly

Router Power supplies

The Utah-400's power supplies are standard, with AC input, alarm monitoring circuitry, and DC output going to the system.

LED Indications

If no alarms are present, the ALM LED will be off while the yellow LEDs (AC OK and DC OK) will be illuminated.

FIGURE 4-15. Power Supply

Individual supply alarms will be indicated with the corresponding red LED. Specific adjustments are available for individual voltage indications within this guide's Troubleshooting section.

The LED is viewable on the front cover through the lightpipe.

CHAPTER 5

Troubleshooting

Note: Parts of this section were derived from the Utah-200 Manual; some areas may not apply directly to the Utah-400 but will be corrected in the next version of this manual.

In This Chapter

This chapter is designed to help the user diagnose problems on the Utah-400 Routers to the subsystem level. There are no repairable boards in the Utah-400 system, contact Utah Scientific Technical Services at 800-447-7204 regarding any problems you may be having. Should any printed circuit boards need repair, Technical Services can advise you on shipping and on the repair process.

Subsystem Level Troubleshooting

A routing system is typically comprised of several subsystems:

- Video System
- Audio System
- Control System
- Power System

Fault finding is simplified by first isolating the problem to one of these subsystems. For example, if the audio-system is functioning normally, but there are problems with video, the problem is probably confined to the video system.

Note: With the exception of a system using Digital Video with embedded audio, audio signals are switched through a different matrix than the video signals.

Main Troubleshooting Chart

The following table provides an indication of what subsystems should be reviewed for common problems.

Please note:

- The numbers shown in the four Subsystem Table Reference columns indicate specific troubleshooting problems that are found in the four individual Subsystem Tables.
- For example: a 1 listed under the Video column refers to problem number 1 in the "Video Subsystem Table" on the following page. Here you will find a list of specific checks that will assist in troubleshooting the problem.

TABLE 2-1. Main Troubleshooting Table

	Subsystem Table Reference			
Problem	**Video**	**Audio**	**Power**	**Control**
No Video or Audio outputs	1	1	1,2	1
Video and Audio outputs are present but neither can be switched	2,3	2,3		1,2,6
No Video output, Audio functions normally	1,2,3		1	2
No Audio output, Video functions normally		1,2,3	2	2
Video switches normally but audio does not switch		2,3		2
Audio switches normally but the video does not switch	2,3			2
Flash on video when switching	4			
Cannot access expansion inputs or outputs of video level	5			
Audio signal level incorrect		4		
Video signal level incorrect	7			
Video signal anomaly	5,6,8			
Video monitor matrix not functional	9			
Audio monitor matrix not functional		5		
Control panel does not function				1,2,3
Control via serial port not functional				4
Ethernet control port not functional				5
Alarm port active			3	6
SC-3/4 Ports not "Active"			3,4	4,5
Undefined level types in SC-3/4 Controller				1,2,4

Video Subsystem Troubleshooting Table

Use the following table to troubleshoot specific video subsystem problems. The numbers in the left-hand column indicate specific references from the Video column in the **Main Troubleshooting Table**.

TABLE 2-2. Video Subsystem Troubleshooting Table

	Problem	Check
1	No video output	• Control cable connected, or internal controller functional? • Different input works on output bus? • Other outputs functional?
2	Unable to select a specific input	• Control panel programming correct? • Output signal level locked or protected?
3	Unable to select any input	• Control cable connected? • Control panel defective? • Controller failure?
4	Video flash when switching between inputs	• Input sources timed correctly? • Input reference signal present and timed? • Input reference correct standard? • Correct video standard jumper set on controller board?
5	Inputs / Outputs inaccessible	• Expansion matrix crosspoint cards present?
6	Sync missing on video output (analog)	• Sync present on selected input? • Normal DC level on input?
7	Video output level incorrect	• Input level correct • Output terminated at destination (analog)? • Input/output compensation jumpers correctly set?
8	Sparkles on video output (digital)	• Input signal amplitude too low? • Cable length > 300 meters on input?
9	Monitor Matrix not functional	• Selected correctly on control panel?

Audio Subsystem Troubleshooting Table

Use the following table to troubleshoot specific audio subsystem problems. The numbers in the left-hand column indicate specific references from the Audio column in the Main Troubleshooting Table.

