Utah Scientific

UHD 12G

System Setup and Operation Guide

32x and 144x Systems

UHD 12G Operations Guide

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Notice

FCC Compliance (USA) and Digital Equipment Compliance (Canada)

This equipment has been tested and found to comply with the limits for a Class A, digital device, pursuant to Part 15, Subpart B of the FCC Rules and the Canadian EMC Requirement (ICES-003). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at their own expense. Shielded cables must be used to ensure compliance with the FCC Class A limits.

Declaration of Conformity

Utah Scientific, Inc.

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

We declare our sole responsibility that the UTAH-100/UHD 12G Digital Routing Switcher is in conformance with the following standards:

Emission

- EN55022:1994+A1&A2

Immunity

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

Safety

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

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

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

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

$$\epsilon$$

Important Safeguards and Notices

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

Safety Symbols

- Hazardous Voltage symbol

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

Warnings

Please observe the following important warnings:

- Any instructions in this guide that require opening the chassis, changing a power supply, or removing a board, should be performed by qualified personnel only. To reduce the risk of electric shock, do not perform any service unless you are qualified to do so.

- Heed all warnings on the unit and in the operating instructions.

- Do not use this product in or near water. Disconnect AC power before installing any options or servicing the unit unless instructed to do so by this manual.

- This product is grounded through the power cord ground conductor. To avoid electric shock, plug the power cord into a properly wired receptacle before connecting the product inputs or outputs.

- Route power cords and other cables so they won't be damaged.

- The AC receptacle (socket) should be located near the equipment and be easily accessible.

- Disconnect power before cleaning. Do not use any liquid or aerosol cleaner - use only a damp cloth.

- Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed conductors and components while power is on. Do not insert anything into either of the systems two-power supply cavities with power connected.

- Do not wear hand jewelry or watches when troubleshooting high current circuits, such as power supplies. During installation, do not use the door handles or front panels to lift the equipment as they may open abruptly and injure you.

- To avoid fire hazard when replacing fuses, use only the specified correct type, voltage and current rating as referenced in the appropriate parts list for this product. Always refer fuse replacement to qualified service personnel.

- Have qualified personnel perform safety checks after any service.

Cautions

Please observe the following important cautions:

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

- Use only specified replacement parts

Company Information

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Warranty Policies

Hardware Warranty

Utah Scientific, Inc. warrants to the original purchaser that the Utah Scientific hardware is free from defects in materials and workmanship and will perform substantially in accordance with the accompanying written materials under normal use and service for a period of two (2), five (5), or ten (10) years from the date of shipment. Any implied warranties on hardware are limited to the above three warranty periods (depending on purchase). Some states/jurisdictions do not allow limitations on duration of an implied warranty, so the above limitation may not apply to certain specific purchasers.

Software Warranty

Utah Scientific warrants that the software will perform substantially in accordance with the accompanying written materials for a period of one (1) year from the date of shipment.

Customer Remedies

For the first one (1) year after purchase of the software and the first two (2), five (5), or ten (10) years after the date of purchase of the hardware, Utah Scientific's and its suppliers' entire liability and purchaser's exclusive remedy shall be, at Utah Scientific's option, either:

- Return of the price paid, or

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

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

No other warranties. To the maximum extent permitted by applicable law, Utah Scientific and its suppliers disclaim all other warranties, either express or implied, including, but not limited to implied warranties of merchantability and fitness for a particular purpose, with regard to the software, the accompanying written materials, and any accompanying hardware. This limited warranty gives the purchaser specific legal rights. These rights may vary in certain states/jurisdictions.

No liability for consequential damages. To the maximum extent permitted by applicable law, in no event shall Utah Scientific or its suppliers be liable for any damages whatsoever (including without limitation, damages for loss of business profits, business interruption, loss of business information, or any other pecuniary loss) arising out of the use of or inability to use Utah Scientific products, even if Utah Scientific has been advised of the possibility of such damages. Because some states/jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply in those circumstances.

Section 1

System Setup

Section 2

Specifications and Alarms

Section 1

System Setup

Introduction

The UHD 12G is a compact, power efficient series of SDI routing switchers. These products provide a compact design with unique control facilities to allow cost effective routing solutions and flexible, configurable distribution amplifiers or, when combined with a Utah Scientific SC-4 or SC-400 control system, provide a cost sensitive alternative to the flagship Utah Scientific UTAH-400 SDI routers.

The UHD 12G routing switchers are available in two frame sizes –

•   32x32 in 1 RU, consuming less than 30 watts of power.

•   144x144 in 4 RU, consuming 100 watts of power.

Both frames are less than 4 inches deep.

Control System

The crosspoint switching and status monitoring of the UHD routing switcher is performed by the 'MX-Bus Interface'.

The routing switcher is simply a slave to a larger Utah Scientific SC4 or SC400 control system. This is useful if a user requires more control locations or hardware panel options than are supplied with a smaller UDS system. Information regarding SC4 and SC400 control systems can be found in their respective manuals.

