Ultrix

ULTRIX-FR1, ULTRIX-FR2, and ULTRIX-FR5 Installation Guide

www.rossvideo.com

ROSS

Thank You for Choosing Ross

You've made a great choice. We expect you will be very happy with your purchase of Ross Technology.

Our mission is to:

1. Provide a Superior Customer Experience
   - offer the best product quality and support
2. Make Cool Practical Technology
   - develop great products that customers love

Ross has become well known for the Ross Video Code of Ethics. It guides our interactions and empowers our employees. I hope you enjoy reading it below.

If anything at all with your Ross experience does not live up to your expectations be sure to reach out to us at *solutions@rossvideo.com*.

David Ross
CEO, Ross Video
dross@rossvideo.com

Ross Video Code of Ethics

Any company is the sum total of the people that make things happen. At Ross, our employees are a special group. Our employees truly care about doing a great job and delivering a high quality customer experience every day. This code of ethics hangs on the wall of all Ross Video locations to guide our behavior:

1. We will always act in our customers' best interest.
2. We will do our best to understand our customers' requirements.
3. We will not ship crap.
4. We will be great to work with.
5. We will do something extra for our customers, as an apology, when something big goes wrong and it's our fault.
6. We will keep our promises.
7. We will treat the competition with respect.
8. We will cooperate with and help other friendly companies.
9. We will go above and beyond in times of crisis. *If there's no one to authorize the required action in times of company or customer crisis - do what you know in your heart is right. (You may rent helicopters if necessary.)*

Ultrix · Installation Guide

- Ross Part Number: **2101DR-003-23**
- Release Date: February 26, 2024.
- Software Issue: **5.3.0**

The information contained in this Guide is subject to change without notice or obligation.

Copyright

Patents

Patent numbers US 7,034,886; US 7,508,455; US 7,602,446; US 7,802,802 B2; US 7,834,886; US 7,914,332; US 8,307,284; US 8,407,374 B2; US 8,499,019 B2; US 8,519,949 B2; US 8,743,292 B2; GB 2,419,119 B; GB 2,447,380 B; and other patents pending.

Notice

The material in this manual is furnished for informational use only. It is subject to change without notice and should not be construed as commitment by Ross Video Limited. Ross Video Limited assumes no responsibility or liability for errors or inaccuracies that may appear in this manual.

Trademarks

- Google® is a registered trademark of Google Inc.
- Microsoft® Excel® and Internet Explorer® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Mozilla® and Firefox® are registered trademarks of the Mozilla Foundation.
- Oracle® and Java® are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.
- Safari® is a trademark of Apple Inc., registered in the U.S. and other countries.

Safety Notices

Refer to the "**Important Regulatory and Safety Notices**" document that accompanied your product.

Statement of Compliance

This product has been determined to be compliant with the applicable standards, regulations, and directives for the countries where the product is marketed.

Compliance documentation, such as certification or Declaration of Compliance for the product is available upon request by contacting techsupport@rossvideo.com. Please include the product; model number identifiers and serial number and country that compliance information is needed in request.

EMC Notices

United States of America - FCC Part 15

This equipment has been tested and found to comply with the limits for a class A Digital device, pursuant to part 15 of the FCC Rules.

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 his own expense.

Canada

This Class A device complies with Canadian ICES-003 and part 15 of the FCC Rules.

Cet appariel numerique de la classe “A” est conforme a la norme NMB-003 du Canada.

Notice — *Changes or modifications to this equipment not expressly approved by Ross Video Ltd. could void the user’s authority to operate this equipment.*

European Union

This equipment is in compliance with the essential requirements and other relevant provisions established under regulation (EC) No 765/2008 and Decision No 768/2008/EC referred to as the “New Legislative Framework”.

Warning — *This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.*

Australia/New Zealand

This equipment is in compliance with the provisions established under the Radiocommunications Act 1992 and Radiocommunications Labeling (Electromagnetic Compatibility) Notice 2008.

Korea

This equipment is in compliance with the provisions established under the Radio Waves Act.

Class A equipment (Broadcasting and communications service for business use).

This device is a business-use (Class A) EMC-compliant device. The seller and user are advised to be aware of this fact. This device is intended for use in areas outside home.

Type of Equipment	User’s Guide
A급 기기 (업무용 방송통신기자재)	이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
Class A Equipment (Industrial Broadcasting & Communication Equipment)	This equipment is **Industrial (Class A) electromagnetic wave suitability equipment** and seller or user should take notice of it, and this equipment is to be used in the places except for home.

International

This equipment has been tested under the requirements of CISPR 22:2008 or CISPR 32:2015 and found to comply with the limits for a Class A Digital device.

Notice — *This is a Class A product. In domestic environments, this product may cause radio interference, in which case the user may have to take adequate measures.*

Warranty and Repair Policy

The product is backed by a comprehensive one-year warranty on all components.

Notice — *Changes or modifications to this equipment not expressly approved by Ross Video Ltd. could void the user's authority to operate this equipment.*

If an item becomes defective within the warranty period Ross will repair or replace the defective item, as determined solely by Ross.

Warranty repairs will be conducted at Ross, with all shipping FOB Ross dock. If repairs are conducted at the customer site, reasonable out-of-pocket charges will apply. At the discretion of Ross, and on a temporary loan basis, plug in circuit boards or other replacement parts may be supplied free of charge while defective items undergo repair. Return packing, shipping, and special handling costs are the responsibility of the customer.

This warranty is void if products are subjected to misuse, neglect, accident, improper installation or application, or unauthorized modification.

In no event shall Ross Video Limited be liable for direct, indirect, special, incidental, or consequential damages (including loss of profit). Implied warranties, including that of merchantability and fitness for a particular purpose, are expressly limited to the duration of this warranty.

This warranty is TRANSFERABLE to subsequent owners, subject to Ross' notification of change of ownership.

Environmental Information

The equipment may contain hazardous substances that could impact health and the environment.

To avoid the potential release of those substances into the environment and to diminish the need for the extraction of natural resources, Ross Video encourages you to use the appropriate take-back systems. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

The crossed-out wheeled bin symbol invites you to use these systems.

If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration. You can also contact Ross Video for more information on the environmental performances of our products.

This appliance may contain a Coin type battery which should not be treated as household waste.

To ensure that the battery will be treated properly use the appropriate take-back systems in your area. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

Company Address

Ross Video Limited
8 John Street
Iroquois, Ontario
Canada, K0E 1K0

Ross Video Incorporated
P.O. Box 880
Ogdensburg, New York
USA 13669-0880

General Business Office: (+1) 613 • 652 • 4886
Fax: (+1) 613 • 652 • 4425

Technical Support: (+1) 613 • 652 • 4886
After Hours Emergency: (+1) 613 • 349 • 0006

E-mail (Technical Support): techsupport@rossvideo.com
E-mail (General Information): solutions@rossvideo.com
Website: http://www.rossvideo.com

Contents

Introduction

This guide is for system administrators and installers of the Ross Video ULTRIX-FR1, ULTRIX-FR2, and ULTRIX-FR5 routers. This guide contains the following chapters that cover the installation of your router:

- "**Introduction**" summarizes the guide and provides important terms, and conventions.
- "**Getting Started**" provides an overview for creating a routing system using the Ultrix routers, and general information to keep in mind before installing and configuring your Ultrix routers.
- "**Hardware Overview**" provides a basic introduction to the Ultrix front and rear panels.
- "**Physical Installation**" provides instructions for the basic physical installation of the Ultrix routers.
- "**Video Reference**" provides instructions on how to connect the Ultrix router to a network, connecting a video reference signal, cabling for a Multiviewer Head, and connecting to source and destination devices.
- "**Connecting the SDI Sources**" outlines the SDI input cabling for each blade.
- "**Connecting the SDI Destinations**" outlines the SDI output cabling for each blade.
- "**Gearbox Cabling**" outlines the Gearbox cabling designations.
- "**Cabling for UltriScape**" outlines the available connections for UltriScape Heads based on the type of blade.
- "**SFP Cabling**" outlines how to connect to a third-party device via an AUX port on a router blade.
- "**Cabling for IP Streaming**" outlines how to cable a blade port for IP streaming.
- "**Cabling for UltriProc**" outlines the cable designations for the UltriProc licensed feature.
- "**Connecting to Ross Devices**" provides workflow examples with other Ross devices.
- "**ULTRIX-HDBNC-IO Overview**" provides a summary of the cabling designations for the ULTRIX-HDBNC-IO blade.
- "**ULTRIX-HDX-IO Overview**" provides a summary of the cabling designations for the ULTRIX-HDX-IO blade.
- "**ULTRIX-IP-IO Overview**" provides a summary of the cabling designations for the ULTRIX-IP-IO blade.
- "**ULTRIX-IPX-IO Overview**" provides a summary of the cabling designations for the ULTRIX-IP-IO blade.
- "**ULTRIX-SFP-IO Overview**" provides a summary of the cabling designations for the ULTRIX-SFP-IO blade.
- "**Technical Specifications**" provides the specifications, such as pinouts and power consumption, for the Ultrix routers.
- "**Software Licenses**" provides third-party software license information for your Ultrix router.

If you have questions pertaining to installation of this Ross Video product, please contact us at the numbers listed in "**Contacting Technical Support**". Our technical staff is always available for consultation, training, or service.

Related Publications

It is recommended to consult the following Ross documentation before installing your Ultrix router:

- ***DashBoard User Manual***, Ross Part Number: 8351DR-004
- ***Ultricore User Guide***, Ross Part Number: 2201DR-104
- ***Ultrix Quick Start Guide***, Ross Part Number: 2101DR-002

- ***Ultrix SFP Modules Guide***, Ross Part Number: 2101DR-008
- ***ULTRIX-FR1, ULTRIX-FR2, and ULTRIX-FR5 User Guide***, Ross Part Number: 2101DR-004

✶ The user documentation is available for download from our website.

Documentation Conventions

Special text formats are used in this guide to identify parts of the user interface, text that a user must enter, or a sequence of menus and sub-menus that must be followed to reach a particular command.

Interface Elements

Bold text is used to identify a user interface element such as a dialog box, menu item, or button. For example:

In the **Save Layout** dialog, click **OK**.

User Entered Text

Courier text is used to identify text that a user must enter. For example:

In the **Language** box, enter `English`.

Referenced Guides

Italic text is used to identify the titles of referenced guides, manuals, or documents. For example:

For more information, refer to the section "**Assigning an IP Address**" in the ***Ultrix User Guide***.

Menu Sequences

Menu arrows are used in procedures to identify a sequence of menu items that you must follow. For example, if a step reads "**File** > **Save**," you would click the **File** menu and then click **Save**.

Important Instructions

Star icons are used to identify important instructions or features. For example:

✶ When the Ultrix router cannot connect to the network, a **Message** dialog box opens to report the connection problem.

Contacting Technical Support

At Ross Video, we take pride in the quality of our products, but if problems occur, help is as close as the nearest telephone.

Our 24-hour Hot Line service ensures you have access to technical expertise around the clock. After-sales service and technical support is provided directly by Ross Video personnel. During business hours (Eastern Time), technical support personnel are available by telephone. After hours and on weekends, a direct emergency technical support phone line is available. If the technical support person who is on call does not answer this line immediately, a voice message can be left

and the call will be returned shortly. This team of highly trained staff is available to react to any problem and to do whatever is necessary to ensure customer satisfaction.

- **Technical Support**: (+1) 613-652-4886
- **After Hours Emergency**: (+1) 613-349-0006
- **E-mail**: techsupport@rossvideo.com
- **Website**: http://www.rossvideo.com

Getting Started

A routing system requires careful planning. This can include allocating common connector numbers across several router levels or partitions within the routing system to ensure that source and destination equipment switch on just one switch command.

General Overview

Figure 1 provides a simplified example and may differ from what your facility requires.

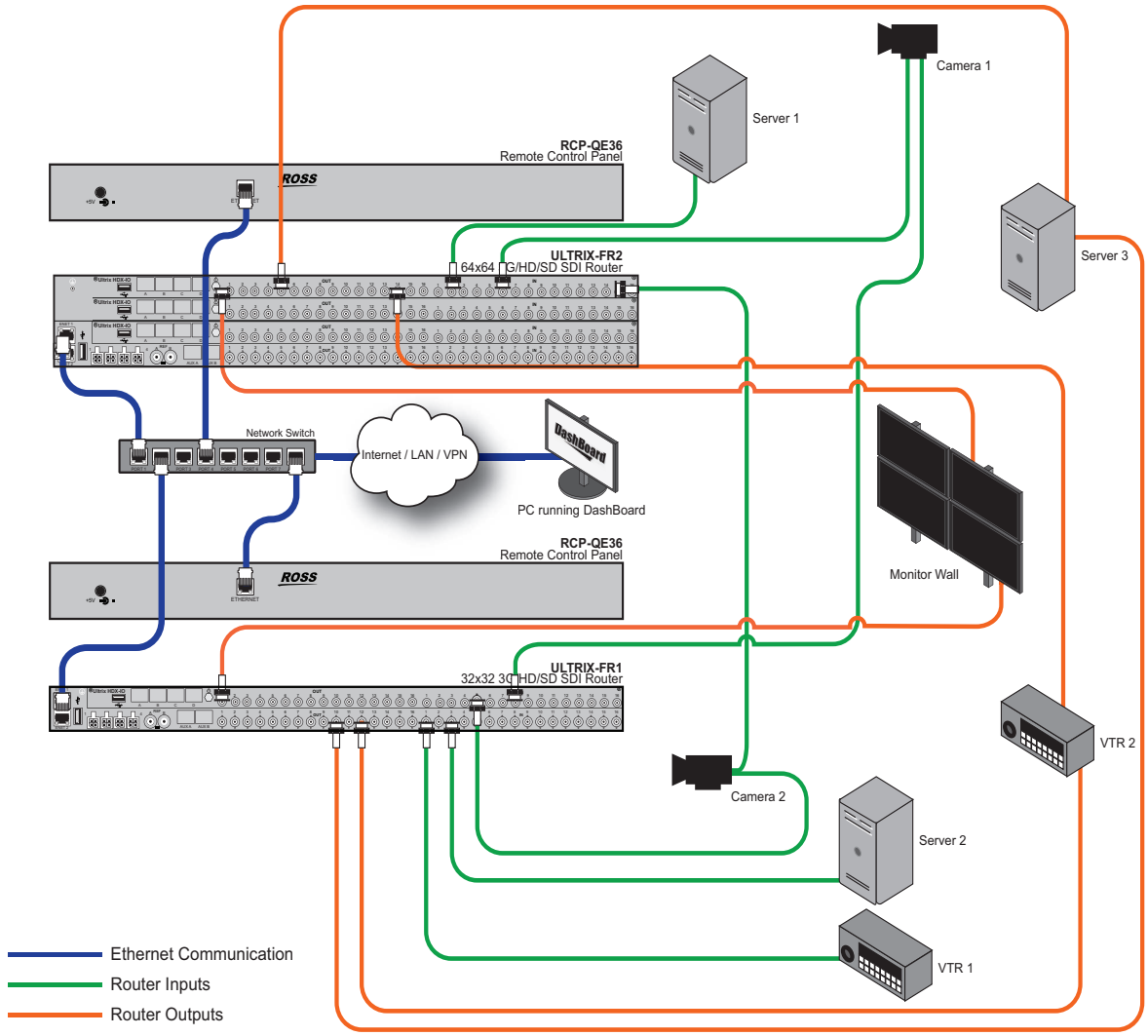


Figure 1 Example of a Routing System

Signal Distribution

A broadcast router is a device that switches signals generated by broadcast equipment from a nominated input to a nominated output. An input is a physical socket on a router, a source is a virtual grouping of inputs tied together under a label. The inputs may be routed to any number of outputs providing signal distribution.

Routing Layers or Levels

Each physical router (or signal type) may be thought of as a layer or level of the routing system (e.g. a video level, an audio level). Ultrix can assign a level to a matrix or signal type and even individual ports on unrelated matrices if required.

Interface and Connectivity

Keep in mind that the Ultrix router uses ethernet protocols to communicate to other devices in your routing system. An Ultrix routing system may use distributed control across the Internet, a LAN, or a VPN. Use your DashBoard client to set up each router via the router interfaces or using the options available for each device in your system.

✶ Ensure that you are using the latest version of the DashBoard client software. The DashBoard software and user manual are available from the Ross Video website.

For More Information on...

- configuring the Ultrix router in DashBoard, refer to the ***Ultrix User Guide***.

Remote Control Panels

Remote control panels (e.g. RCP-QE, RCP-ME) provide a physical switching surface to control the router switching. Each panel uses data derived from the Ultrix database to display text on LCDs and assign functions to the buttons.

When the system is powered up, the router restores its crosspoint status. The remote control panel requests the status of the router and displays the current status for the selected destination.

Marketing Codes

The Ultrix routers is expandable depending on the chassis.

Table 1 List of Ultrix Products

Model Number	Description
1RU Models	
ULTRIX-FR1(-NS)	Provides 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports in a 1RU chassis
ULTRIX-HDB-IO	Provides additional 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports
ULTRIX-HDX-IO	Provides additional 16x16 inputs/outputs on HD-BNCs and 4 unpopulated AUX ports
ULTRIX-IP-IO	Provides 4x25GE advanced connectivity and 2 unpopulated AUX ports
ULTRIX-IPX-IO	Provides 4x100Gigabit Ethernet (100GbE) ethernet connections and 4 unpopulated AUX ports[a]
ULTRIX-MODX-IO	Provides 4 x Plug-and-Play I/O modules and 2 unpopulated AUX ports
ULTRIX-SFP-IO	Provides 16x16 inputs/outputs via SFP modules and 2 unpopulated AUX ports
2RU Models	
ULTRIX-FR2(-NS)	Provides 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports in a 2RU chassis
ULTRIX-HDB-IO	Provides additional 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports

Table 1 List of Ultrix Products

Model Number	Description
ULTRIX-HDX-IO	Provides additional 16x16 inputs/outputs on HD-BNCs and 4 unpopulated AUX ports
ULTRIX-IP-IO	Provides 4x25GE advanced connectivity and 2 unpopulated AUX ports
ULTRIX-IPX-IO	Provides 4x100Gigabit Ethernet (100GbE) ethernet connections and 4 unpopulated AUX ports[a]
ULTRIX-MODX-IO	Provides 4 x Plug-and-Play I/O modules and 2 unpopulated AUX ports
ULTRIX-SFP-IO	Provides 16x16 inputs/outputs via SFP modules and 2 unpopulated AUX ports
5RU Models	
ULTRIX-FR5	Provides 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports in a 5RU chassis
ULTRIX-HDB-IO-A	Provides additional 16x16 inputs/outputs on HD-BNCs and 2 unpopulated AUX ports
ULTRIX-HDX-IO	Provides additional 16x16 inputs/outputs on HD-BNCs and 4 unpopulated AUX ports
ULTRIX-IP-IO	Provides 4x25GE advanced connectivity and 2 unpopulated AUX ports
ULTRIX-IPX-IO	Provides 4x100Gigabit Ethernet (100GbE) ethernet connections and 4 unpopulated AUX ports[a]
ULTRIX-MODX-IO	Provides 4 x Plug-and-Play I/O modules and 2 unpopulated AUX ports
ULTRIX-SFP-IO	Provides 16x16 inputs/outputs via SFP modules and 2 unpopulated AUX ports

a. The AUX C and AUX D ports are not implemented in the Ultrix v5.3 software.