TABLE 2-3. Audio Subsystem Troubleshooting Table

	Problem	Check
1	No audio output	• Control cable connected, or internal controller functional? • Different input works on output bus? • Other outputs functional?
2	Unable to select a specific input	• Control panel programming correct? • Output signal level locked or protected?
3	Unable to select any input	• Control cable connected? • Control panel defective? • Controller failure?
4	Output level incorrect (analog)	• Input level correct? • Input termination in correct position? • Output termination in correct position?
5	Monitor Matrix not functional	• Selected correctly on control panel?

Power Subsystem Troubleshooting Table

Use the following table to troubleshoot specific power subsystem problems. The numbers in the left-hand column indicate specific references from the Power column in the **Main Troubleshooting Table**.

TABLE 2-4. Power Subsystem Troubleshooting Table

Problem		Check
1	No video output	• Power applied to video frame? • Warning indicators on the front of each power supply? • Control cable between chassis connected?
2	No audio output	• Power applied to audio frame? • Warning indicators on the front of each power supply? • Control cable between chassis connected?
3	Alarm active	• Voltage alarm active (LED on)? • Fan alarm active (LED on)? • Temperature alarm active (LED on)?
4	Controller power	• Power applied to controller frame?

Power Supply Alarms

Power supply alarms are indicated by red LEDs on the front of each power supply module. They consist of voltage, fan, and temperature alarms.

- The voltage alarm indicates that one of the supply voltages is either too high or too low.
- The fan alarm indicates that the fan has stalled.
- The temperature alarm indicates that the temperature is elevated in the power supply. This may be caused by dirt or dust blocking the airway, a defective cooling fan, or by operation in extreme temperatures.

Note: Optional redundant power supplies may be fitted to UTAH-400 systems. In this configuration, the failure of a power supply should not affect normal system operations, but users would be unaware of the power supply failure. Thus, it is highly advisable to utilize the SMPTE alarm output provided at the rear of the chassis.

Control Subsystem Troubleshooting Table

Use the following table to troubleshoot specific control subsystem problems. The numbers in the left-hand column indicate specific references from the Control column in the **Main Troubleshooting Table**.

TABLE 2-5. Control Subsystem Troubleshooting Table

	Problem	Check
1	No control of any level	• Internal controller operating (see below) • External controller connected • Control panels connected (see below) • MX bus terminated (see below) • U-Net terminated (see below) • Completed controller software upgrade
2	No control of individual signal level or levels	• MX bus cable connected (see below) • MX bus correctly terminated (see below) • Is non functional signal level address set correctly (see • below). • Control panel programmed correctly (see "Operations") • Output locked or protected on that level (see "Operations")
3	Control panel not functional	• Panel address set to unique number • Completed panel software upgrade
4	Serial control port not functional	• Communications baud rate incorrect • Serial control Protocol incorrect • Serial control cable wired correctly
5	Ethernet port not functional	• Ethernet option fitted • Connected to PC directly by null cable • Connected to network via gateway
6	Alarm active	• Active CPU indicator extinguished (SC-4) • Heartbeat indicator extinguished (SC-4) • MX activity light does not flash (SC-4)

System Controller Alarms

System controller alarms are indicated by LEDs on the front of each controller card.

- The active LED should be lit on one of the controller cards. If only one controller is present (non redundant system), the active LED should be illuminated.

Please note the following additional points regarding the controller:

- The heartbeat LED (DS6) indicates that the processor is communicating with the vital parts of the system and is running the application software.
- The MX LEDs indicates communication with the crosspoint matrix. The transmit LED (DS8) will flash whenever communication is being made from the controller to the matrix. The receive LED (DS7) will flash whenever communication is being received by the controller from the matrix.
- U-Net is used for communication between the controller and the control panels. The U-Net data and U-Net transmit enable LEDs (DS9 and DS10) indicate when information is exchanged between the system controller and a control panel.
- If the active LED is on and the U-Net transmit enable LED (DS10) is off, this indicates that a controller software upgrade has failed and the controller is waiting for a valid controller software upgrade to be uploaded.
- If used with an SC-4 or SC-400 system controller consult the appropriate controller manual for details about the controller card.
- The total MX bus cable length must be less than 300 feet and must be terminated at the last chassis.

Control Panel Troubleshooting

If your control panel does not control any of the matrix, check that power is applied to the panel.

UNET Panels

- Panels communicate to the controller by a special network known as U-Net. Panels are connected together daisy chain style to the controller. Removing a panel physically from the network will break the chain and disconnect panels downstream from the controller.
- U-Net uses unshielded twisted pair cable. It requires two twisted pairs terminated in an RJ 45 connector. The maximum length of any segment is 1000 feet and must be terminated at the last control panel in each segment. Refer to the Appendix C "U-Net Cabling" for details.
- The panel may be communicating to the controller correctly, but the required signal level matrix may not be responding. Check the Dipswitch setting on the rear panel of the non-functional router level.

  Confirm that the control panel address is a unique number. Each panel address is set by a rear panel Dipswitch and must be a unique address. This control panel address is read when the control panel is powered up.

Ethernet Panels

- Panels should be connected to the same network as the SC-3/4 controller.
- There should be a network hub between a panel and the SC-3/4 controller.
- Unique IP addresses.
- CAT-5 cable lengths should be less than 100 meters.

APPENDIX A

Specifications

In this Appendix

This appendix provides detailed lists of all system audio, video, control, physical, power and regulatory specifications.

Power

The following table lists power specifications:

Input Power and DC Power Specifications

TABLE A-1. Input and DC specifications

Parameter	Specification
(AC Supply)	
Input Power Consumption Voltage	1250 Watts per module, max
Voltage	90 - 240 Volts AC, universal power supply
Frequency	50 - 60 Hertz
Redundancy	Quad 1250 w/ rectifiers standard, only 2 required to run system
DC Output Voltages (From external supply)	
48 volts	35 Amps, max

Digital Video

The following table lists the system digital video specifications.

TABLE A-2. Digital Video Specifications

Jitter	Conforms to SMPTE 259, 292, 424
Reclocked Data Rates	270, 1485, 2970, Mb/Sec
Input Return Loss	< -15 dB to 1.5 Ghz, -10dB to 3Ghz
Output Return Loss	< -15 dB to 1.5 Ghz, -10dB to 3Ghz
Input EQ level	
Belden 1694A cable	> 300 M @ 270 Mb/Sec
	> 150 M @ 1.485 Gb/Sec
	> 100 M @ 2.970 Gb/Sec

Digital Audio Specifications

TABLE A-3.

Parameter	Specification
Digital Audio Processing	48 kHz. 16 - 24 Bit, AES / EBU; AES-3
Input Impedance - Balanced	110¾ ±20%. 100 KHz. to 6.144 MHz
Input Level minimum:	200 mVPP. w/> 50% Eye Pattern Opening
Modes of Operation	Synchronous and Asynchronous
Input Level maximum:	7 VPP
Common Mode Range:	± 7V (DC + Peak Signal)
Common Mode Rejection:	Per AES-3, Section 6.3.5 (1997)
Output Impedance - Balanced	110¾ ±20%, 100 kHz. to 6.144 MHz
Output Amplitude:	2.0 VPP into 110?, minimum
Nominal Rise / Fall Times:	25 nano seconds
Common Mode Rejection:	>30 dB, DC to 6 MHz
Sample Rate:	48 kHz
Intrinsic Jitter:	< 0.025 UI Peak, w/700 Hz. HPFApplies to discreet AES outputs
Output Phasing with respect to DARS Input:	± 2.5% (± 9º) of Frame Interval.Applies to discreet AES outputs

Reference

The table below lists reference specifications

Reference Specifications

TABLE A-4.

Parameter	Specification
Audio	One 75Ohm terminated AES sync
Video 1	NTSC or PAL black burst, or Tri-Level Sync
Video 2	NTSC or PAL black burst, or Tri-Level Sync

Control

The following table lists control specifications:

Control Specifications

TABLE A-5.

Parameter	Specification
Control	MX-Bus Daisy Chain - Terminated
Audio	One AES Audio Sync

Alarms

The following table lists alarm specifications:

Alarm Specifications

TABLE A-6.

Parameter	Specification
Primary alarm	ANSI / SMPTE 269M fault reporting (Relay closure)
Connector Type	Phoenix Male Barrier Strip – 3 pin
Functions	• Power • Temperature • Fans • System Board Failure
Maximum current	20 milli-Amp

Physical

The following table lists physical specifications:

Physical Specifications

TABLE A-7.