Small Form-factor Pluggable (SFP+) Modules

The AUX ports and SFP ports can be populated with one of the following options listed in **Table 2**.

Table 2 List of SFP Modules

	Supported ULTRIX Blades					
Model	**HDB-IO**	**HDX-IO**	**IP-IO**	**IPX-IO**	**SFP-IO**	**Description**
SFP-ANA-IO	✓	✓			✓	Composite CODEC Transceiver that provides 1 analog input and 1 analog output
SFP-FIBER-3G	✓	✓			✓	3G SDI Optical Transceiver that provides 1 optical input and 1 optical output
SFP-FIBER-12G	✓	✓			✓	12G SDI Optical Transceiver that provides 1 optical input and 1 optical output
SFP-HDB-IO-3G	✓	✓	✓	✓	✓	3G SDI HD-BNC Transceiver that provides 1 SDI input and 1 SDI output
SFP-HDB-IO-12G	✓	✓	✓	✓	✓	12G/3G/HD SDI Coax Transceiver that provides 1 SDI input and 1 SDI output
SFP-HDB-IN-12G	✓	✓			✓	12G SDI HD-BNC Dual Receiver that provides 1 SDI input
SFP-HDB-OUT-12G	✓	✓			✓	12G SDI HD-BNC Dual Receiver that provides 1 SDI output
SFP-HDM-OUT	✓	✓	✓	✓	✓	SDI to HDMI/DVI Transmitter
SFP-HDM-OUT-12G	✓	✓	✓	✓	✓	12G/3G/HD-SDI to HDMI 2.0/DVI Transmitter

Table 2 List of SFP Modules

Supported ULTRIX Blades						
Model	**HDB-IO**	**HDX-IO**	**IP-IO**	**IPX-IO**	**SFP-IO**	**Description**
SFP-HDM-IN	✓	✓			✓	HDMI/DVI to SDI Receiver
SFP-HDM-IN-12G	✓	✓			✓	HDMI/DVI to 12G/3G/HD-SDI Receiver
SFP-MADI-850MM	✓	✓			✓[a]	3G SDI multi-mode optical transceiver (850 nanometer)
SFP-MADI-1300MM	✓	✓			✓[a]	3G SDI multi-mode optical transceiver (1330 nanometer)
SFP-MADI-1310SM	✓	✓			✓[a]	3G SDI optical transceiver that supports MADI
SFP-MADI-COAX	✓	✓			✓[a]	MADI Transceiver that provides a MADI Link with up to 64 channels in and out

a. Only supported in the AUX A and/or AUX B ports only.

Getting Started

When installing devices in a network topology, consider the physical placement of the devices in the network and how the communications (data) will flow within that network. Consideration must also be given to the distances between devices, physical interconnections, transmission rates, and signal types that you are installing.

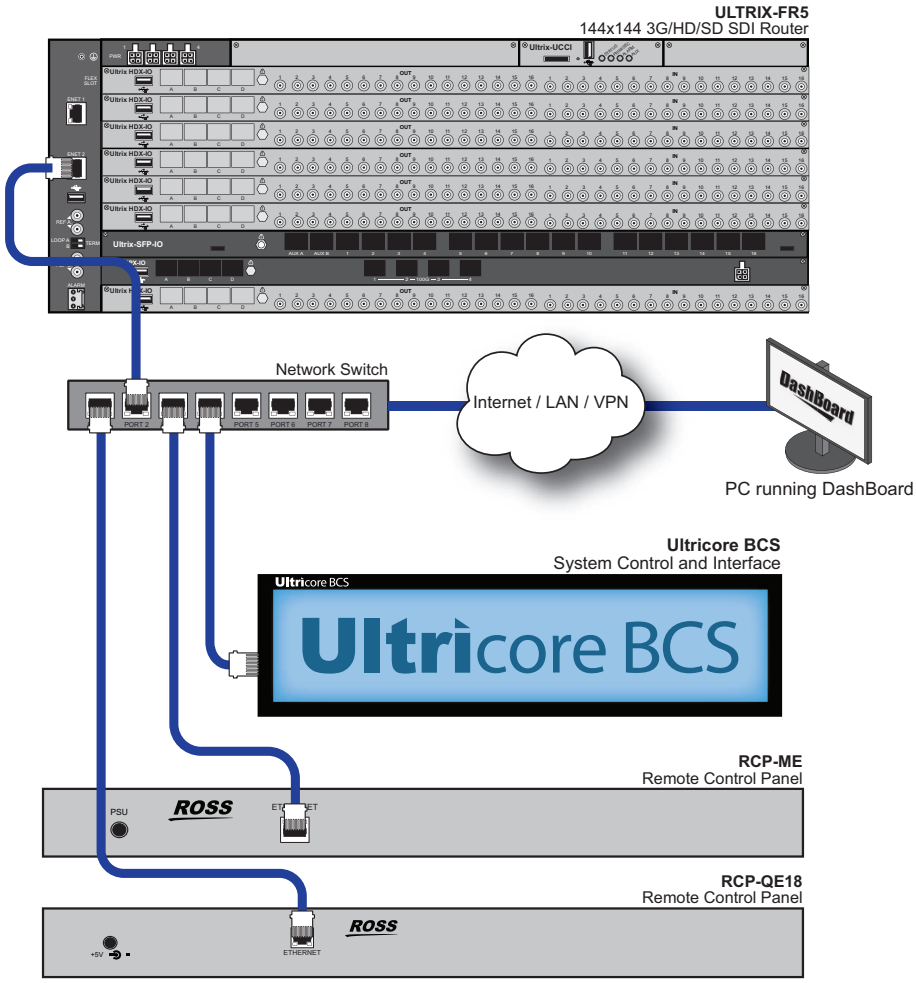


Figure 2 Example of a Possible Layout

✶ The Ultrix family communicates via a standard IT Ethernet communications network (1Gbe). For installations comprising a managed switch, ensure TCP ports 15000 and 5000 are not blocked for inter-device communications.

MC1 Connection

Communication between the MC1-MK or MC1-UHD and an Ultrix router is via an Ethernet connection. Ultrix can support up to ten MC1 connections.

For More Information on...

- the MC1-MK, refer to the ***MC1-MK Installation*** and ***Operation Guides***.
- the MC-UHD, refer to the ***MC1-UHD User Guide***.

Hardware Overview

There are three router models in the Ultrix family: ULTRIX(-NS)-FR1, ULTRIX(-NS)-FR2, and ULTRIX-FR5. All routers fit into the standard 19” rack. This chapter presents information on the Ultrix front and rear panels.

✶ The ULTRIX-NS-FR1 and ULTRIX-NS-FR2 have updated frame components to allow the support of more advanced IO modules such as ULTRIX-IPX-IO. The ULTRIX-NS-FR1 and ULTRIX-NS-FR2 may be identified by the blue dot above the i on the front panel Ultrix logo (**Figure 3**).

Front Panel Overview

The Ultrix router is designed to be operated with the door closed to ensure adequate cooling via the fans. The front panel includes the same features regardless of the router model. **Figure 3** shows an ULTRIX-NS-FR1.

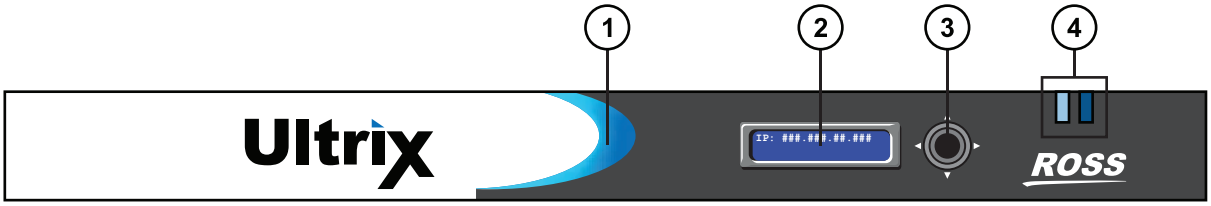


Figure 3 Front Panel — ULTRIX-NS-FR1

1) Front Panel Wave Light	3) Navigation Positioner
2) LCD Display	4) ENET Port LEDs

1. Front Panel Wave Light

The front panel provides various system status indication via the 'wave light'. The concave section of the black front panel bezel emits light of various colors to indicate system function.

Table 3 Front Panel Wave Light

Status	Description
Blue	When lit blue, this indicates normal operation.
Red	When lit red, this indicates a serious issue that requires immediate attention.

2. LCD Display

The LCD display reports on the overall system status, IP address of the panel, and current fault conditions. During normal operations, the display reports the Device Name (user assigned) and the active IP address of the panel. Under some conditions, fault conditions are reported such as: device boot status, Walkabout locate mode indication, SRAM battery warnings, and firmware upgrade states. The information on the display alternates between normal operation and the error messages.

3. Navigation Positioner

The front panel includes a five-direction round finger joystick that is used to navigate the messages on the LCD Display.

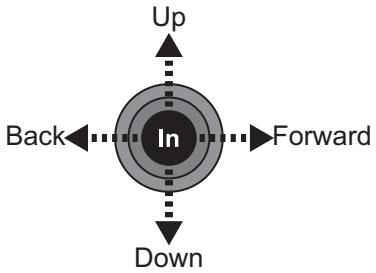


Figure 4 Positioner Movement

Use the following actions to navigate the parameters:

- **In** — pressing once brings the menu system onto the monitor output; holding for two seconds exits the menu system. This position is also used to enter the menu values/parameters.
- **Up** — pressing once selects the menu, item, or value above the current selection; holding scrolls to the top of the available selections.
- **Down** — pressing once selects the menu, item, or value below the current selection; holding scrolls to the bottom of the available selections.
- **Forward** — pressing once moves from menu to item to value.
- **Back** — pressing once moves from value to item to menu.

4. ENET Port LEDs

Table 4 describes the two Ultrix front panel LEDs that are used to monitor ethernet communication activity of the Ultrix router. When facing the front panel, the left LED reports the status of the **ENET 1** port while the right LED reports the status of the **ENET 2** port. Refer to the section "**Rear Panel Overview**" for details.

Table 4 Front Panel LEDs

LED	Status	Description
ENET #	Bright Blue	A valid physical Ethernet connection is established, and the port is active. There is data transfer activity on the indicated Ethernet port.
	Dim Blue	A valid physical Ethernet connection is established, but the port is not the active one. There is no data transfer activity on the indicated Ethernet port.
	Off	No valid Ethernet connection to the indicated Ethernet port.

Interior of the Router

The interior of the router is accessed by removing the door from the chassis.

Caution — *For reliable performance, it is recommended that the Ultrix front panel not be opened for longer than one minute.*

Figure 5 Overview of the Chassis Interior — ULTRIX-FR1(-NS)

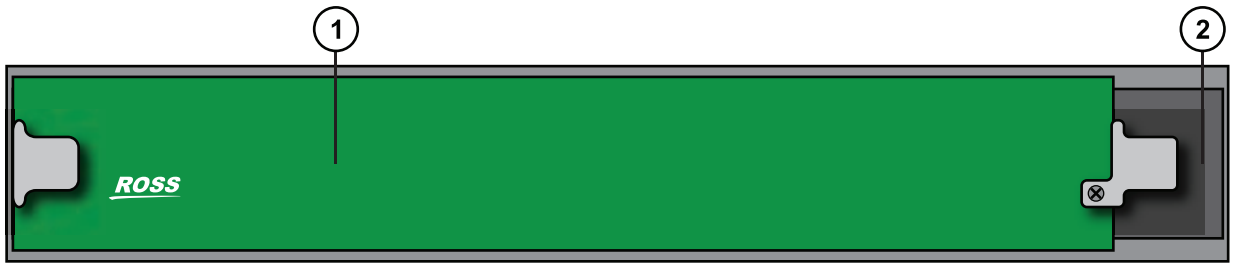


Figure 6 Overview of the Chassis Interior — ULTRIX-FR2(-NS)

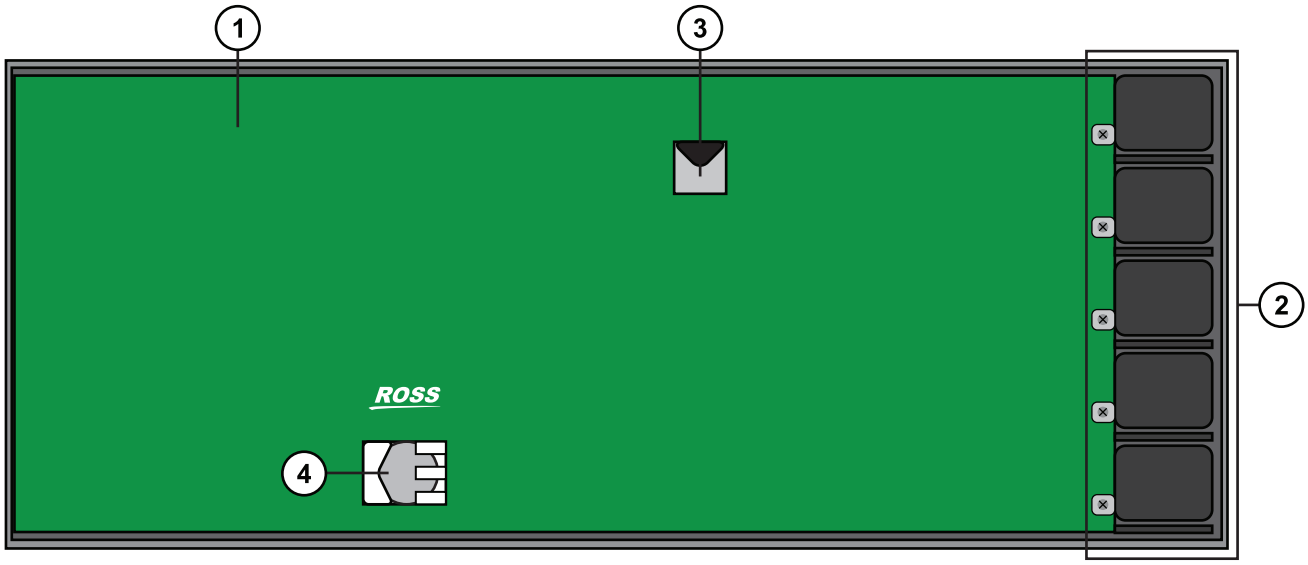


Figure 7 Overview of the Chassis Interior — ULTRIX-FR5

1) Main Board	3) Micro SD Card
2) Cooling Fan Module(s)	4) Battery

1. Main Board

The Main board is the main switching matrix for the I/O Boards. It also distributes power and communication from the main control and the I/O Boards.

ESD Susceptibility — *Static discharge can cause serious damage to sensitive semiconductor devices. Avoid handling circuit boards in high static environments such as carpeted areas and when synthetic fiber clothing is worn. Always exercise proper grounding precautions when working on circuit boards and related equipment.*

2. Cooling Fan Module

The Ultrix router comes standard with a Cooling Fan Module installed in the right-side of the chassis. This module mates directly to the control board of the router (located in the back of the chassis).

Caution — *The two sides of the Ultrix router have perforations that are needed to ventilate the boards and components inside the chassis. Do not block these perforations.*

The fans intake air at the right-side of the chassis, then the fans blow the air over the I/O Boards. The air flows from right to left, to the exit ventilation holes on the left-side of the chassis.

On the ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 chassis, the Cooling Fan Module also houses the MicroSD card that is a key component of the router operating system. Do not remove this card unless directed by Ross Technical Support.

✶ A three-way jumper is available on the ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 Cooling Fan Modules. Do not change its settings unless directed by Ross Technical Support.

3. Micro SD Card (ULTRIX-FR5 only)

The Micro SD provides system storage and a default software build. Do not remove this card unless directed by Ross Technical Support.

4. Battery

The ULTRIX-FR5 uses this battery to serve as an emergency backup power source for the essential memory of the router. On the ULTRIX-FR1(-NS) and ULTRIX-FR2(-NS) chassis, this battery is located on the Cooling Fan Module. Refer to the ***Ultrix User Guide*** for information on monitoring and replacing this battery.

Rear Panel Overview

The rear panel provides a support structure for connecting input or output signals, and two looping reference connections. Note that the number of populated slots in your router may differ from what is presented here.

✶ The ULTRIX-NS-FR1 and ULTRIX-NS-FR2 routers can be identified by the Ultrix logo on the front door with an “i” with a blue dot. Refer to **Figure 3** for an example of the ULTRIX-NS-FR1 front door.