Parameter	Specification
Width	EIA – RS-310 – D 92 19” rack mount standard
Height	20 rack units for the 528 (300 lbs.), and 40 rack units for the
Depth	400 XL (600 lbs.)[a]
Weight	19 inches, 483 mm maximum
Mounting	150 pounds
System connectors	Eight front mount rack ears
Cooling	All connectors rear panel mounted
Temperature range	8 Fans – side exhaust 528, 16 fans for XL
Humidity range	10 – 40 Degrees Celsius
	0 – 90% non - condensing

a. - The power supply adds one rack unit to the 528, and 2 rack units to the 400 XL

Regulatory

The following table lists system regulatory specifications

Regulatory Specifications

TABLE A-8.

Parameter	Specification
EMC	EN50 081-1 (EN50 022 Class A)
Susceptibility	EN50 082 (IEC 801-3, IEC 801-4)
Safety	EN60 950, UL 1950, CSA 022.2 No. 234
Shock / Vibration	MIL Std. 810E, Method 514.4(cargo truck 500 / 500 miles)

Connector Suppliers and USI Part Numbers

The following table lists connector supplies and Utah Scientific Part Numbers where applicable: Not all connectors are used on the Utah-400 but are supplied as a courtesy.

Connector Suppliers

TABLE A-9.

Manufacturer Part Description	**Part Number**	**USI Part No.**	**Contact**
Norcomp Inc.			
• DB-37B – Male connector, solder cup	171-037-103 L001	41226-3037	
Amp			AMP Inc.Harrisburg, PA 17105(800) 522 – 6752
• BNC Male connector	225395-2	41215-0001	
	5-569278-2	41211-0011	
• RJ-45 Male connector	747904-2	41223-1009	
• DB-9B Male connector			
Phyco			Kimball Electronics1600 Royal St.; GO-149Jasper, IN 47549(800) 634-9497
• 6 pin CirDin	A-9001-069	41329-1006	

APPENDIX B

The Debug Port

This Appendix contains the following:

Serial Port Usage

Baud Rate Information

Baud	38,4000
Data Bits	8
Stop Bits	1
Parity Bits	N
Handshake	XON/XOFF
Output Translation	CR = CR/LF

Pinout Information

Pin	Signal Name	Direction
2	Receive Data	In
3	Transmit Data	Out
7	RTS	Out
8	CTS	In
5	Ground	

Diagnostic Port Usage

The diagnostic port is a ‘command and response’ type interface. The system will display a menu in response to a press of the spacebar. Pressing the letter that is displayed on the screen in front of a particular menu item will cause that item to be executed. The Menu on each device in the system is similar, but each has its own unique set of command and status values based on the function of the device.

System Diagnostic Port

The system diagnostic port on the rear of the chassis will be the most commonly used port. Following is a description of the commands available at this diagnostic port. Pressing the spacebar on the terminal will cause the Frame Controller Module to display this menu -

FCM Menu-
M = FPGA Memory Status
V = Version
R = Router Crosspoint Status
I = IO Card Information
S = Hardware Status

M = FPGA Memory Status

Pressing the ‘m’ key will display the following information-

FPGA MEMORY STATUS
Level Switch = 01
Offset Switch = 00
MX Active? -> No.
Monitor Matrix = 000
Primary / ID Reg = 5103
FPGA Rev = 1.01
Sync Select Reg = 0
Alarm Led Reg = 0
Sync1 Stat Reg = 0
Sync2 Stat Reg = 0
IRQ Mask Reg = 0
IRQ Stat Reg = 3
Test Point Reg = 0

Board Pres Regs = 18-00-00-00-00-00-00-00-00-00-00

Status Descriptions –

Level Switch = 01 – Sows the MX Bus level this router is set to.

Offset Switch = 00 – Show what offsets are set for this router. See the 'Determining and Setting Router Signal Levels' section on page 2-12 of this guide for further information.

MX Active? -> No. – Indicates if the MX bus is active or not

Monitor Matrix = 000 – Indicates which output the Monitor Matrix is connected to.

Primary / ID Reg = 5103 – Shows the MX ID of this chassis (51)

FPGA Rev = 1.01 – Indicates the revision of FPGA firmware installed.

Sync Select Reg = 0 – Indicates which sync port is being used for switching reference for this chassis. 0 = MX Bus, 1 = SYNC A, 2 = SYNC B.