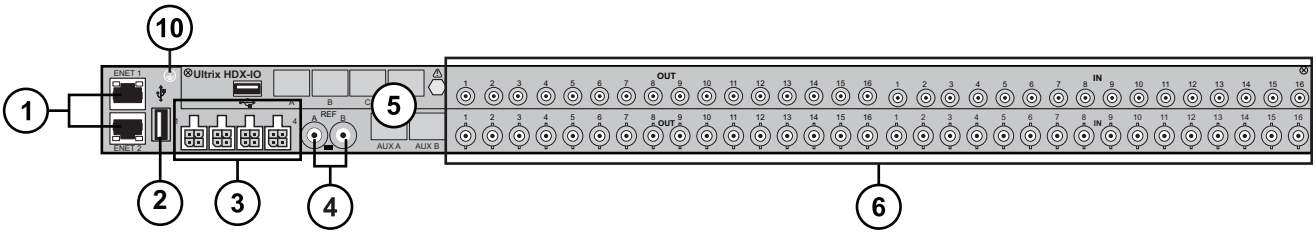


Figure 8 Rear Panel — ULTRIX(-NS)-FR1

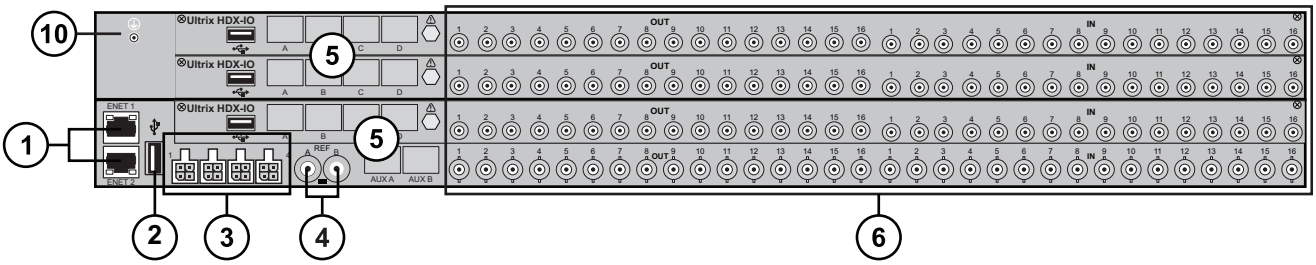


Figure 9 Rear Panel — ULTRIX(-NS)-FR2

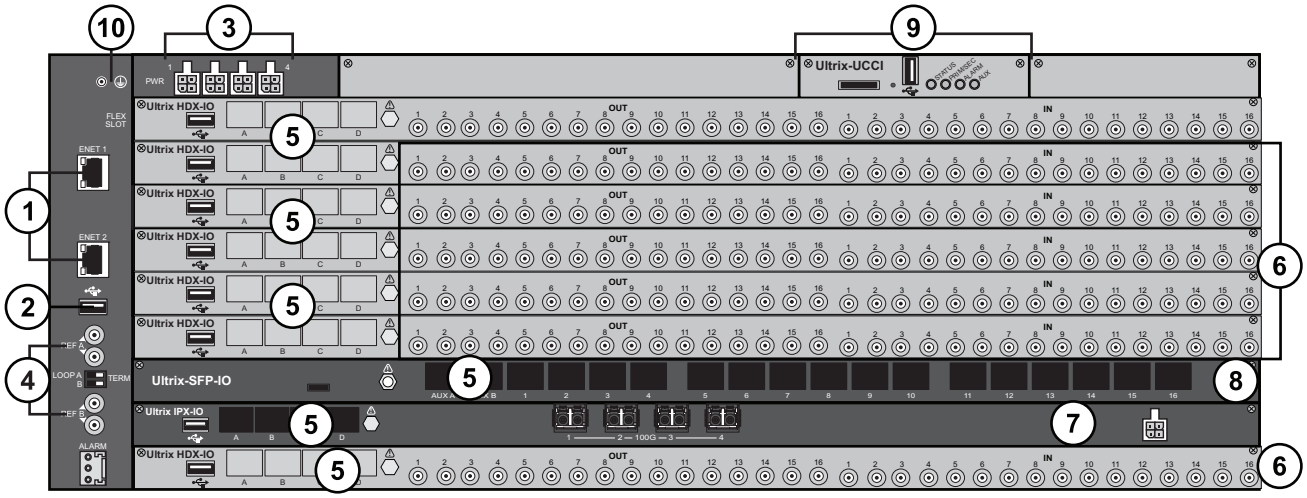


Figure 10 Rear Panel — ULTRIX-FR5

1) Ethernet Connections	5) Auxiliary SFP+ Ports	9) Ultrix-UCCI Slots
2) USB Port	6) SDI IN and OUT Connections	10) Protective Earth Stud
3) PSU Connections	7) ULTRIX-IPX-IO Blade	
4) Video Reference Connections	8) Ultrix-SFP-IO Blade	

1. Ethernet Connections

Each Ethernet port is an RJ45 connector used to connect the router to an external 1Gbe Ethernet network. Each port has its RJ45 connector wired as a Network Interface Card (NIC). Connect ENET1 as the primary ethernet connection to bridge the external Ethernet network to the local communications bus for monitoring and control of the router. Only connect ENET2 when a redundant connection is required

Notice — *The Ethernet ports do not provide Power-over-Ethernet (PoE).*

At least one Ethernet connection is required to bridge the external Ethernet network to the local communications bus for monitoring and control of the router.

2. USB Port

The USB port provides the ability for various USB-serial converts to be attached for serial communications with the Ultrix router. Refer to "**Supported USB-Serial Converters**" for a list.

3. PSU Connections

There are four power supply connectors located on the rear of each Ultrix router numbered 1-4 starting from the leftmost connector. Each connector requires a 15VDC connection to an external power supply.

Caution — *The Ultrix router automatically powers on when power is applied.*

- The ULTRIX(-NS)-FR1 ships with one power supply. An option is available to order a second power supply for redundancy.
- The ULTRIX(-NS)-FR2 ships with two power supplies. An option is available to order a third power supply to enable n+1 redundancy or two additional power supplies for full redundancy.

Caution — *The ULTRIX(-NS)-FR2 chassis requires a minimum of two power supplies.*

- The ULTRIX-FR5 requires power from an Ultripower power supply only.

4. Video Reference Connections

Two (individual or looping) HD-BNC inputs are provided to accept reference signals supporting the following reference types: analog black, tri-level sync, and AES/DARs.

✶ A switch is located between the HD-BNCs. Do not move this switch from its default position.

Refer to **Table 5** to learn what REF ports are supported on each type of blade and router.

Table 5 Supported Blades for Each Router

Blade	ULTRIX-FR1	ULTRIX-NS-FR1	ULTRIX-FR2	ULTRIX-NS-FR2	ULTRIX-FR5
SDPE-ACUITY	N/S	N/S	N/S	N/S	REF A
SDPE-CARBONITE	REF A	REF A	REF A	REF A	REF A or REF B
ULTRIX-HDX-IO	REF A	REF A	REF A	REF A	REF A or REF B
ULTRIX-IP-IO	REF A	REF A	REF A	REF A	REF A or REF B
ULTRIX-IPX-IO	REF A	REF A	REF A	REF A	REF A or REF B
ULTRIX-MODX-IO	REF A	REF A	REF A	REF A	REF A or REF B
ULTRIX-SFP-IO	REF A	REF A	REF A	REF A	REF A or REF B

N/S is Not Supported

5. Auxiliary SFP+ Ports

The AUX ports can be populated with Small Form-factor Pluggable (SFP+) modules from the factory or by installing modules in the field. For a list of SFP+ modules available from Ross Video, refer to **Table 2**.

If an AUX port is populated on the Ultrix rear panel, its status is reported in DashBoard and options are provided for mapping and labeling the I/O as required.

6. SDI IN and OUT Connections

The number of input and output HD-BNCs depends on the router model you are using. Each row of 16x16 HD-BNCs is a separate Ultrix-HDBNC-IO or ULTRIX-HDX-IO[1] blade (known as a slot in the Frame Slot Port Channel (FSPC) nomenclature). These I/O blades provide non-blocking connectivity for up to 32x32 inputs/outputs in the ULTRIX-NS-FR1, 64x64 inputs/outputs in the ULTRIX-NS-FR2, or 144x144 inputs/outputs in the ULTRIX-FR5.

✶ The Slots are numbered sequentially with Slot 1 as the topmost slot except on the ULTRIX-FR5. On the ULTRIX-FR5, the topmost slot is identified as the FLEX Slot with the second topmost slot identified as Slot 1. Refer to "**Chassis Slot Numbering**".

✶ The FLEX slot has an inputs limitation of 16x16 I/O. Depending on the blade, this may impact the blade functionality.

1. The ULTRIX-HDX-IO blade can only be installed in the ULTRIX-NS-FR1, ULTRIX-NS-FR2, and ULTRIX-FR5.

7. ULTRIX-IPX-IO Blade

The ULTRIX-IPX-IO blade is installed in any available slot of an ULTRIX-NS-FR1, ULTRIX-NS-FR2, or an ULTRIX-FR5. Each ULTRIX-IPX-IO blade provides four QSFP28 ports with 100GbE bandwidth per port. Refer to "**ULTRIX-IPX-IO Overview**" for more information on this optional blade.

8. ULTRIX-SFP-IO Blade

The ULTRIX-SFP-IO blade is installed in any available slot of an ULTRIX-NS-FR1, ULTRIX-NS-FR2, or an ULTRIX-FR5. Each ULTRIX-SFP-IO blade provides two AUX ports, and sixteen SFP ports. Each port can be populated with Small Form-factor Pluggable (SFP+) modules from the factory or by installing modules in the field. For a list of SFP+ modules available from Ross Video, refer to **Table 2**. Refer to "**ULTRIX-SFP-IO Overview**" for more information on this optional blade.

✶ AUX A and AUX B are not available when the ULTRIX-SFP-IO blade is installed in a FLEX slot.

If a port is populated on the ULTRIX-SFP-IO blade, its status is reported in DashBoard and options are provided for mapping and labeling the I/O as required.

9. Ultrix-UCCI Slots (ULTRIX-FR5 only)

By default, the left Ultrix-UCCI slot is populated. If you have the Ultrix-UCCI redundancy option, the right Ultrix-UCCI slot is also populated.

Each Ultrix-UCCI slot houses an Ultricore-CC Internal board which includes a Micro SD Card slot, a USB port, and four status LEDs.

Table 4 describes the Ultrix-UCCI status LEDs.

Table 6 Ultrix-UCCI LEDs

LED	Status	Description
STATUS	Green	Indicates the Ultrix-UCCI is powered and the last re-boot was successful
	Flashing Green	Indicates the Ultrix-UCCI is powered and in the progress of a re-boot
	Red	Indicates the Ultrix-UCCI is powered but requires a re-boot
PRIM/SEC	Green	Indicates the Ultrix-UCCI is configured and functioning as a Master
	Flashing Green	Indicates the Ultrix-UCCI is in standby mode
ALARM	Red	Indicates the Ultrix-UCCI is experiencing an error condition; verify the message(s) on the router front panel LCD display and DashBoard
	Off	Indicates the Ultrix-UCCI is operating correctly and is not experiencing any errors
AUX	This LED is not implemented.	

For More Information on...

- installing and configuring a second Ultrix-UCCI in your ULTRIX-FR5 in an existing routing system, contact Ross Technical Support.

10.Protective Earth Stud

✶ The protective earth stud may not be present on all hardware.

The ULTRIX-NS-FR1, ULTRIX-NS-FR2, and ULTRIX-FR5 include a protective earth ground stud.

Caution — *Risk of electrical shock. Enclosure shall be connected to earth ground via protective earth stud and 18AWG conductor or larger.*

Chassis Slot Numbering

This section summarizes the slot numbering based on the router model.

ULTRIX(-NS)-FR1

Figure 11 outlines the numbering scheme for the ULTRIX-FR1 and ULTRIX-NS-FR1 chassis. Note that **Slot 1** is the topmost slot.

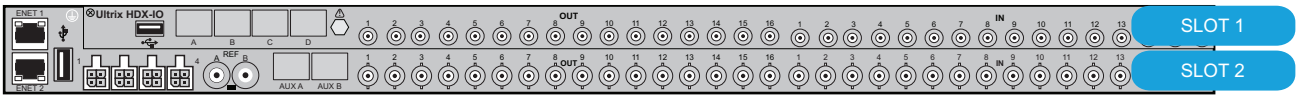


Figure 11 Slot Numbering — ULTRIX-FR1 and ULTRIX-NS-FR1

ULTRIX(-NS)-FR2

Figure 12 outlines the numbering scheme for the ULTRIX-FR2 and ULTRIX-NS-FR2 chassis. Note that **Slot 1** is the topmost slot.

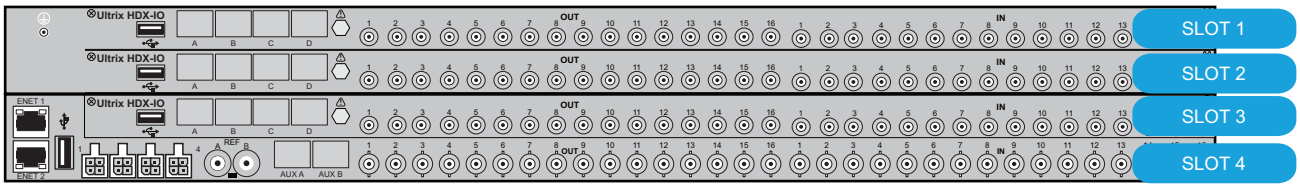


Figure 12 Slot Numbering — ULTRIX-FR2 and ULTRIX-NS-FR2

ULTRIX-FR5

Figure 13 outlines the numbering scheme for the ULTRIX-FR5 chassis. Note that the **FLEX** slot is the topmost slot.

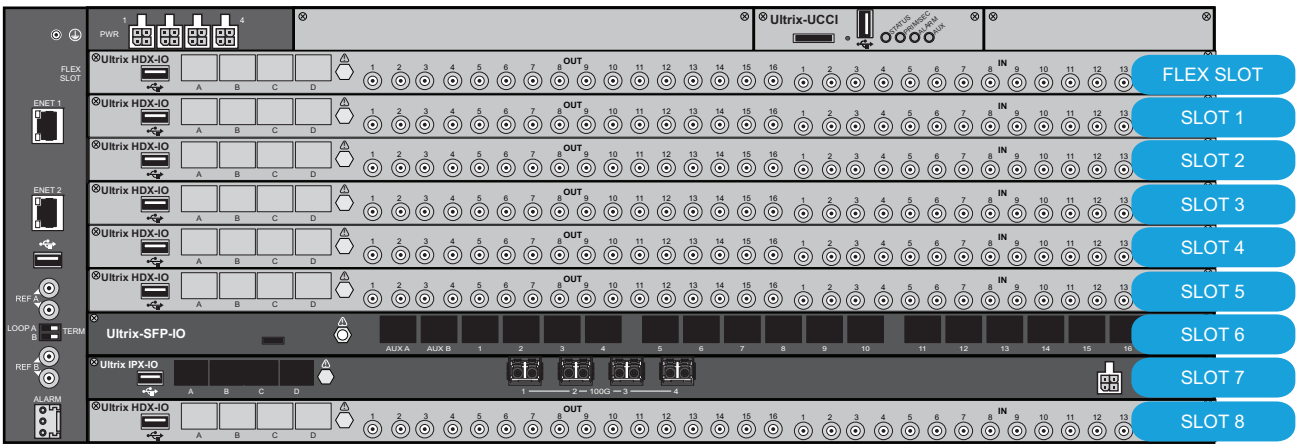


Figure 13 Slot Numbering — ULTRIX-FR5

Physical Installation

If you have questions pertaining to the installation of your Ultrix router, contact us at the numbers listed in "**Contacting Technical Support**".

Before You Begin

Caution — *The Ultrix router utilizes side-to-side airflow management (right to left looking at the front of the chassis). It is a requirement that the sides of the mounted Ultrix router are not obscured.*

These installation guidelines assume the following:

- The relevant Ross equipment is installed into a ventilated rack frame. The relative humidity in the environment of the equipment should be <70% (non-condensing). The ambient temperature of the air entering the front panel should not exceed 40°C (104°F), and should not fall below 0°C (32°F). It is recommended to leave a 1RU gap between each module.
- Ensure that adequate space exists in front, behind, and on both sides of the router for airflow exhaust.
- Ensure that adequate space exists on both sides of the router and side access is not blocked from the rear.
- If a Ross openGear frame is included in the installation, it is recommended that the Ultrix router be installed directly above the openGear frame.
- If the ambient temperature of the installation site is likely to reach temperatures at the high end of the specified operating range, you may choose to set the fan speed to medium or high to reduce any potential risk. Refer to the ***Ultrix User Guide*** for instructions on setting the fan speed.
- The install location of the router should be accessible, dry, and dust-free.
- The socket/outlet should be installed near the equipment and be easily accessible.
- The routing system is well planned and designed. Consideration must be given to inputs and outputs across multiple router levels and typical operating scenarios for breakaways.
- Valid IP addresses are assigned to the equipment.

Static Discharge

Throughout this chapter, please heed the following cautionary note:

ESD Susceptibility — *Static discharge can cause serious damage to sensitive semiconductor devices. Avoid handling circuit boards in high static environments such as carpeted areas and when synthetic fiber clothing is worn. Always exercise proper grounding precautions when working on circuit boards and related equipment.*

Mounting Requirements

The Ultrix router is designed for installation into a standard 19" equipment rack. It has integrated rack ears, allowing it to be screwed in using standard screws and cage nuts.

The Ultrix mounts in the rack frame by means of four rack screws fastened through the front and back mounting ears. This should normally be sufficient to carry the load, including the weight of accompanying cables.

Under some conditions, the ambient air temperature inside rack-mount cabinets can be greater than the ambient temperatures within a room. For safe long term reliability, ensure the ambient air

temperatures at the router right-side intake are within the router's specified operating temperature range. Adequate ventilation within a rack frame must also be maintained.

For More Information on...

- the technical specifications for the Ultrix router, refer to "**Technical Specifications**".

Connecting the Ultrix Router to a Network

Each Ethernet port is a standard RJ45 Ethernet connector and is used to exchange data and communicate with other devices in your router system.

✶ Contact your IT department before connecting to your facility network to ensure that there are no conflicts. They will provide you with an appropriate value for the IP Address, Subnet Mask, and Gateway for your device.

The Ultrix router is connected directly to your network so that it can interface with the devices and the computer running the DashBoard client. After a physical connection is established, DashBoard is used to configure the network settings for the Ultrix. While this section uses the ULTRIX-FR1 as an example, it is applicable to all Ultrix models.

For More Information on...

- downloading and installing DashBoard, refer to the ***DashBoard User Manual***.

✶ If difficulties or problems are experienced when connecting the Ultrix router to a network hub, or with assigning IP addresses, please contact your network administrator.

To establish a physical connection to the network

✶ A 1GbE connection is required.

1. To connect the primary network connection for the Ultrix router:
   a. Connect one free end of a standard CAT 5/5e/6 Ethernet cable to a free port of the network hub.
   b. Connect the other end of the same cable to the **ENET 1** port on the rear of the Ultrix router.

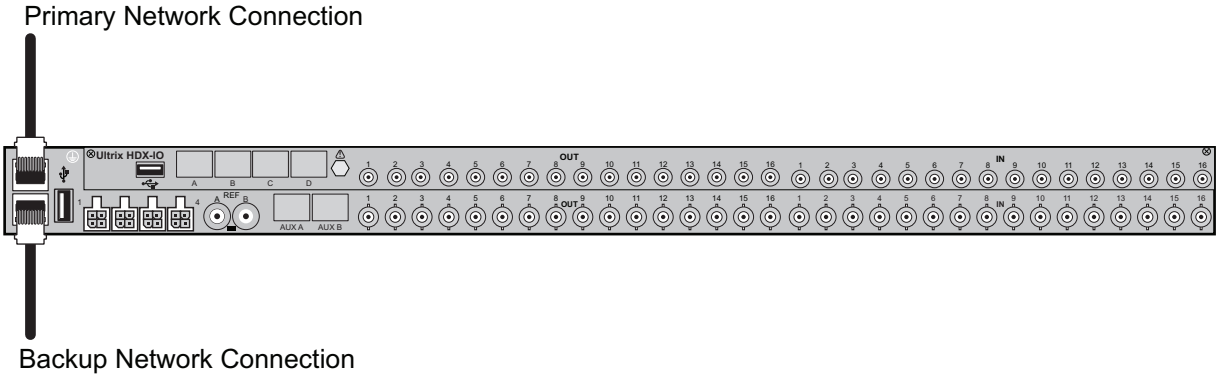


Figure 14 ULTRIX-NS-FR1 — Network Connections

2. To connect the redundant network connection for the Ultrix router:
   a. Connect one free end of a second straight through CAT 5/5e/6 cable to a free port of the network hub.
   b. Connect the other end of the same cable to the **ENET 2** port on the rear of the Ultrix router.

Powering on the Router

There are four PSU sockets on the back of each Ultrix router. The minimum number of PSU your router requires is based on the router size.

Warning Hazardous Voltages — *The safe operation of this product requires that a protective earth connection be provided. This protective earth is provided by the ground conductor in the equipment's supply cord. To reduce the risk of electrical shock to operator and service personnel, this ground connector must be connected to an earthed ground.*

Warning — *In some countries it may be necessary to supply the correct mains supply cord. Use only certified cords for the country of use.*

Powering on the ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2

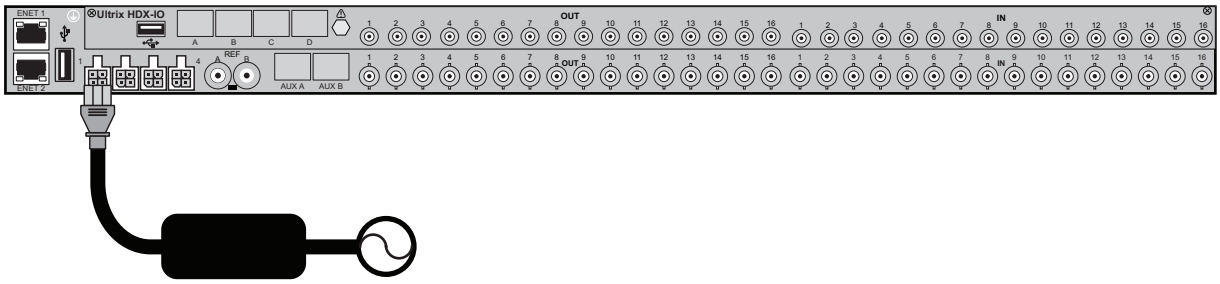
Before you begin, keep in mind that:

- Each ULTRIX(-NS)-FR1 router requires a minimum of one +15V DC, 32A PSU. For redundancy and load sharing, up to 3 optional PSU can be used.
- Each ULTRIX(-NS)-FR2 router requires a minimum of two +15V DC, 32A PSU. For redundancy and load sharing, up to 2 optional PSU can be used.
- For redundancy, each power cord should be connected to a separate power source for protection against failure of the A/C power circuit. In the event of one power supply failure, the panel load is seamlessly transferred to the other connected redundant power supplies.

Notice — *The Ultrix router automatically powers on when power is applied.*

To connect the power cables to the ULTRIX(-NS)-FR1 or ULTRIX(-NS)-FR2

1. Connect the female end of the provided power cable into the socket marked **PS1**.



Note: It is recommended that you always connect the Power Supply Unit to the Ultrix before connecting to Mains Power.

Figure 15 ULTRIX(-NS)-FR1 — Primary Power Connection

2. Connect the remaining three power cables into the separate power supply sockets.

Notice — *The ULTRIX(-NS)-FR2 requires a minimum of two power supplies.*

3. Connect the supplied AC power cable into the power module.
4. Connect the supplied power cable's three-prong male connector to Mains Power.

Powering on the ULTRIX-FR5

Each ULTRIX-FR5 router requires powering from an Ultripower Rack Mount Power Supply Unit. Powering an ULTRIX-FR5 from individual external power supplies is not supported. Ultripower is a 1RU 1200W power supply specifically designed for the Ultrix series routers.

✶ Refer to the ***ULTRIX-FR5 Quick Start Guide*** for more information on connecting to the Ultripower.

To connect an Ultripower to an ULTRIX-FR5

1. Connect the ends of four power cables to the Ultripower rear panel **OUT** sockets.
2. Connect the free ends of the same power cables to the ULTRIX-FR5 rear panel.

Notice — *Ensure that the power cable end with the ferrite bead connects to the Ultripower port.*

Notice — *The ULTRIX-FR5 automatically powers on when power is applied to Ultripower. Connect DC cables prior to connecting AC power source to the Ultripower. This prevents the ULTRIX-FR5 from trying to draw too much power while only one DC cable is installed.*

✶ Refer to the ***Ultripower User Guide*** for more information on connecting the Ultripower to a power source.

3. Connect an AC power cable to the Ultripower **PSU 1** socket.
4. If Ultripower is fitted with a second power module, connect a second AC power cable to the Ultripower **PSU 2** socket.

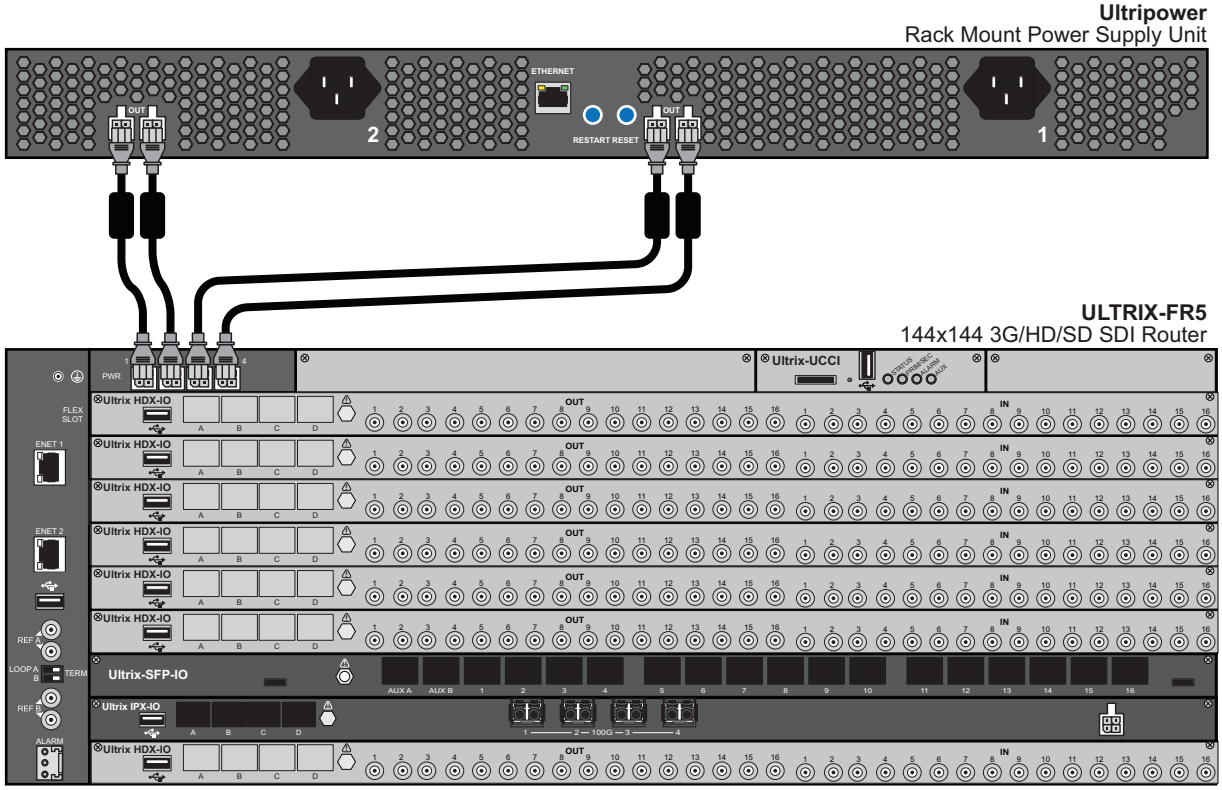


Figure 16 ULTRIX-FR5 — Power Connections

Video Reference

The Ultrix routers handle high-bandwidth, broadcast-quality, digital video and audio signals, and embedded audio signals. Digital video signals can be 12G[1], 3G, high definition, or standard definition. The Ultrix routers support SMPTE standards 424M, 344M, 259M, and 292M.

Overview

All Ultrix routers accept a video reference signal. If connected, a video references ensures that switching occurs in the default vertical interval across all router levels. The default switching pulse complies with ***SMPTE RP168*** as follows:

- line 6 for SD (PAL reference)
- line 10 for SD (NTSC reference)
- line 7 for HD (1080i)
- line 7 for HD (720p)
- line 7 for 3G (1080p)

Alternatively, you can set your own custom switching point to meet the requirements of your system. For example, if the default settings for the switching pulse occur within the data elements of your signal, you need to assign your own switching trigger.

For More Information on...

- setting a custom switching trigger, refer to the ***Ultrix User Guide***.
- supported reference formats for Frame Sync/Clean Switch, refer to "**Supported Frame Sync/Clean Switch Video Formats for Conversion**".

Cabling for the ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2

The ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 each accept a single composite or tri-level sync signal to feed timing information to the routing system.

To connect the video reference source to the ULTRIX(-NS)-FR1 or ULTRIX(-NS)-FR2

1. Connect a 75ohm coaxial cable between the video reference signal output and the **REF A** port on the rear panel of the Ultrix router.

✶ Use the **REF B** port only as a loop when configuring the ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 for a loop-through work flow.

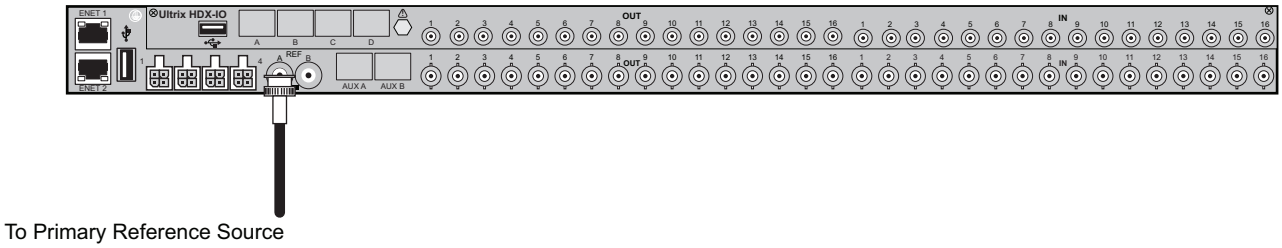


Figure 17 Video Reference Cabling — ULTRIX(-NS)-FR1 or ULTRIX(-NS)-FR2

2. If you have multiple routers that will switch on with the same reference:

1. Requires installing an Ultrispeed license key for each slot. Refer to the ***Ultrix User Guide*** for details.

a. Connect the **REF B** connector on the rear panel of the router to the **REF A** connector on the rear panel of another router using a 75ohm coaxial cable.

b. Continue looping the **REF** connectors across the routers that you want referenced to this signal.

c. Ensure that the last router in the video referencing loop has a 75ohm termination connected to its **REF B** connector.

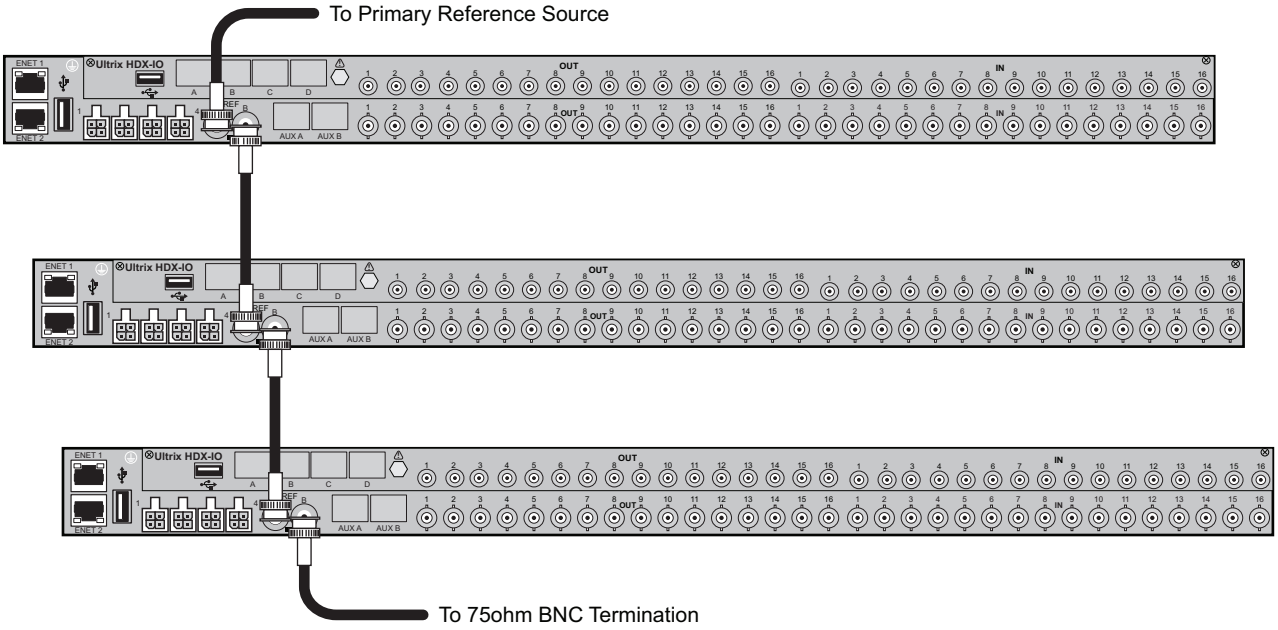


Figure 18 Connecting Multiple Routers for Simultaneous Switching

Cabling for the ULTRIX-FR5

The ULTRIX-FR5 consists of two independent reference connections (REF A, REF B). Each may be configured for loop-through or terminating functionality. The ULTRIX-FR5 requires at least one reference connection.

To connect the video reference source to the ULTRIX-FR5

1. Connect a valid reference signal to either BNC in the BNC pair labeled **REF A**.

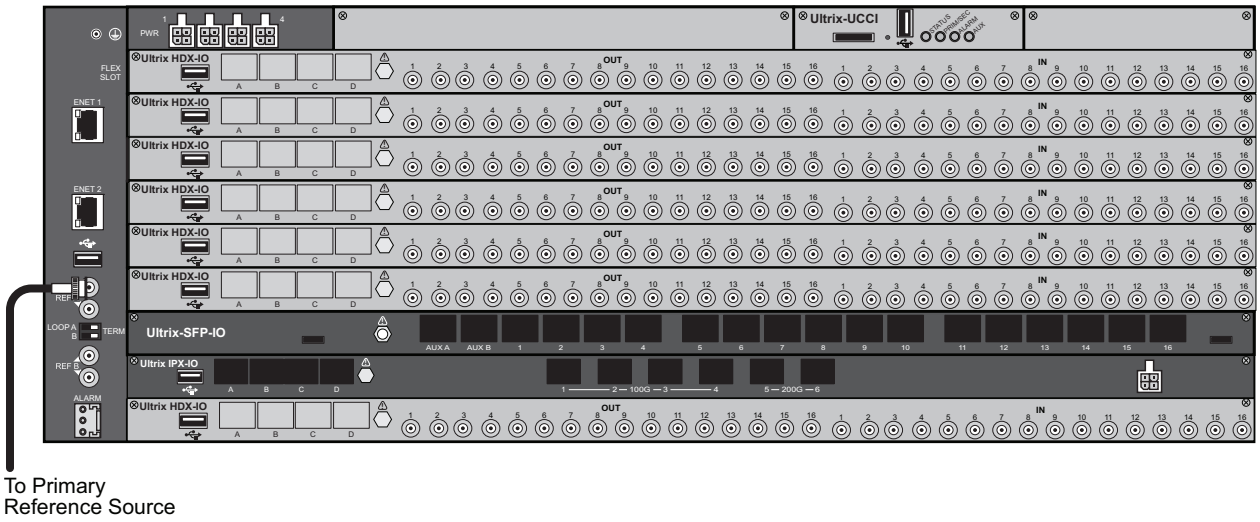


Figure 19 Video Reference Cabling — REF A Port on the ULTRIX-FR5

2. Select either **TERM** or **LOOP** on the DIP switch **A** to select the preferred BNC mode.

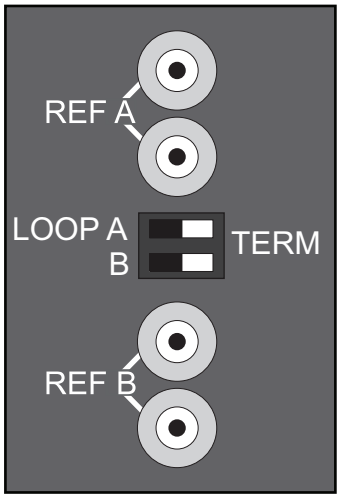


Figure 20 ULTRIX-FR5 — DIP Switch in the TERM Positions

Connecting the SDI Sources

The Ultrix routers handle high-bandwidth, broadcast-quality, digital video and audio signals, and embedded audio signals. Digital video signals can be 12G[1], 3G, high definition, or standard definition. The Ultrix routers support SMPTE standards 424M, 344M, 259M, and 292M.

Overview

The Source connections on the Ultrix rear panel are located on the right-hand side and are clearly defined with white text on a black background around the HD-BNCs.

ESD Susceptibility — *Anti-static precautions must be taken when fitting or removing all cables. Wear an earthed wrist wrap strap if possible, or place both hands on the metal rack frame before handling the cables.*

To connect SDI source devices to the Ultrix router

1. Refer to the following sections to learn more about the specific input designations for your blade.
2. Connect the end of a 75ohm coaxial cable with HD-BNC connectors to an **IN** HD-BNC on the rear panel.
3. Connect the other end of the coaxial cable to the device that will supply the signal to that **IN** HD-BNC on the router.

ULTRIX-HDBNC-IO Cabling

The ULTRIX-HDBNC-IO blade can be installed in an ULTRIX-FR1, ULTRIX-NS-FR1, ULTRIX-FR2, ULTRIX-NS-FR2, and ULTRIX-FR5 router. This section outlines the HD-BNCs for each router model. The BNCs are numbered starting with **IN 1** and the total number of BNCs depends on the router model you are using.

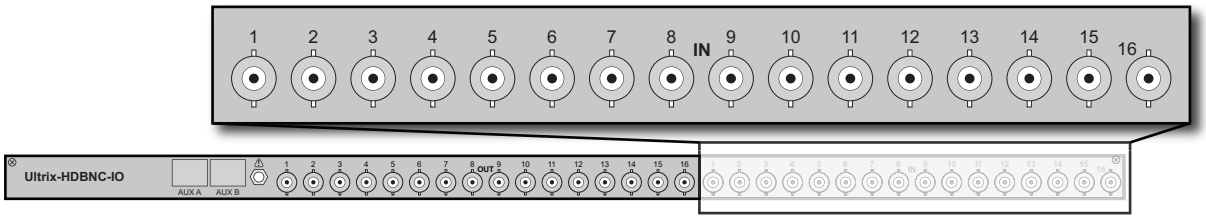


Figure 21 ULTRIX-HDB-IO Blade — SDI Inputs

1. Requires installing an Ultrispeed license key for each slot. Refer to the ***Ultrix User Guide*** for details.

ULTRIX-HDX-IO Cabling

The ULTRIX-HDX-IO blade can be installed in an ULTRIX-NS-FR1, ULTRIX-NS-FR2, and ULTRIX-FR5 router. Each blade provides 16 SDI inputs. The BNCs are numbered starting with **IN 1** and the total number of BNCs depends on the router model you are using.