Alarm Led Reg = 0 – Indicates which alarm LED's are lit, if any

Sync1 Stat Reg = 0 – Indicates the Line Standard of the reference signal applied to SYNC A, in Lines Per Frame, hexadecimal.

Sync2 Stat Reg = 0 - Indicates the Line Standard of the reference signal applied to SYNCBA, in Lines Per Frame, hexadecimal.

IRQ Mask Reg = 0 - Internal usage

IRQ Stat Reg = 3 - Internal usage

Test Point Reg = 0 - Internal usage

Board Pres Regs = 18-00-00-00-00-00-00-00-00-00-00 – Describes which of the IO cards are installed. This register is communicated to the control system for board information gathering purposes.

V = Version

Pressing the 'V' key will display the software version banner –

```
************************************************

        Utah Scientific Inc.

Utah-400 528R Video System Monitor, Rev. x.11

************************************************
```

R = Router Crosspoint Status

Pressing the ‘R’ key will display the map of connected crosspoints in the system. The display numbering is in hexadecimal. Each line contains entries for 16 outputs, starting at the number indicated on the far left, and the number in the entry indicates the source connected to that output. The value ‘3FF’ is used to indicate an unconnected output.

ROUTER STATUS

Ot000 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot010 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot020 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot030 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot040 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot050 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot060 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot070 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot080 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot090 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0A0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0B0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0C0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0D0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0E0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot0F0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot100 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot110 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot120 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot130 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot140 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot150 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot160 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot170 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot180 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot190 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1A0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1B0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1C0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1D0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1E0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot1F0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,
Ot200 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

I = IO Card Information

Pressing the ‘i’ key will display an entry for each of the IO, Crosspoint and Monitor matrix cards installed in the system.

IO card raw status

PN-rev SPD SN IC TM VR ER X1 X2 X3 E1 E2 E3

Card 0 - 12290105 0300 0332 0C 15 0D 00 00 00 00 55 55 55
Card 1 - 12290105 0100 0281 09 18 0D 00 00 00 00 55 55 55
Card 2 - 12290105 0000 0150 09 14 0D 00 00 00 00 55 55 55
Card 3 - 12290105 0100 0262 0C 15 0D 00 00 00 00 55 55 55
Card 4 - 12290105 0100 0144 0C 18 0D 00 00 00 00 55 55 55
Card 5 - 12290105 0100 0272 0C 14 0D 00 00 00 00 55 55 55
Card 6 - 12290105 0100 0266 0C 18 0D 00 00 00 00 55 55 55
Card 7 - 12290105 0100 0306 0C 17 0D 00 00 00 00 55 55 55
Card 8 - 12290105 0100 0324 0C 18 0D 00 00 00 00 55 55 55
Card 9 - 12290105 0100 0303 0F 16 0D 00 00 00 00 55 55 55

Xpt card status

PN-rev CURR TEMP VER ERR SN

Card 0 - 12220111 60 AA 11 00 0132

MMtrx card status
PN-rev VER ERR

Status Descriptions – (In reference to the Card 0 line, above)

PN-rev – Displays the part number “1229” Sub part number “01” and rev “05”.

SPD – Signal Presence Detect – shows active signals on this particular card. The first byte “03” shows sources 0-7, and the next byte “00” shows sources 8-11. This card is indicated that sources 0 and 1 have signal, while the others do not.

SN – Serial Number.

IC – Current draw, in watts. hex. Indicates that this card is drawing 12 watts.

TM – Temperature, in C, hex. Indicates that this car is 21 degrees C.

VR – Software version, hex, x.y. Indicates that this card is rev 0.13.

ER – Error. A non-zero value indicates an error on this card.

S = Hardware Status

Pressing the ‘s’ key will display the status of the Frame Controller Module itself.

System Type -> 528 System - In an 528 Chassis.
Slot = Redundant
Local Voltage Levels
5V = 5122mv
3.3V = 3302mv
2.5V = 2509mv
1.2V = 1222mv
-5V = 1846mv
Fan Module 1 OK - Fan Module 2 OK : 0000
GPIO Registers = 0F

Status Descriptions –

System Type -> Indicates which chassis type installed in, 528, XL lower or XL upper.