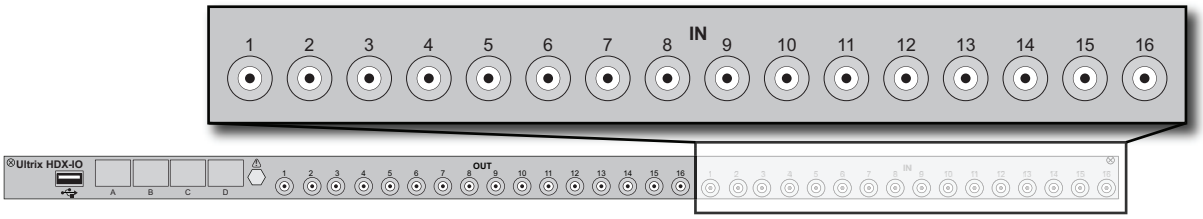


Figure 22 ULTRIX-HDX-IO Blade — SDI Inputs

Connecting the SDI Destinations

The Ultrix routers handle high-bandwidth, broadcast-quality, digital video and audio signals, and embedded audio signals. Digital video signals can be 12G[1], 3G, high definition, or standard definition. The Ultrix routers support SMPTE standards 424M, 344M, 259M, and 292M.

Overview

The Destination connections on the Ultrix rear panel are located on the left-hand side and are clearly defined with black text on a gray background around the HD-BNCs.

ESD Susceptibility — *Anti-static precautions must be taken when fitting or removing all cables. Wear an earthed wrist wrap strap if possible, or place both hands on the metal rack frame before handling the cables.*

To connect SDI destination devices to the Ultrix router

1. Refer to the following sections to learn more about the specific output designations for your blade.
2. Connect the end of a 75ohm coaxial cable with HD-BNC connectors to an **OUT** HD-BNC on the rear panel.
3. Connect the other end of the coaxial cable to the device that will ingest the signal from that **OUT** HD-BNC on the router.

ULTRIX-HDBNC-IO Cabling

The ULTRIX-HDBNC-IO blade can be installed in an ULTRIX-FR1, ULTRIX-NS-FR1, ULTRIX-FR2, ULTRIX-NS-FR2, and ULTRIX-FR5 router. This section outlines the HD-BNCs for each router model. The SDI destinations are numbered starting with **OUT 1** and the total number of BNCs depends on the router model you are using.

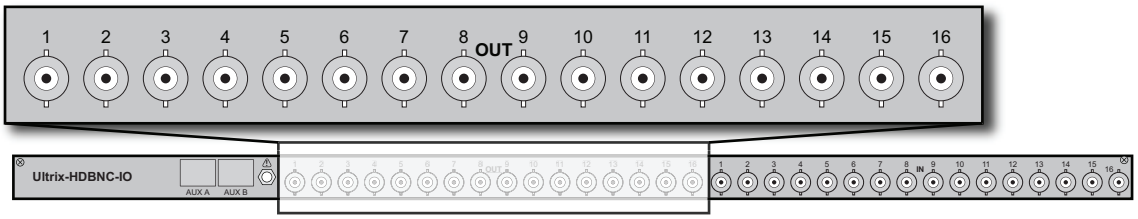


Figure 23 ULTRIX-HDB-IO Blade — SDI Outputs

1. Requires installing an Ultrispeed license key for each slot. Refer to the ***Ultrix User Guide*** for details.

ULTRIX-HDX-IO Cabling

The ULTRIX-HDX-IO blade can be installed in an ULTRIX-NS-FR1, ULTRIX-NS-FR2, and ULTRIX-FR5 router. Each blade provides 16 SDI outputs. The BNCs are numbered starting with **OUT 1** and the total number of BNCs depends on the router model you are using.

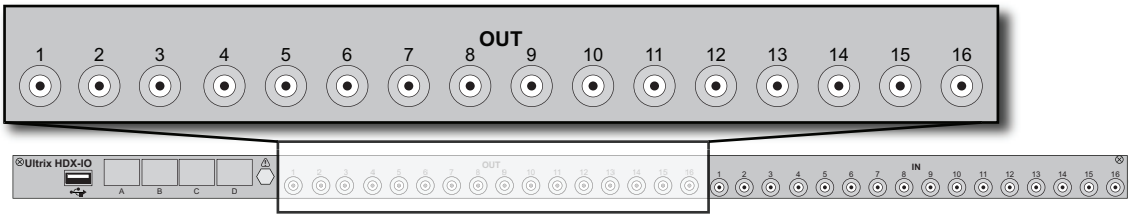


Figure 24 ULTRIX-HDX-IO Blade — SDI Outputs

Gearbox Cabling

A Gearbox is a group of four consecutive inputs or four consecutive outputs that are automatically grouped together in the Ultrix database. The first port of the Gearbox group is used for routing and Ultriscape, while the remaining three ports in the group are reserved but not used (they are not listed in the Third Party Matrices, Sources, and Destinations tabs of the database).

✶ An Ultrispeed license is required for Gearbox functionality. Refer to the ***Ultrix User Guide*** for details on installing license keys.

For More Information on...

- supported video formats for a Gearbox, refer to "**Supported Video Formats**".

ULTRIX-HDBNC-IO Cabling

This section outlines the Gearbox cabling designations when using an ULTRIX-HDBNC-IO blade. **Figure 25** illustrates the connections allocated for Gearbox groups on an ULTRIX-HDBNC-IO blade.

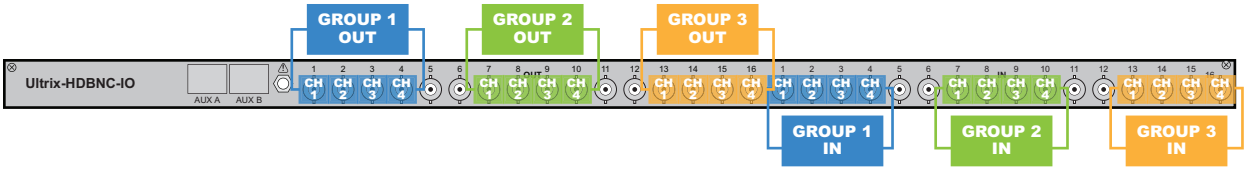


Figure 25 Example of Gearbox Mapping on a Single Ultrix-HDBNC-IO Blade

Outputs

When you configure a Gearbox output group, Ultrix takes the signals of the four 3G Level A channels together and provides a single 12G signal to an output. **Table 7** outlines the default output groups for the ULTRIX-HDBNC-IO blade

Table 7 Gearbox Mapping — Default Output Groups

Group	Channel 1	Channel 2	Channel 3	Channel 4
1	slot#.out[1]	slot#.out[2]	slot#.out[3]	slot#.out[4]
2	slot#.out[7]	slot#.out[8]	slot#.out[9]	slot#.out[10]
3	slot#.out[13]	slot#.out[14]	slot#.out[15]	slot#.out[16]

Inputs

When you enable a Gearbox input group, Ultrix multiplexes the signals of the four 3G Level A channels together. **Table 8** outlines the default inputs for the ULTRIX-HDBNC-IO blade

Table 8 Gearbox Mapping — Default Input Groups

Group	Channel 1	Channel 2	Channel 3	Channel 4
1	slot#.in[1]	slot#.in[2]	slot#.in[3]	slot#.in[4]
2	slot#.in[7]	slot#.in[8]	slot#.in[9]	slot#.in[10]
3	slot#.in[13]	slot#.in[14]	slot#.in[15]	slot#.in[16]

ULTRIX-HDX-IO Cabling

Figure 25 illustrates the connections allocated for Gearbox groups on the ULTRIX-HDX-IO blade.

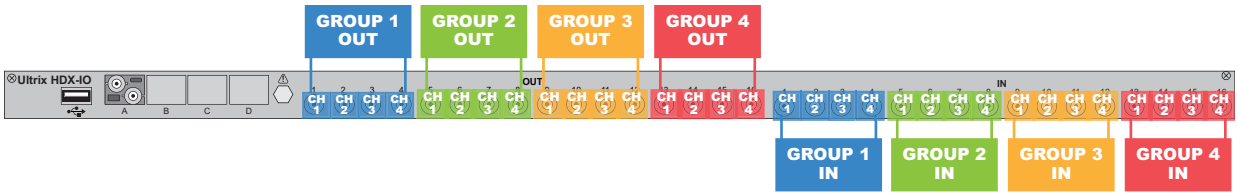


Figure 26 Example of Gearbox Mapping on a Single ULTRIX-HDX-IO Blade

Outputs

When you configure a Gearbox output group, Ultrix takes the signals of the four 3G Level A channels together and provides a single 12G signal to an output. **Table 9** outlines the default output groups for the ULTRIX-HDX-IO blade.

Table 9 Gearbox Mapping — Default Output Groups on the ULTRIX-HDX-IO

Group	Channel 1	Channel 2	Channel 3	Channel 4
1	slot#.out[1]	slot#.out[2]	slot#.out[3]	slot#.out[4]
2	slot#.out[5]	slot#.out[6]	slot#.out[7]	slot#.out[8]
3	slot#.out[9]	slot#.out[10]	slot#.out[11]	slot#.out[12]
4	slot#.out[13]	slot#.out[14]	slot#.out[15]	slot#.out[16]

Inputs

When you enable a Gearbox input group, Ultrix multiplexes the signals of the four 3G Level A channels together. **Table 10** outlines the default inputs for the ULTRIX-HDX-IO blade.

Table 10 Gearbox Mapping — Default Input Groups on the ULTRIX-HDX-IO

Group	Channel 1	Channel 2	Channel 3	Channel 4
1	slot#.in[1]	slot#.in[2]	slot#.in[3]	slot#.in[4]
2	slot#.in[5]	slot#.in[6]	slot#.in[7]	slot#.in[9]
3	slot#.in[9]	slot#.in[10]	slot#.in[11]	slot#.in[12]
4	slot#.in[13]	slot#.in[14]	slot#.in[15]	slot#.in[16]

Cabling for UltriScape

The number of UltriScape (Multiviewer) Heads for your Ultrix router depends on the number of UltriScape licenses enabled and the total number slots populated with I/O Boards.

For More Information on...

- cabling the ULTRIX-MODX-IO blade, refer to the ***ULTRIX-MODX-IO User Guide***.

Overview

Table 11 lists the connections on the rear panel that are available for UltriScape Heads based on the type of blade installed in the slot.

Table 11 Outputs Allocated for UltriScape Heads

Blade Model	Slot	UltriScape Head 1	UltriScape Head 2	UltriScape Head 3
ULTRIX-HDBNC-IO	Slot #	AUX A or OUT 1	OUT 5 or OUT 7	OUT 11 or OUT 13
ULTRIX-HDX-IO	Slot #	AUX A or OUT 1	AUX B or OUT 5	OUT 13
ULTRIX-IP-IO	Slot #	AUX 1	AUX 2	--
ULTRIX-IPX-IO	Slot #	AUX A	AUX B	--
ULTRIX-SFP-IO	Slot #	AUX A or SFP 1	SFP 5 or SFP 7	SFP 11 or SFP 13

Cabling Designations

This section outlines the UltriScape Head cabling designations for each I/O blade.

ULTRIX-HDBNC-IO Cabling

Figure 27 illustrates the connections allocated for UltriScape Heads on the ULTRIX-HDBNC-IO blade.

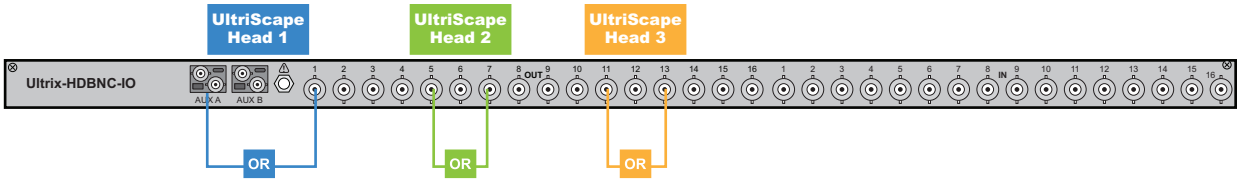


Figure 27 Example of UltriScape Head Mapping on a Single ULTRIX-HDBNC-IO Blade

ULTRIX-HDX-IO Cabling

Figure 28 illustrates the connections allocated for UltriScape Heads on the ULTRIX-HDX-IO blade.

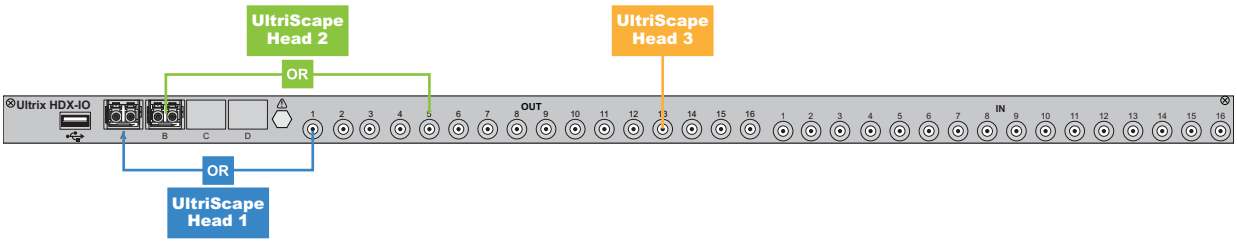


Figure 28 Example of UltriScape Head Mapping on a Single ULTRIX-HDX-IO Blade

ULTRIX-IP-IO Cabling

Figure 29 illustrates the connections allocated for UltriScape Heads on the ULTRIX-IP-IO blade.

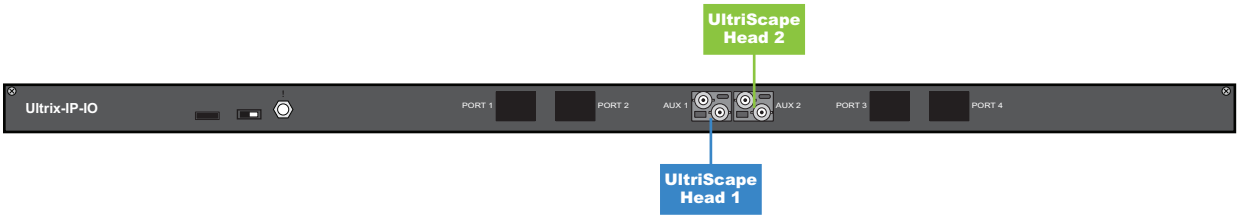


Figure 29 Example of UltriScape Head Mapping on a Single ULTRIX-IP-IO Blade

ULTRIX-IPX-IO Cabling

Figure 29 illustrates the connections allocated for UltriScape Heads on the ULTRIX-IPX-IO blade.

Figure 30 Example of UltriScape Head Mapping on a Single ULTRIX-IPX-IO Blade

ULTRIX-SFP-IO Cabling

Figure 27 illustrates the connections allocated for UltriScape Heads on the ULTRIX-SFP-IO blade.

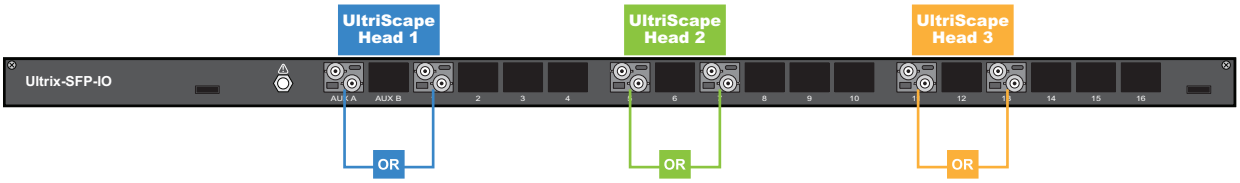


Figure 31 Example of UltriScape Head Mapping on a Single ULTRIX-SFP-IO Blade

SFP Cabling

The primary function of SFP+ modules is to provide inputs and outputs different to the formats that the HD-BNCs provide. The number of ports you have depends on the model of Ultrix router you are using, the blade(s) installed in the router, and the number of SFP+ modules you have chosen to install for each blade.

✶ The AUX ports on the ULTRIX-IP-IO and ULTRIX-IPX-IO blades can only be used for Ultriscape Head outputs.

For More Information on...

- cabling the ULTRIX-MODX-IO blade, refer to the ***ULTRIX-MODX-IO User Guide***.

Working with Fiber Optic Connectors

Keep the following in mind if the SFP+ module(s) installed in a port includes a fiber optic connector:

- Every time you are required to insert a connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.
- Connectors must always be inserted into a device or have a dust cap on.
- A poor optical connection is often similar to a poor electrical connection. Try removing the connector, cleaning, and re-inserting the connector. A bad connection can result in experiencing instability of signal, high loss, or a noisy signal.

For More Information on...

- the available SFP+ modules, refer to "**Supported SFP Modules**".

Cabling Overview

✶ AUX port I/O are not available in the FLEX slot (topmost slot of the ULTRIX-FR5).

To connect to a third-party device via an AUX port on the ULTRIX-HDBNC-IO blade

1. Connect the end of an interface cable to an **AUX** port on the blade.
2. Connect the other end of the interface cable to the device that will communicate with the router via the **AUX** port.

ULTRIX-HDBNC-IO Cabling

The ULTRIX-HDBNC-IO blades can be installed in an ULTRIX-FR1, ULTRIX-NS-FR1, ULTRIX-FR2, ULTRIX-NS-FR2, and ULTRIX-FR5 router. Each blade provides up to two AUX ports that can be connected to a third-party device. Refer to **Figure 32** for AUX port designations.

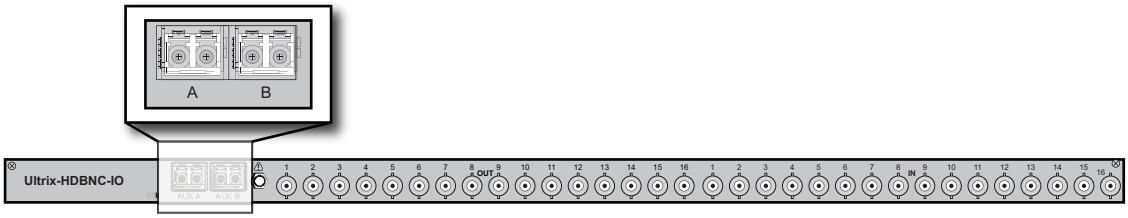


Figure 32 AUX Ports — ULTRIX-HDBNC-IO Blade

ULTRIX-HDX-IO Cabling

The ULTRIX-HDX-IO blade can be installed in an ULTRIX-NS-FR1, ULTRIX-NS-FR2, and ULTRIX-FR5 router. Each blade provides AUX ports that can be connected to a third-party device. (**Figure 33**)

✶ The AUX C and AUX D ports are not implemented.

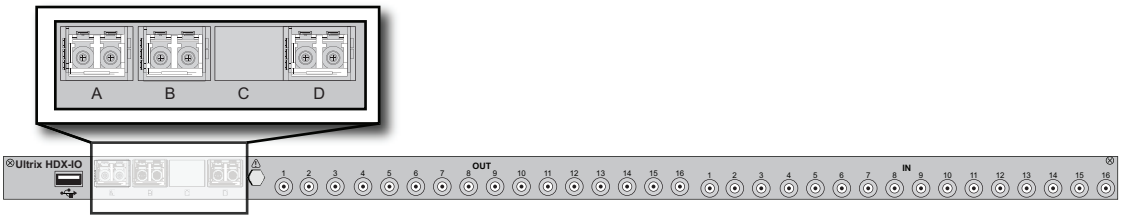


Figure 33 AUX Ports — ULTRIX-HDX-IO Blade

ULTRIX-IP-IO Cabling

Each ULTRIX-IP-IO blade provides two AUX ports that can be connected to a third-party device. (**Figure 34**)

✶ The AUX ports on the ULTRIX-IP-IO blade can only be used for Ultriscape Head outputs.

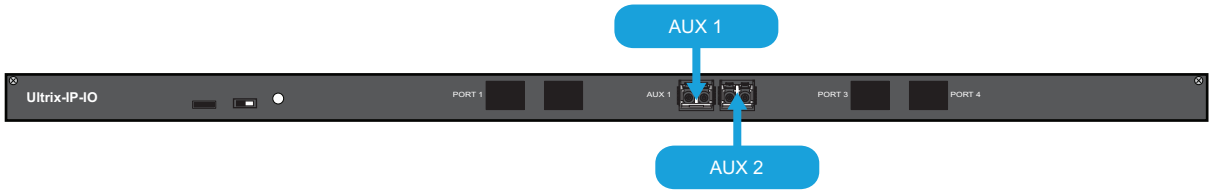


Figure 34 Location of the AUX Ports on the ULTRIX-IP-IO Blade

ULTRIX-IPX-IO Cabling

Each ULTRIX-IPX-IO blade includes four AUX ports that can be connected to a third-party device. (**Figure 34**)

✶ The AUX A and B ports on the ULTRIX-IPX-IO blade can only be used for Ultriscape Head outputs.

✶ The AUX C and AUX D ports are not implemented.

Figure 35 Location of the AUX Ports on the ULTRIX-IPX-IO Blade

ULTRIX-SFP-IO Cabling

The ULTRIX-SFP-IO blade provides up to 16 ports that can be populated with supported SFP+ modules.

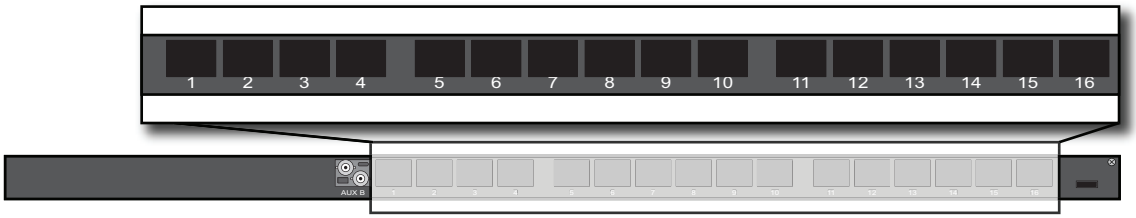


Figure 36 Location of SFP Ports on the ULTRIX-SFP-IO Blade

Each blade also provides two AUX ports that can be connected to a third-party device. (**Figure 37**)

✶ AUX port I/O are not available in the FLEX slot (topmost slot of the ULTRIX-FR5).

Figure 37 ULTRIX-FR5 — ULTRIX-SFP-IO Blade

Cabling for IP Streaming

This chapter applies when an ULTRIX-IP-IO or ULTRIX-IPX-IO blade is installed in your router and a port is populated with an SFP+ module.

✶ Refer to the document ***Ultrix Important Regulatory and Safety Notices*** that shipped with your router, for safety information when handling fiber optic components.

Working with Fiber Optic Connectors

Keep the following in mind if the QSFP28 module installed in a port includes a fiber optic connector:

- Every time you are required to insert a connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.
- Connectors must always be inserted into a device or have a dust cap on.
- A poor optical connection is often similar to a poor electrical connection. Try removing the connector, cleaning, and re-inserting the connector. A bad connection can result in experiencing instability of signal, high loss, or a noisy signal.

For More Information on...

- the available SFP+ modules, refer to "**Supported SFP Modules**".

To cable an port on the blade

Caution — *Every time you are required to insert a connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors. Connectors must always be inserted into a device or have a dust cap on.*

1. Remove the dust caps from each port on the blade.
2. Ensure that the exposed surface of the ceramic ferrule of each connector is clean. Refer to "**Working with Fiber Optic Connectors**" for cleaning tips.
3. Cable your port as required. (**Figure 38** or **Figure 39**)

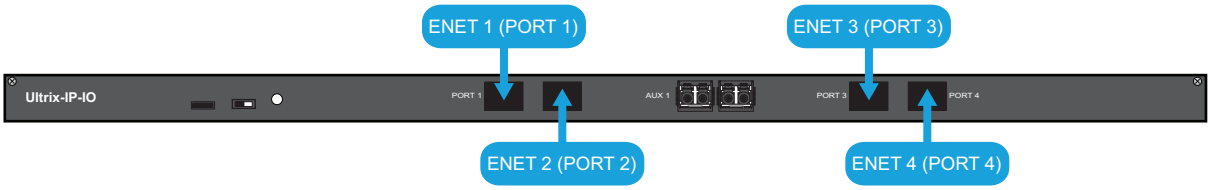


Figure 38 ULTRIX-IP-IO — Ports 1-4

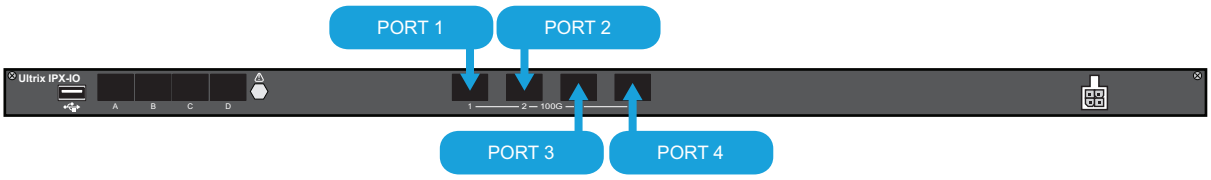


Figure 39 ULTRIX-IPX-IO — Ports 1-4

For More Information on...

- configuring the senders and receivers, refer to the ***Ultrix User Guide*** for your router.

Cabling for UltriProc

The number of UltriProc ports for your Ultrix router depends on the number of UltriProc licenses enabled on a slot, and the data rate the UltriProc will operate in. Each UltriProc license provides one proc amp engine that can be assigned to one physical port on the router.

✶ The UltriProc licenses are supported on the ULTRIX-HDX-IO or ULTRIX-MODX-IO blades only.

For More Information on...

- setting the data rate for UltriProc, refer to the ***Ultrix User Guide***.
- cabling the ULTRIX-MODX-IO blade, refer to the ***ULTRIX-MODX-IO User Guide***.

ULTRIX-HDX-IO Cabling

The UltriProc cabling designations depend on the data rate mode.

Data Rates of 3Gbps

When the UltriProc operates at data rates up to 3Gbps[1], the license is available on the even numbered inputs (Input 2, 4, 6, 8, 10, 12, 14, 16) or outputs (Output 2, 4, 6, 8, 10, 12, 14, 16) per blade.

Figure 40 illustrates the connections allocated for UltriProc on the ULTRIX-HDX-IO blade for data rates up to 3Gbps.

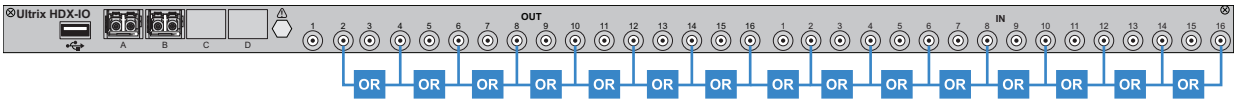


Figure 40 Example of UltriProc 3Gbps Mapping on a Single ULTRIX-HDX-IO Blade

Data Rates of 6Gbps or 12Gbps

When the UltriProc operates at data rates up to 6Gbps[2] and 12Gbps[3], the license is available on 4 inputs (Input 2, Input 6, Input 10, Input 14) or 4 outputs per blade (Output 2, Output 6, Output 10, Output 14). This mode also requires an UltriSpeed license.

Figure 41 illustrates the connections allocated for UltriProc on the ULTRIX-HDX-IO blade for data rates up to 6Gbps and 12Gbps.

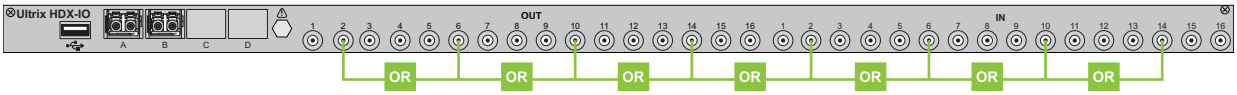


Figure 41 Example of UltriProc 6Gbps or 12Gbps Mapping on a Single ULTRIX-HDX-IO Blade

1. 1080p 50/59.94/60Hz
2. 2160p 23.98/24/25/29.97/30Hz
3. 2160p 50/59.94/60Hz

Connecting to Ross Devices

This chapter provides workflow examples with other Ross devices.

Connecting to an Ultricore BCS

Adding an Ultricore BCS allows for greater connectivity and router control. It adds support for advanced features such as ULTRIX-IPX-IO blades, NMOS interoperability, tie-line management, and control system redundancy.

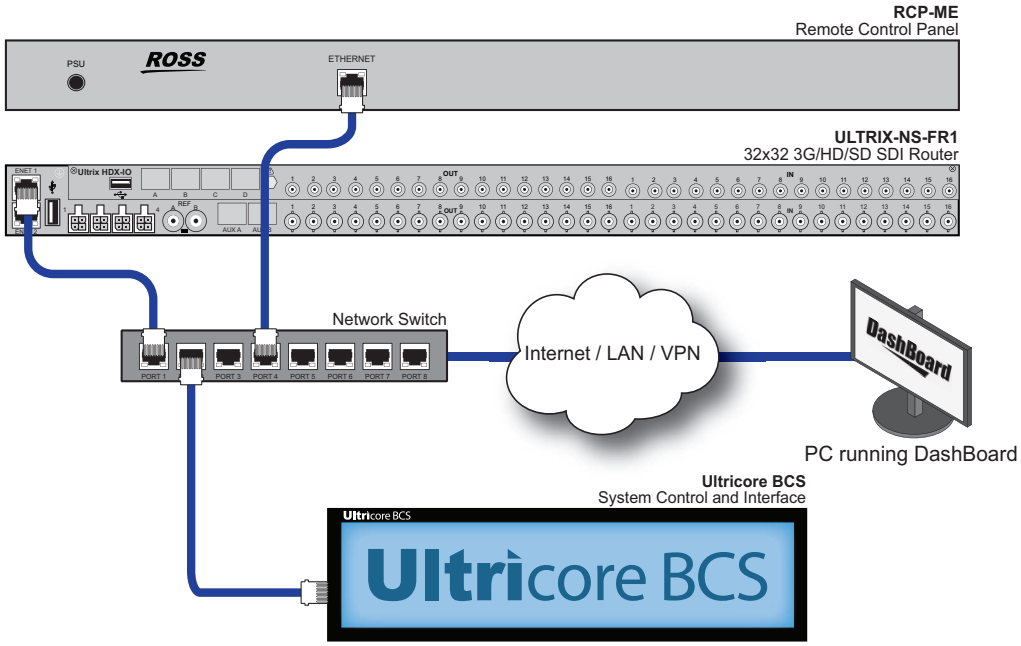


Figure 42 Example of a Simple Routing System with Ultrix and Ultricore BCS

Connecting to a Ross NK Series Device

Ross NK Series devices, such as routers and remote control panels, communicate within the routing system via the Ross T-BUS interface. However, the Ultrix routers communicate only via an Ethernet protocol via a network connection. If you wish to establish communications between an Ultrix router and a Ross NK series device, you have two options: establish an Ethernet connection from the Ross NK Series device to your facility network via an NK-IPS or NK-NET device, or use an Ultricore CC to establish an NK native T-BUS connection.

To establish communication between an Ross NK device, such as an RCP-NKM, and your Ultrix router

- Connect the NK device to the same Ethernet network as your Ultrix router using an NK-NET or an NK-IPS, and then set up communications via the Ultricore interface in DashBoard. (**Figure 44**)
- Connect the NK device via the T-Bus connections on an Ultricore and then set up communications via the Ultricore interface in DashBoard. (**Figure 43**)

For More Information on...

- connecting your Ross NK Series device to your facility network, refer to its user documentation.

Adding an Ultricore Central Controller (CC) to the system allows for native T-BUS devices to be added to the system, as well as RS-232 or RS-422 third-party control. The Ultricore communicates over Ethernet to devices in your routing system. **Figure 43** shows a typical connection of Ultricore

with other routing system components. Note that in this arrangement, Ultricore will act as a system master for all switching and database related functions.

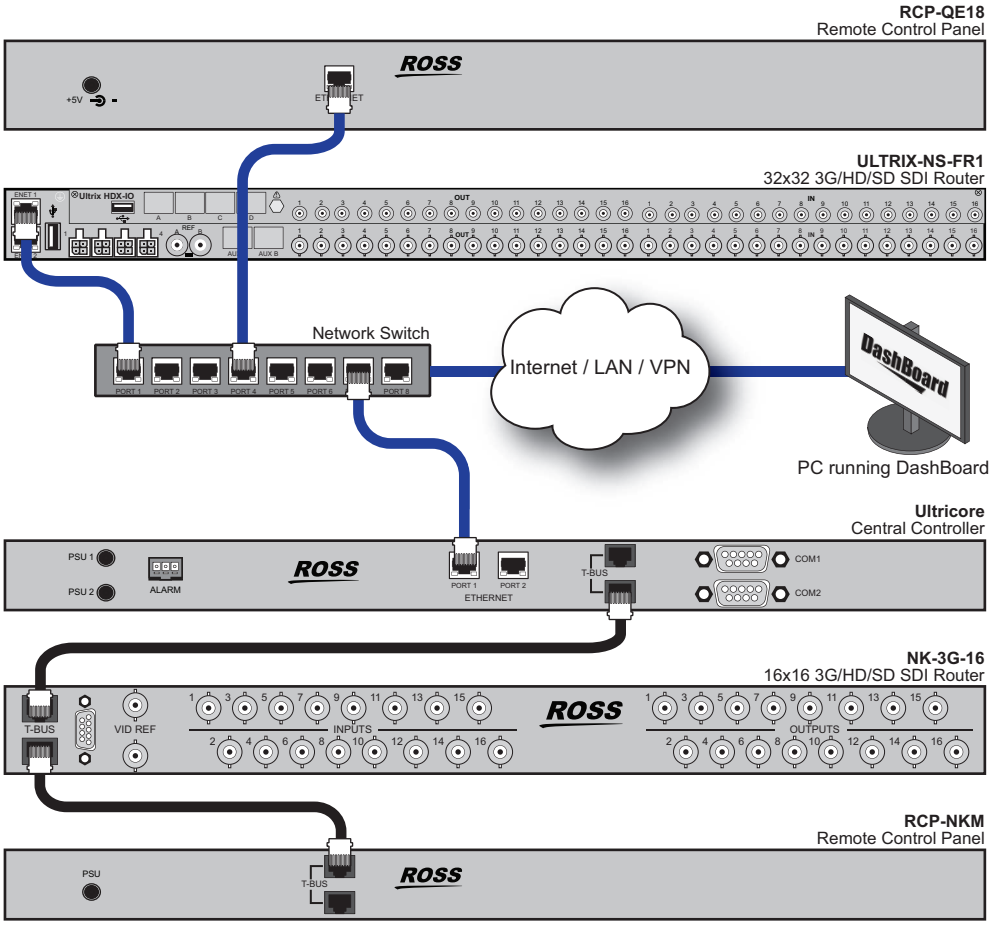


Figure 43 Example of a Routing System with Ross NK Devices and an ULTRIX-FR1 Router

Figure 44 provides an example of a system with an Ultrix and several Ross NK devices over T-Bus.

✶ The NK-NET requires any Ross NK router to supply phantom power for operation.

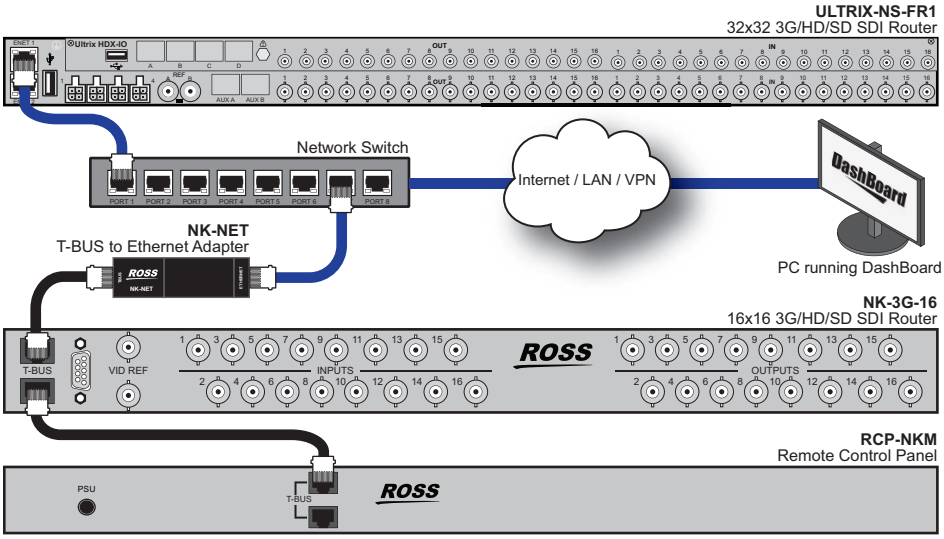


Figure 44 Connection Example with an NK-NET

ULTRIX-HDBNC-IO Overview

This chapter outlines the default input and output cabling designations for an ULTRIX-HDBNC-IO blade. The SDI cabling designations are the same regardless of the router model.

SDI Input Cabling

Figure 45 outlines the SDI input cabling designations for an ULTRIX-HDBNC-IO blade. The input BNCs are located on the right side of each blade.

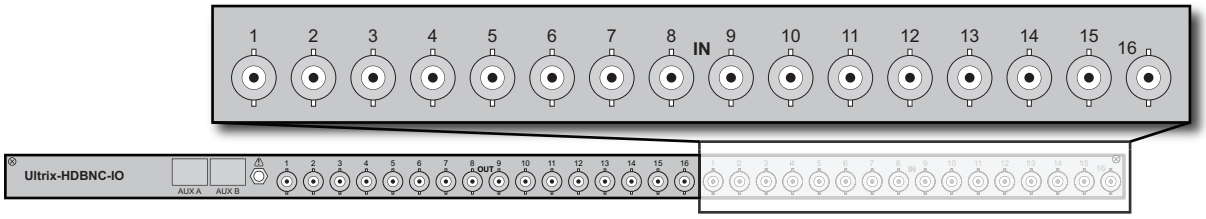


Figure 45 Ultrix Rear Panel — IN BNC Mapping for an ULTRIX-HDBNC-IO Blade

SDI Output Cabling

Figure 46 outlines the SDI output cabling designations for an ULTRIX-HDBNC-IO blade. The output BNCs are located on the left side of each blade.