Slot – Indicates which slot the active FCM is installed in, primary or redundant.

Local Voltage levels – Indicates the levels of the internal voltages. Note that the tolerance on these voltages is +- 5%, and that a typical reading for the -5V supply is 1800 mV.

Fan Module status – Indicates the health of the two fan modules.

GPIO Registers – Indicates the state of the incoming GPI’s on the rear of the frame. See the GPI port on page 2-16 of this guide.

IO Card Diagnostic Port

The IO card diagnostic port is a plastic RJ-45 card on the front edge of every IO card. It provides information specific to that IO card only. Pressing the space bar after connecting to an IO card with the 140000-8 adapter and a CAT 5 cable will yield the following menu –

IO Card Menu-
V = Version
S = Hardware Status
F = Fiber Module Status

V = Version

Pressing the ‘V’ key will display the software version banner –

```
************************************************
        Utah Scientific Inc.
    UT400-528 IO CD Monitor R0.13
************************************************
```

S = Hardware Status

Pressing the ‘s’ key will display the status of the IO card hardware.

```
Status Report
Presence - Lock Detect = 0000
Board Power = 11 W.
Board Temperature = 22 C.
Board PN = 1235-1001
Board SN = 0001  Build Date = 01/30/09
Slot Address = 00
Fiber Output
Semaphore = 1fab
Version = 1f01
Select Reg 1-4 = 1f00
Select Reg 5-8 = 1f00
Select Reg 9-12 = 1f00
Enable Reg 1-8 = 1fff
Enable Reg 9-12 = 1f0f
Bypass Reg 1-8 = 1f80
Bypass Reg 9-12 = 1f00
MMX Reg = 1f00
```

F = Fiber Module Status

Pressing the ‘f’ key will display the status of the fiber modules if connected to a fiber optic IO card.

Crosspoint Card Diagnostic Port

The Crosspoint Card diagnostic port (P1) is a black plastic RJ45 connector on the front edge of the card. It provides information specific to that IO card only. Pressing the space bar after connecting to an IO card with the 140000-8 adapter and a CAT 5 cable will yield the following menu –

1222-1 XPT Menu-

M = FPGA Memory Status

V = Version

R = Router Crosspoint Status

S = Hardware Status

M = FPGA Memory Status

Pressing the ‘m’ key will display the following information. Note that all of the definitions are the same as for the Frame Controller module above except as noted here.

FPGA MEMORY STATUS

Level Switch = 01

Offset Switch = 00

SysType fr FCM= 00 – System type set from FCM.

Decoded IO Val= 00 – Describes the IO range serviced by this crosspoint within the frame.

MX Active? -> YES.

Seating Register = 20 – Samples the rear panel at 6 locations to ensure that it is seated correctly. The value should always be 20.

Slot ID Register = 00 – Reports which of the four possible slots the card is in, 0 for leftmost, 3 for rightmost.

Primary / ID Reg = 53

FPGA Rev = 0.01 – Revision of internal FPGA firmware.

V = Version

Pressing the ‘v’ key will display the following information-

```
************************************************
        Utah Scientific Inc.
Utah-400-528 Routing System Monitor, Rev. 0.01
************************************************

FPGA MEMORY STATUS
Level Switch = 01
Offset Switch = 00
SysType fr FCM= 00
Decoded IO Val= 00
MX Active?  ->   YES.
Seating Register = 20
Slot ID Register = 00
Primary / ID Reg = 53
FPGA Rev =  0.01
```

R = Router Crosspoint Status

Pressing the ‘R’ key will display the map of connected crosspoints in the system. The display numbering is in hexadecimal. Each line contains entries for 16 outputs, starting at the number indicated on the far left, and the number in the entry indicates the source connected to that output. The value ‘3FF’ is used to indicate an unconnected output. Note that these outputs may be offset from 0 depending upon which crosspoint slot this card is installed in.