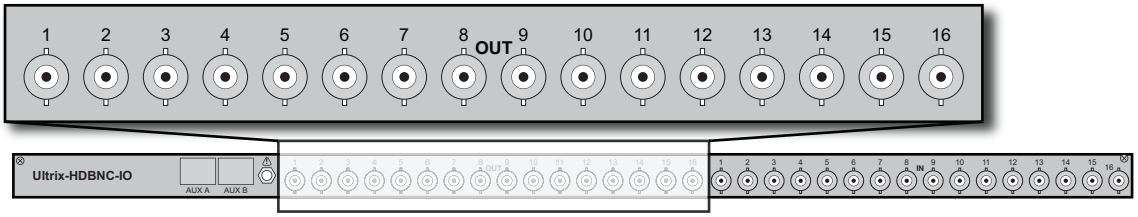


Figure 46 Ultrix Rear Panel — OUT BNC Mapping for an ULTRIX-HDBNC-IO Blade

AUX Ports Designations

Figure 47 outlines the AUX port cabling designations for an ULTRIX-HDBNC-IO blade.

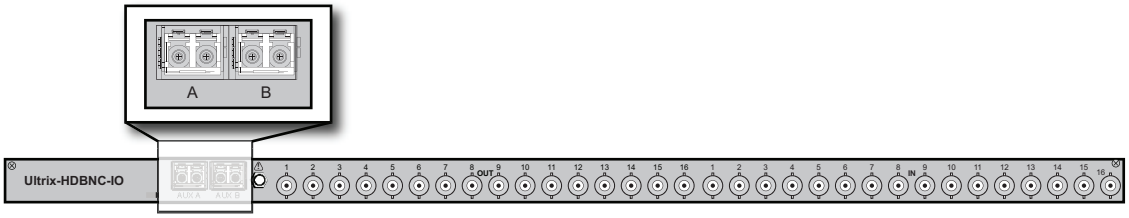


Figure 47 Ultrix Rear Panel — AUX Mapping for an ULTRIX-HDBNC-IO Blade

UltriScape Cabling

Figure 48 illustrates the connections allocated for UltriScape Heads on the ULTRIX-HDBNC-IO blade.

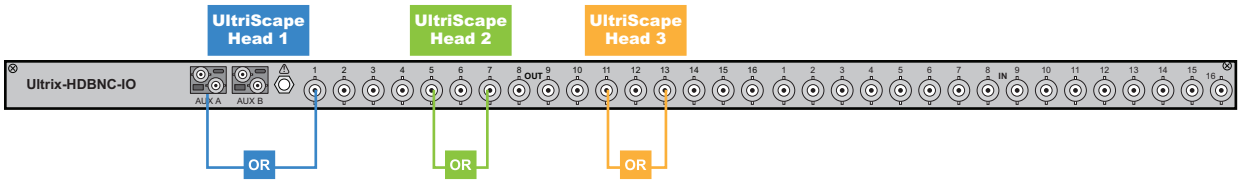


Figure 48 Ultrix Rear Panel — UltriScape Head Mapping for an ULTRIX-HDBNC-IO Blade

ULTRIX-HDX-IO Overview

This chapter outlines the default cabling designations for an ULTRIX-HDX-IO blade.

SDI Input Cabling

Figure 49 outlines the input cabling designations for an ULTRIX-HDX-IO blade. The input BNCs are located on the right side of each blade.

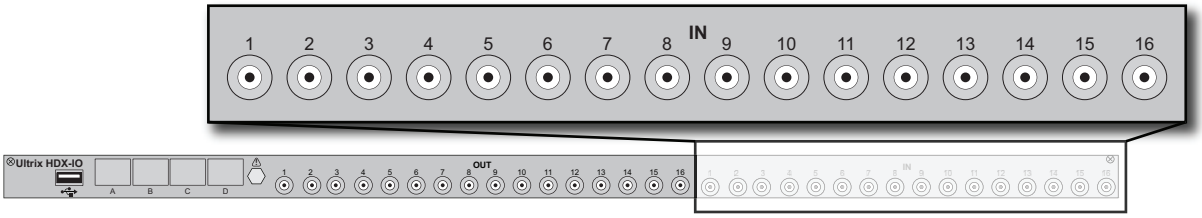


Figure 49 Ultrix Rear Panel — SDI Input BNC Mapping for an ULTRIX-HDX-IO Blade

SDI Output Cabling

Figure 50 outlines the output cabling designations for an ULTRIX-HDX-IO blade. The output BNCs are located on the left side of each blade.

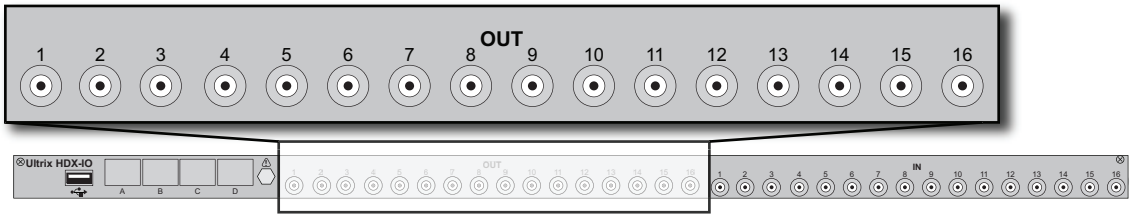


Figure 50 Ultrix Rear Panel — SDI Output BNC Mapping for an ULTRIX-HDX-IO Blade

AUX Ports Designations

Figure 51 outlines the AUX designations for an ULTRIX-HDX-IO blade.

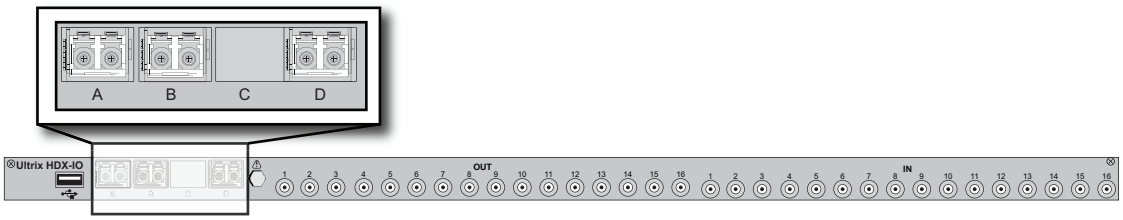


Figure 51 Ultrix Rear Panel — AUX Port Mapping for an ULTRIX-HDX-IO Blade

- AUX C is not implemented.
- AUX D is only required for the UltriStream licensed feature. Refer to the ***Ultrix User Guide*** for details.

UltriScape Cabling

Figure 52 outlines the mapping of the UltriScape Heads on an ULTRIX-HDX-IO blade.

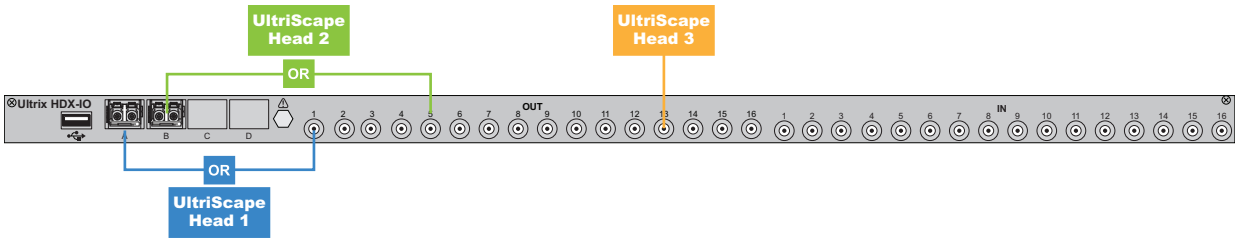


Figure 52 Ultrix Rear Panel — UltriScape Head Mapping for an ULTRIX-HDX-IO Blade

UltriProc Cabling

Figure 53 illustrates the connections allocated for UltriProc on the ULTRIX-HDX-IO blade for data rates up to 3Gbps.

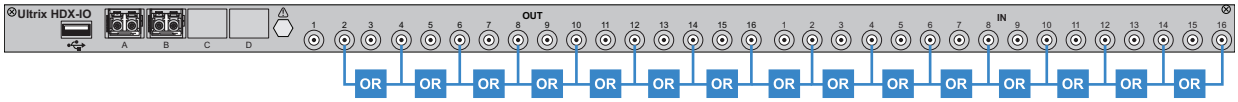


Figure 53 Example of UltriProc 3Gbps Mapping on a Single ULTRIX-HDX-IO Blade

Figure 54 illustrates the connections allocated for UltriProc on the ULTRIX-HDX-IO blade for data rates up to 6Gbps and 12Gbps.

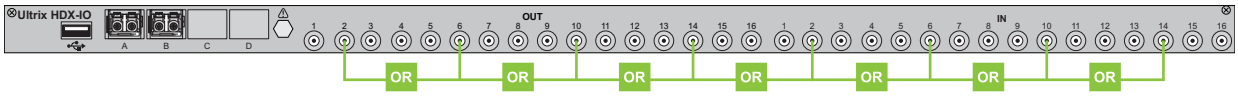


Figure 54 Example of UltriProc 6Gbps or 12Gbps Mapping on a Single ULTRIX-HDX-IO Blade

ULTRIX-IP-IO Overview

This chapter outlines the default cabling designations for an ULTRIX-IP-IO blade.

✶ The ULTRIX-IP-IO blade cannot be installed in the FLEX slot of an ULTRIX-FR5.

For More Information on...

- the available SFP+ modules, refer to "**Supported SFP Modules**".

ENET Ports

There are four ports on the ULTRIX-IP-IO blade that can be populated with supported SFP modules and designated as ethernet connections. The primary function of each ULTRIX-IP-IO PORT (1-4) is to provide a 25GbE network interface (SFP28) that can be configured as a Receiver and/or a Sender in DashBoard.

✶ These ports are labeled as ENET ports in the DashBoard interfaces.

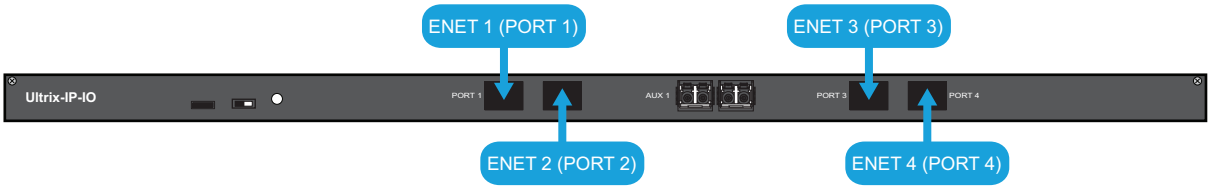


Figure 55 Location of the ENET Ports on the ULTRIX-IP-IO

AUX Ports

✶ The AUX ports on the ULTRIX-IP-IO blade can only be used for Ultriscape Head outputs.

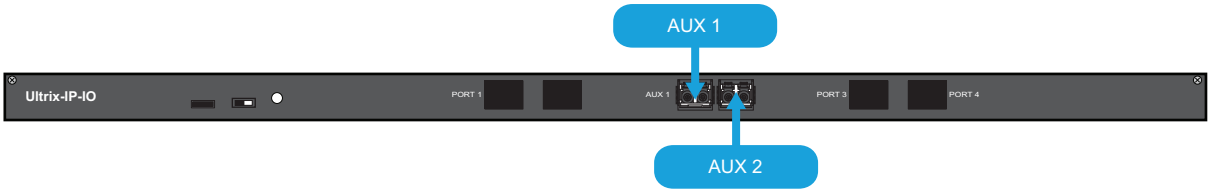


Figure 56 Location of the AUX Ports on the ULTRIX-IP-IO

ULTRIX-IPX-IO Overview

The ULTRIX-IPX-IO blades seamlessly integrate SMPTE ST-2110 IP streams into the Ultrix platform, without compromising on its powerful features and licensing capabilities. The ULTRIX-IPX-IO offers scalability and high total bandwidth, making it suitable for a range of IP applications.

Features

- Can be installed in the:
  - ULTRIX-NS-FR1
  - ULTRIX-NS-FR2
  - ULTRIX-FR5
  - ULTRIX-FR12
- Video streams per blade:
  - UHD: 8+8 redundant[1]
  - 3G/HD: 16+16 redundant
- Supported video formats:
  - 720p 25/ 29.97/ 30/ 50 / 59.94 / 60
  - 1080i 50 / 59.94 / 60
  - 1080p 25/ 29.97/ 30/ 50 / 59.94 / 60
  - 2160p 25/ 29.97/ 30/ 50 / 59.94/60
- IP transport support:
  - SMPTE ST 2110-10, System Timing and Definitions
  - SMPTE ST 2110-20, Uncompressed Active Video
  - SMPTE ST 2110-30, PCM Digital Audio
  - SMPTE ST 2110-40, ANC Data
- System timing: PTP Follower (SMPTE 2059, AES67 and IEEE-1588 default profiles)
- Control and setup via:
  - NMOS IS-04 and IS-05 for AIMS-compliant discovery, registration, and connection control
  - Ember+ discovery, registration, and connection control from popular third-party control systems (requires an Ultricore-EMBER+ license)[2]
  - Provisioning and monitoring via DashBoard and/or our published JSON API

Hardware

The Ultrix v5.3.0 software currently supports:

- The 100Gb QSFP28 transceiver modules based on 4x25Gb NRZ optical lanes, requiring no FEC or RS(528,514) KR4 FEC, or based on 1x100Gb PAM4 optical lane, either requiring no FEC or providing built-in RS(544,514) KP4 FEC.
- The 4x25Gb NRZ QSFP28 transceiver modules, available for both multi-mode or single-mode fibers, are identifiable by 100GBASE-SR4, 100GBASE-SWDM4, 100GBASE-PSM4, 100GBASE-CWDM4, 100GBASE-4WDM-10/20/40, and 100GBASE-CLR4.

1. Due to software limitations.
2. Ultrix implements BESS v1.1 for Ember+ support.

- The 1x100Gb PAM4 QSFP28 transceiver modules, available for single-mode fibers, are identifiable by 100GBASE-DR, 100GBASE-FR, 100GBASE-LR, compliant with the 100G Lambda MSA, including built-in RS(544,514) KP4 FEC.

✶ Contact Ross Technical Support about other QSFP28 transceiver modules not listed above.

QSFP28 Ports

The ULTRIX-IPX-IO blade includes four QSFP28 ports (1-4). Each port is a:

- fiber optical transceiver module that integrates four transmit and four receiver lanes
- 100Gigabit Ethernet (100GbE) ethernet connection

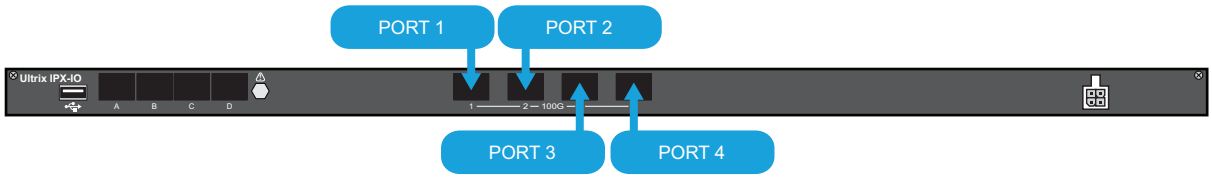


Figure 57 Location of Ports 1-4 on the ULTRIX-IPX-IO

AUX Ports

The AUX A and AUX B ports can only be used for Ultriscape Head outputs.

✶ The AUX C and AUX D ports are not implemented.

Figure 58 Location of the AUX Ports on the ULTRIX-IPX-IO

PSU Port

The power supply connector located on the ULTRIX-IPX-IO blade requires a 15VDC connection to an external power supply. Refer to the Ross Configuration Tool on our website for the power requirements of your configuration.

Figure 59 Location of the PSU Port on the ULTRIX-IPX-IO

USB Port

The USB Type B port is used for recovery only.

Figure 60 Location of the USB Port on the ULTRIX-IPX-IO

ULTRIX-SFP-IO Overview

This chapter outlines the default input and output cabling designations for an ULTRIX-SFP-IO blade.

For More Information on...

- the available SFP+ modules, refer to "**Supported SFP Modules**".

SFP Ports

The ULTRIX-SFP-IO blade provides up to 16 ports that can be populated with supported SFP+ modules.

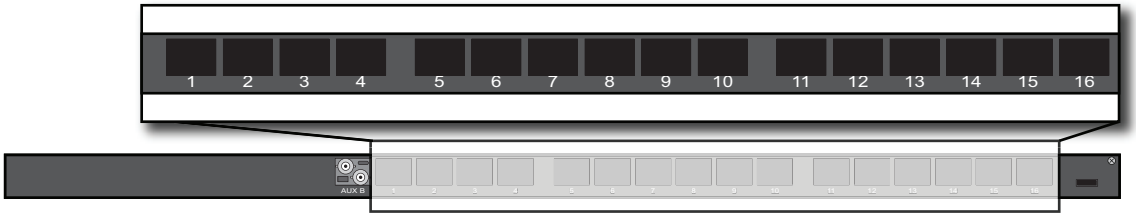


Figure 61 Location of SFP Ports on the ULTRIX-SFP-IO Blade

AUX Ports

✶ AUX port I/O are not available in the FLEX slot (topmost slot of the ULTRIX-FR5).

Figure 62 Location of AUX Ports on the ULTRIX-SFP-IO Blade

Technical Specifications

This chapter provides technical information for Ultrix routers. Note that specifications are subject to change without notice.

Physical Dimensions

Table 12 Technical Specifications — Physical Dimensions

Item	ULTRIX(-NS)-FR1	ULTRIX(-NS)-FR2	ULTRIX-FR5
Width	17.5″ (44.45cm)	17.5″ (44.45cm)	17.5″ (44.45cm)
Depth	7.9″ (20cm)	7.9″ (20cm)	7.9″ (20cm)
Height	1.74″ (4.40cm)	3.48″ (8.80cm)	8.7″ (22cm)
Weight (approx.)	12lb (5.4kg)	17lb (7.70kg)	42.5lb (19.3kg)

Inventory

Table 13 Technical Specifications — Inventory

Item	ULTRIX(-NS)-FR1	ULTRIX(-NS)-FR2	ULTRIX-FR5
Video Matrix Size (max.)	36x36	72x72	160x160
Fixed I/O Slots[a]	1 (16x16)	1 (16x16)	0
Optional I/O Slots[a]	1 (16x16)	3 (48x48)	9 (144x144)
Audio			
Audio Matrix Size (max.)[b]	512x512	1024x1024	2592x2592
Audio Matrix Size (with Optional MADI SFPs)	768x768	1536x1536	3456x3456
MultiViewer			
Ultriscape Licenses per slot	3	3	3
Maximum Multiviewer Heads per System	6	12	27
UHD			
UltriSpeed Licenses per frame	1	1	1

a. Optional SFP AUX I/O available to support up to 18x18 per slot.

Supported Frame Sync/Clean Switch Video Formats for Conversion

Table 14 Reference Formats — FSCS Video

Provided Reference Format	Frame Sync/Clean Switch Video
NTSC	480i 59.94Hz
	720p 29.97Hz
	720p 59.94Hz
	1080i 59.94Hz
	1080p 29.97Hz
	1080p Level A 59.94Hz
	1080p Level B 59.94Hz
	1080pSF 29.97Hz
	2160p 29.97Hz
	2160p 59.94Hz
PAL	576i 50Hz
	720p 25Hz
	720p 50Hz
	1080i 50Hz
	1080p 25Hz
	1080p Level A 50Hz
	1080p Level B 50Hz
	1080pSF 25Hz
	2160p 25Hz
	2160p 50Hz
720p[a]	
50Hz	720p 50Hz
	1080p Level A 50Hz
	1080p Level B 50Hz
	2160p 50Hz
59.94Hz	720p 59.94Hz
	1080p Level A 59.94Hz
	1080p Level B 59.94Hz
	2160p 59.94Hz
60Hz	720p 60Hz
	1080p 60Hz
	2160p 60Hz

Table 14 Reference Formats — FSCS Video

Provided Reference Format	Frame Sync/Clean Switch Video
1080i[b]	
50Hz	576i 50Hz
	720p 25Hz
	720p 50Hz
	1080i 50Hz
	1080p 25Hz
	1080p Level A 50Hz
	1080p Level B 50Hz
	1080pSF 25Hz
	2160p 25Hz
	2160p 50Hz
59.94Hz	480i 59.94Hz
	720p 29.97Hz
	720p 59.94Hz
	1080i 59.94Hz
	1080p 29.97Hz
	1080p Level A 59.94Hz
	1080p Level B 59.94Hz
	1080pSF 29.97Hz
	2160p 29.97Hz
	2160p 59.94Hz
60Hz	720p 30Hz
	720p 60Hz
	1080i 60Hz
	1080p 30Hz
	1080p Level A 60Hz
	1080p Level B 60Hz
	1080pSF 30Hz
	2160p 30Hz
	2160p 60Hz
1080p	
23.98Hz	1080p 23.98Hz
24Hz	1080p 24Hz

Table 14 Reference Formats — FSCS Video

Provided Reference Format	Frame Sync/Clean Switch Video
1080p	
25Hz	576i 50Hz
	720p 25Hz
	720p 50Hz
	1080i 50Hz
	1080p 25Hz
	1080p Level A 50Hz
	1080p Level B 50Hz
	1080pSF 25Hz
	2160p 25Hz
	2160p 50Hz
29.97Hz	480i 59.94Hz
	720p 29.97Hz
	720p 59.94Hz
	1080i 59.94Hz
	1080p 29.97Hz
	1080p Level A 59.94Hz
	1080p Level B 59.94Hz
	1080pSF 29.97Hz
	2160p 29.97Hz
	2160p 59.94Hz
30Hz	720p 30Hz
	720p 60Hz
	1080i 60Hz
	1080p 30Hz
	1080p Level A 60Hz
	1080p Level B 60Hz
	1080pSF 30Hz
	2160p 30Hz
	2160p 60Hz
1080pSF[c]	
23.98Hz	1080pSF 23.98Hz
24Hz	1080pSF 24Hz

a. The Frame Sync does not support 720p dual stream 60/59.94/50 formats. The Clean Switch does.
b. The Frame Sync does not support 1080i dual stream 60/59.94/50 formats. The Clean Switch does.
c. The Frame Sync does not support 1080pSF 30/29.97/25 formats. The Clean Switch does.

Supported Video Formats

Table 15 Technical Specifications — Supported Formats

Resolution (lines)	Interlace / Progressive	Frame Rate (Hz)	SDI Routing	UltriMix	Ultriscape	Gearbox
SD						
525	I	59.94	✓	✓	✓	
625	I	50	✓	✓	✓	
HD						
720	P	60	✓	✓	✓	
720	P	59.94	✓	✓	✓	
720	P	50	✓	✓	✓	
1080	I	60	✓	✓	✓	
1080	I	59.94	✓	✓	✓	
1080	I	50	✓	✓	✓	
1080	P	30	✓	✓	✓	
1080	P	29.97	✓	✓	✓	
1080	P	25	✓	✓	✓	
1080	P	24	✓	✓	✓	
1080	P	23.98	✓	✓	✓	
1080	PSF	30	✓	✓	✓	
1080	PSF	29.97	✓	✓	✓	
1080	PSF	25	✓	✓	✓	
1080	PSF	24	✓	✓	✓	
1080	PSF	23.98	✓	✓	✓	
3G						
720	P (dual stream)	60	✓	✓[a]	✓[a]	
720	P (dual stream)	59.94	✓	✓[a]	✓[a]	
720	P (dual stream)	50	✓	✓[a]	✓[a]	
1080	I (dual stream)	60	✓	✓[a]	✓[a]	
1080	I (dual stream)	59.94	✓	✓[a]	✓[a]	
1080	I (dual stream)	50	✓	✓[a]	✓[a]	
1080	P	60	✓	✓	✓	✓
1080	P	59.94	✓	✓	✓	✓
1080	P	50	✓	✓	✓	✓
1080	Level B	60	✓	✓	✓	
1080	Level B	59.94	✓	✓	✓	
1080	Level B	50	✓	✓	✓	

Table 15 Technical Specifications — Supported Formats

Resolution (lines)	Interlace / Progressive	Frame Rate (Hz)	SDI Routing	UltriMix	Ultriscape	Gearbox
6G						
2160	P	30	✓	✓	✓	
2160	P	29.97	✓	✓	✓	
2160	P	23.98	✓	✓	✓	
2160	P	25	✓	✓	✓	
2160	P	24	✓	✓	✓	
12G (UHD)						
2160	P	50	✓	✓	✓	
2160	P	59.94	✓	✓	✓	
2160	P	60	✓	✓	✓	

a. First stream is processed (same as Level B).

ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 Power Specifications

The ULTRIX(-NS)-FR1 and ULTRIX(-NS)-FR2 are powered from up to four external power supplies. Each PSU port on the Ultrix rear panel accepts 15V DC power.

Table 16 Technical Specifications — Power Supply Ratings

Item	Specifications
Output	15VDC @ 17A
Output Power	255W
Input	100-240VAC, 50/60Hz
Input Current	4.5A

Table 17 Technical Specifications — Power Connections

Item	Specifications
ULTRIX(-NS)-FR1	Minimum 1 power supply required
	2+ for redundancy
ULTRIX(-NS)-FR2	Minimum 2 power supplies required
	4 for full redundancy

ULTRIX-FR5 Power Specifications

✶ The ULTRIX-FR5 requires the Ultripower Rack Mount Power Supply Unit.

Table 18 Technical Specifications — Power Supply Ratings

Item	Specifications
Output	15VDC @ 20A per connection
Output Power	1200W max. De-rates to 1100W with 110VAC mains supply

Table 18 Technical Specifications — Power Supply Ratings

Item	Specifications
Input	100-264VAC, 50/60Hz
Input Current	10A

Table 19 Technical Specifications — Power Supply Connections

Item	Specifications
ULTRIX-FR5	Minimum 1 Ultripower fitted with 1 power module
	1 Ultripower fitted with 2 power modules

Maximum Power Ratings

Table 20 outlines the maximum power ratings for fully loaded Ultrix router models.

Table 20 Technical Specifications — Maximum Power Ratings

Item	Specifications[a]
ULTRIX(-NS)-FR1 with 2 ULTRIX-HDBNC-IO blades	~150W
ULTRIX(-NS)-FR2 with 4 ULTRIX-HDBNC-IO blades	~310W
ULTRIX-FR5 with 8 ULTRIX-HDBNC-IO blades	~630W
ULTRIX-FR5 with 8 ULTRIX-IP-IO blades	~763W
ULTRIX-NS-FR1 with 2 ULTRIX-HDX-IO blades	204W typical
ULTRIX-NS-FR2 with 4 ULTRIX-HDX-IO blades	395W typical
ULTRIX-FR5 with 8 ULTRIX-HDX-IO blades	979W typical

a. For the latest power numbers for your configuration, refer to the Ross Configuration Tool on our website.

SDI Inputs

Table 21 ULTRIX-HDBNC-IO Blade — Inputs

Item	Specification
Standard Input	HD-BNC
Signal Type (SDI Formats)	270MB/s 1.5GB/s 3GB/s 12GB/s
Impedance	75ohm
Max. Input Level	880mV
Return Loss	Per SMPTE 2082-1

Table 21 ULTRIX-HDBNC-IO Blade — Inputs

Item	Specification
Equalization (typical)	UHD: 50m (160ft) HD, 3G: 200m (650ft) SD: 400m (1300ft)
SFP AUX Connector	Refer to "**Supported SFP Modules**" for a list of AUX options. Refer to the ***Ultrix SFP Modules Guide*** for more information on these options.

SDI Outputs

Table 22 ULTRIX-HDBNC-IO Blade — Outputs

Item	Specification
Standard Output	HD-BNC
Signal Type (SDI Formats)	270MB/s 1.5GB/s 3GB/s 12GB/s
Impedance	75ohm
Amplitude	800mV +/-10%
Rise and Fall Time	270MB/s: 400-800ps 1.5GB/s, 3GB/s: < 135ps 12GB/s: <45ps
DC Offset	0.0V +/-0.5V
Jitter	<0.15UI up to 3G <0.20UI 3G and 12G typical (<0.30UI max.)
Return Loss	Per SMPTE 2082-1
SFP AUX Connector	Refer to "**Supported SFP Modules**" for a list of AUX options. Refer to the ***Ultrix SFP Modules Guide*** for more information on these options.

Embedded Audio

Table 23 Technical Specifications — Audio Inputs

Item	ULTRIX-FR1(-NS)	ULTRIX-FR2(-NS)	ULTRIX-FR5
Audio Channels per SDI I/O	16	16	16
Audio Channels per MADI I/O	Selectable 56 or 64		

Environmental

Table 24 Technical Specifications — Environmental

Item	Specifications
Max. Ambient Temperature Range	0°C to 40°C (32°F to 104°F)
Humidity, non-condensing	< 95%

MicroSD Card

Table 25 Technical Specifications — MicroSD Card

Item	Specifications
Types Supported	Contact Ross Technical Support
Operating Systems Supported	

Ethernet Port Connectors

Each Ultrix router comes standard with two Ethernet ports. Each port uses a standard single 8-pin, RJ45 connector to interface to an 802.3x Ethernet network. While Ultrix supports 1000Mbps (1GbE), 100Mbps, or 10Mbps network interface speeds, an 1GbE network connection is required. The Ethernet ports are operated in a link aggregated or bonded configuration to provide failover functionality.

✶ An 1GbE network connection is required.

Specifications

Table 26 Technical Specifications — Ethernet Ports

Item	Specifications
Standards Accommodated	1000BASE-T (GbE) network
Connector Type	RJ45

Supported USB-Serial Converters

The following USB-Serial chip-sets are supported:

- FTDI
- Silicon Labs CP210x
- Prolific PL2303
- Belkin

Supported SFP Modules

Some of the blades installed in the Ultrix rear panel can be populated with small form-factor pluggable (SFP) modules. Refer to the document ***Ultrix SFP Modules Guide*** for more information on the supported SFP models and their specifications.

Software Licenses

This chapter provides third-party software license information for your Ultrix router. This product includes multiple software components which are individually licensed under one or more of the following licenses included in this chapter.

BSD

Copyright (c) 1991,1993, The Regents of the University of California. All rights reserved.

This code is derived from software contributed to Berkeley by Kenneth Almquist.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

3. <BSD Advertising Clause omitted per the July 22, 1999 licensing change ftp://ftp.cs.berkeley.edu/pub/4bsd/README.Impt.License.Change> California, Berkeley and its contributors.

4. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Dual GPL

Portions of this software are copyright (C) 1996-2002 The FreeType Project (www.freetype.org). All rights reserved.

This project is also covered under the GPL v2.

GPL

GNU GENERAL PUBLIC LICENSE
Version 3, 29 June 2007
Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>
Preamble

The GNU General Public License is a free, copyleft license for software and other kinds of works.

The licenses for most software and other practical works are designed to take away your freedom to share and change the works. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change all versions of a program--to make sure it remains free software for all its users. We, the Free Software Foundation, use the GNU General Public License for most of our software; it applies also to any other work released this way by its authors. You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for them if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you these rights or asking you to surrender the rights. Therefore, you have certain responsibilities if you distribute copies of the software, or if you modify it: responsibilities to respect the freedom of others.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps: (1) assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS

0. Definitions.

“This License” refers to version 3 of the GNU General Public License.

“Copyright” also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

“The Program” refers to any copyrightable work licensed under this License. Each licensee is addressed as “you”. “Licensees” and “recipients” may be individuals or organizations.

To “modify” a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a “modified version” of the earlier work or a work “based on” the earlier work.

A “covered work” means either the unmodified Program or a work based on the Program.

To “propagate” a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To “convey” a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays “Appropriate Legal Notices” to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1.Source Code.

The “source code” for a work means the preferred form of the work for making modifications to it. “Object code” means any non-source form of a work.

A “Standard Interface” means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The “System Libraries” of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A “Major Component”, in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The “Corresponding Source” for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

2.Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

3.Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

4.Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

5.Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

a. The work must carry prominent notices stating that you modified it, and giving a relevant date.

b. The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to “keep intact all notices”.

c. You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

d. If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an “aggregate” if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

6.Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c. Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d. Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e. Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

7.Additional Terms.

"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions. Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.

When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.

Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

a. Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or

b. Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or

c. Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or

d. Limiting the use for publicity purposes of names of licensors or authors of the material; or

e. Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or

f. Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered "further restrictions" within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.

If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.

Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

8.Termination.

You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

9.Acceptance Not Required for Having Copies.

You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

10.Automatic Licensing of Downstream Recipients.

Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.

An “entity transaction” is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

11.Patents.

A “contributor” is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's “contributor version”.

A contributor's “essential patent claims” are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, “control” includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.

Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.

In the following three paragraphs, a “patent license” is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To “grant” such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.

If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. “Knowingly relying” means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.

If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.

A patent license is “discriminatory” if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

12.No Surrender of Others' Freedom.

If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

13.Use with the GNU Affero General Public License.

Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

14.Revised Versions of this License.

The Free Software Foundation may publish revised and/or new versions of the GNU General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies that a certain numbered version of the GNU General Public License “or any later version” applies to it, you have the option of following the terms and conditions either of that numbered version or of any

later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.

If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.

Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

15.Disclaimer of Warranty.

THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16.Limitation of Liability.

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

17.Interpretation of Sections 15 and 16.

If the disclaimer of warranty and limitation of liability provided above cannot be given local legal effect according to their terms, reviewing courts shall apply local law that most closely approximates an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption of liability accompanies a copy of the Program in return for a fee.

LGPL

GNU LESSER GENERAL PUBLIC LICENSE
Version 3, 29 June 2007
Copyright (C) 2007 Free Software Foundation, Inc. <http://fsf.org/>

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

0. Additional Definitions.

As used herein, “this License” refers to version 3 of the GNU Lesser General Public License, and the “GNU GPL” refers to version 3 of the GNU General Public License.

“The Library” refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An “Application” is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A “Combined Work” is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined

Work was made is also called the “Linked Version”.

The “Minimal Corresponding Source” for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the

Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The “Corresponding Application Code” for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

1.Exception to Section 3 of the GNU GPL.

You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

2.Conveying Modified Versions.

If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

a. under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or

b. under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

3.Object Code Incorporating Material from Library Header Files.

The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

a. Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.

b. Accompany the object code with a copy of the GNU GPL and this license document.

4.Combined Works.

You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

a. Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.

b. Accompany the Combined Work with a copy of the GNU GPL and this license document.

c. For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.

d. Do one of the following:

   1) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.

   2) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.

e. Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

5.Combined Libraries.

You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

a. Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.

b. Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

6.Revised Versions of the GNU Lesser General Public License.

The Free Software Foundation may publish revised and/or new versions of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License “or any later version” applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.

MIT

Copyright 1987, 1988 by MIT Student Information Processing Board.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose is hereby granted, provided that the names of M.I.T. and the M.I.T. S.I.P.B. not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. M.I.T. and the M.I.T. S.I.P.B. make no representations about the suitability of this software for any purpose. It is provided “as is” without express or implied warranty.

zlib

Copyright (C) 1995-1998 Jean-loup Gailly and Mark Adler

This software is provided 'as-is', without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.

2. Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.

3. This notice may not be removed or altered from any source distribution.Jean-loup Gailly Mark Adler jloup@gzip.org madler@alumni.caltech.edu

The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files ftp://ds.internic.net/rfc/rfc1950.txt (zlib format), rfc1951.txt (deflate format) and rfc1952.txt (gzip format).

Glossary

The following terms are used throughout this guide:

Connection Point — setting to define a communication connection between an Ultrix and a device in the routing system.

Crosspoint — a switch within a matrix. For example, the connection of signal IN 1 to OUT 1 requires one crosspoint.

Destination — a label applied to a router output (or group of outputs).

Device — a physical, virtual, or software application that may include multiple sources, destinations, senders, or receivers.

Hard Panel — a physical hardware panel of buttons that is used to control the routing system.

Head — An OUT port on the Ultrix router that is assigned as an Ultriscape (Multiviewer) output.

IP Address — a setting that defines the Internet protocol address of a device within a network.

Logical (virtual) Label — a name for a group of routing system inputs or outputs.

Logical (virtual) Routing — the action of switching a group of otherwise unrelated signals via a common label (name).

Map — a table that defines the allocation of names (labels) to router input and output sockets.

Matrix — the part of the routing system that performs the actual signal switching tasks.

Partition — matrices may be partitioned to behave as smaller independent matrices.

Picture in Picture (PIP) — a sub-picture in an Ultriscape (Multiviewer) output.

QSFP28 — Quad Small Form-factor Pluggable 28

Remote Control Panel (RCP) — a physical hardware panel of buttons that is used to control the routing system.

Resource — a source or destination of a router configuration; an external device providing some conversion functionality for use within the routing control system.

Soft Panel — a DashBoard interface that represents a panel of buttons that is used to control the routing system.

Source — a label applied to a router input (or group of inputs).

T-Bus — the Ross Video proprietary routing communication method via a defined physical interface.

UltriClean — clean switch functionality of the Ultrix routers.

Ultricore — refers to the Ultricore-CC and the Ultricore-BCS unless otherwise stated.

UltriMix — SDI embedded audio manipulation sub-system of the Ultrix routers.

Ultriscape — licensed Multiviewer option for Ultrix routers.

UltriSpeed — licensed 12Gbps SDI video option.

UltriSync — a per input licensed frame synchronizer.

ULTRIX-NS-FR1 — refers to the next generation of the ULTRIX-FR1 router. This router displays the Ultrix logo on the front door with a blue dot in the “i”.

ULTRIX-NS-FR2 — refers to the next generation of the ULTRIX-FR2 router. This router displays the Ultrix logo on the front door with a blue dot in the “i”.