ROUTER STATUS

Ot000,203,003,206,207,208,20A,20A,20B,008,20D,203,1F8,0FC,0FC,0FC,0FC,

Ot010 0FC,0FC,0FC,0FC,0FC,0FC,0FC,0FC,000,000,000,000,000,000,000,000,

Ot020 000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,

Ot030 000,000,000,000,000,000,000,000,3FF,000,000,3FF,3FF,3FF,3FF,3FF,

Ot040 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot050 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot060 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot070 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot080 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot090 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0A0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0B0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0C0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0D0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0E0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

Ot0F0 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,0FD,3FF,3FF,3FF,

Ot100 3FF,3FF,3FF,3FF,3FF,3FF,3FF,3FF,

S = Hardware Status

Pressing the ‘s’ key will display the status of the crosspoint card.
HARDWARE STATUS
Crosspoint type = 576X288 XPT
Part Number = 1222-1001
Total Power Consumption = 72W
XPT1 IO voltage = 1807 mV
XPT2 IO voltage = 1820 mV
XPT3 IO voltage = 1820 mV
XPT4 IO voltage = 1820 mV
XPT1 Core voltage = 1196 mV
XPT2 Core voltage = 1196 mV
XPT3 Core voltage = 1183 mV
XPT4 Core voltage = 1183 mV

APPENDIX C

The Utah-400 Digital Audio Breakout Panel

This Appendix contains the following:

Scope

This Appendix applies only to the installation of the AES Digital Audio Break Out Panel. The Breakout Panel and Cables are pre-tested at the factory before shipment and do not need any modifications. The customer is responsible for wiring the Sources and Destinations to each panel.

The AES Breakout Panel Kit

Each breakout panel kit ordered from Utah Scientific is shipped with the following items:

- (1) Breakout Panel (part number 161044-1)
- (9) 3 foot D/D 26 pin high density cables (part number 65366-3)
- (1) field wiring kit, which includes nine tension grip connectors and nine hoods.

Description of the AES Breakout Panel

The AES Breakout Panel is designed to simplify the installation of the Utah-400 Balanced Digital Audio Routing System. The 26 pin high-density connectors are pre-wired to connect directly between the Utah-400 Balanced Digital Audio backplane and the breakout panel. Only a screwdriver is needed for this installation.

The Breakout panels are generic; they may be used for either sources or destinations.

Each panel is silk screened from 0 on the left, to 71 on the right. Each labeled block on the rear of the panel corresponds to the labeled block on the front of the panel.

Installation of the AES Breakout Panel

To install the Breakout Panel:

1. Install the BOP at the desired location on the rack frame. (Within three feet of the Utah-400 Digital Audio Backplane.)
2. Install the D/D 26 pin cables from the Utah-400 input or output 00 - 07 to the BOP backplane input or output 00 - 07. Continue in the same manner for each input or output for the remaining eight blocks on the breakout panel.
3. Unpack the Field Wiring Kit and connect the required sources or destinations to each of the tension clamp connectors. Refer to Figure C-2 on page C -4, for wiring each tension clamp connector.

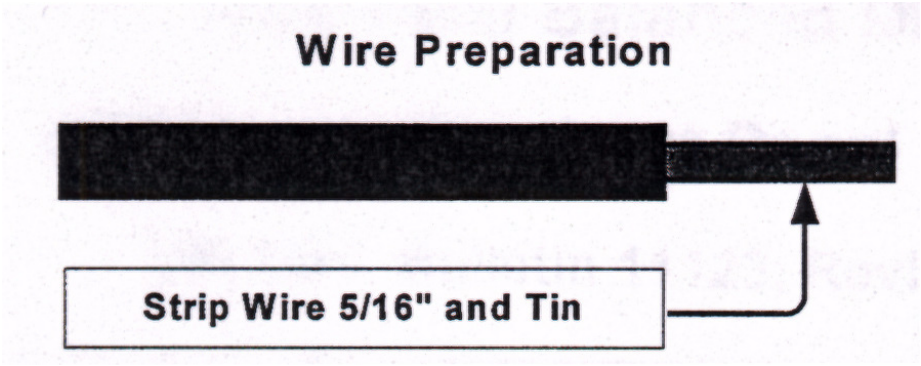


FIGURE C-1. Wire Prep

1. Insert the small screwdriver into the rectangular holes to release the wire clamp.
2. Insert the wire into the round hold above or below the rectangular slot.
3. While holding the wire in the hole, pull out the screwdriver (inserted in Step 1).
4. Tug on the inserted wire to verify that it is properly clamped.
5. Repeat for the entire connector.

Note: Wiring is the same for each sequential block following 0 - 7. Example; 8 - 15, 16 - 23, etc. ***Failure to follow these steps will result in loose or no connections, and the wire may fall out of the hole.***

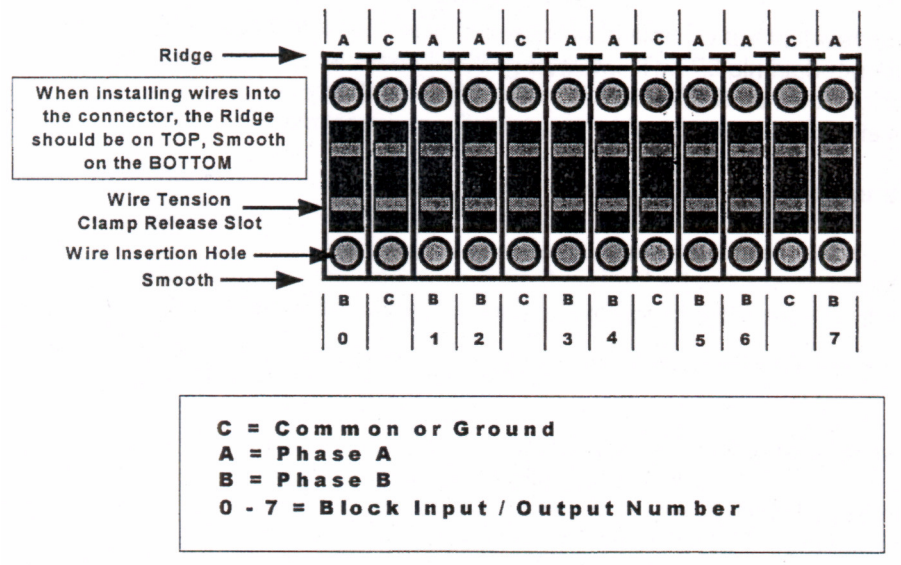


FIGURE C-2. Tension Clamp Connector (viewed from the back)

Label Instructions for the Utah-400 Breakout Panel

Scope

This document applies to the label installation on the Utah-400 Breakout Panel. Labels included in this kit include the 54450-1035 (Input Labels 000 through 287) and 54450-1036 (Output Labels 000 through 287).

Section Two of this document shows the proper wiring techniques to use on the Breakout Panel.

Application

The labels provided for the Utah-400 Breakout Panels are to be applied over the silk-screened blocks (00 – 71) below the front and back connectors on each panel. Each label sheet has two labels for each input / output range (e.g. 000 – 007) for this application.

Each label sheet will consecutively label up to four breakout panels from Inputs 000 through 287 and four breakout panels from Outputs 000 through 287.

If you do not receive enough labels for your particular application, contact Utah Scientifics' Technical Services at 1-800-447-7204 for additional labels.

The illustration below shows the proper application of the labels on the breakout panel.

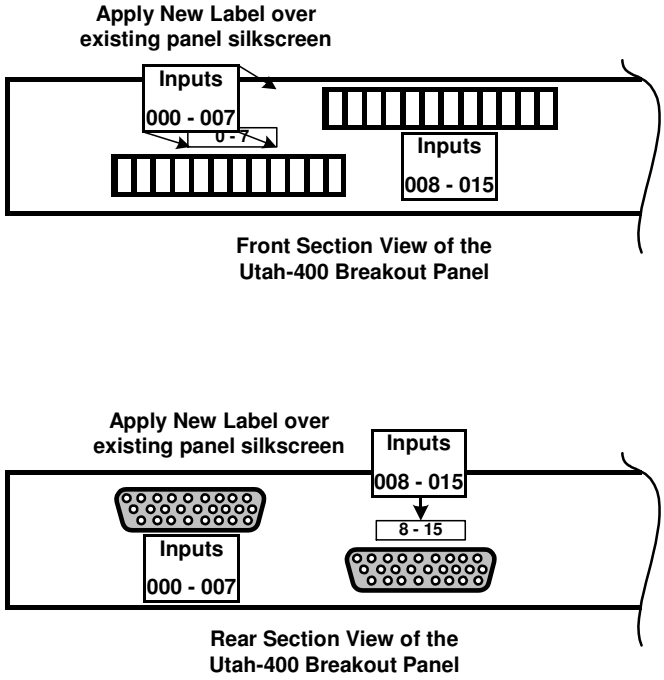


FIGURE C-3. Breakout Panel Label Application

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