Router Hardware Description

The UHD system is based upon a four board architecture similar to other Utah Scientific routing switchers. These four boards are made up of an Input board, a crosspoint board, midplane, and output board.

Input or Output boards can be removed or added (via the midplane) in the field to expand systems, change IO types or replace defective modules.
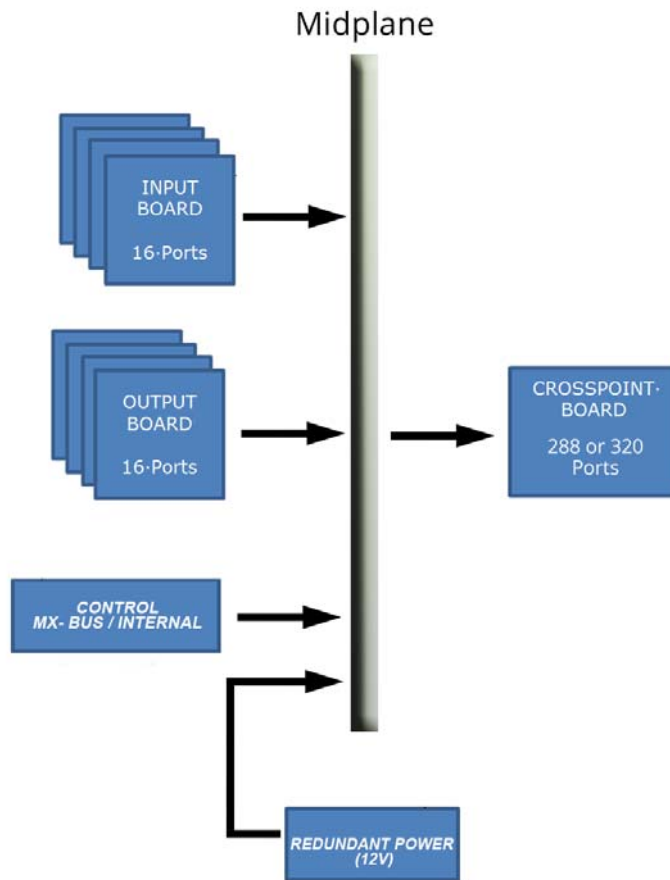

Figure 1-1.

The UHD system is designed to carry SDI signals. The system natively supports and reclocks SMPTE259C, SMPTE292, SMPTE424, ST2081, ST2082, and DVB-ASI signals with a maximum data rate of 11.88 Gb/Sec.

The reclocking mechanism within the UHD automatically bypasses when a signal that is not one of these standards is presented to it, allowing non-reclocked routing of any signal from 18 Mb/Sec to 11.88 Gb/Sec.

The coaxial version of IO cards uses the HD-BNC connector offered by Amphenol and Samtec. It provides superior performance and density while allowing connection of industry standard Belden 1694 cable or other cable types with standard tools. Visit http://hdbnc.amphenolrf.com/ for more information.

UHD Routing Switchers are powered by 12V DC connections. Systems are delivered with 1 power supply as a standard. (The part number for the optional redundant power supply is USI 94001-9006.)

3G/12G

The UHD 12G supports two types of IO cards; those that support signals p to 3Gb/Sec and others that support up to 11.88 Gb/Sec signals.
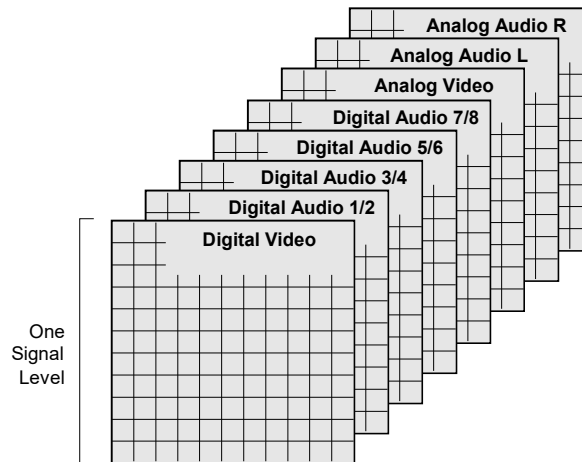
Signal Levels

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

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

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

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

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

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

Hardware Installation

Initial Inspections

Check the contents of the shipment for completeness and possible transport damage.

If the contents are incomplete or damaged, contact Utah Scientific Inc immediately for repairing or replacement parts of the equipment.

Before Applying Power

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

The modules of the UTAH-100/UHD frame may only be installed in specific positions. Interchanging power and function modules may harm the UTAH-100/UHD frame permanently.

Service

Servicing, adjustments, maintenance or repair of this product may be performed by qualified personnel only. Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. Capacitors inside this product may still be charged even when disconnected from their power source.

Initial Setup

1. Remove the chassis and inspect the unit carefully for damages that may have occurred during transport.

2. Check that the frame is installed so the airflow though the unit is unrestricted. No forced ventilation is required under normal operating conditions.

3. Connect the external power cord to the corresponding power connector on the rear side of the UTAH-100/UHD frame. Check that the Power LED on the front panel is lit. Green LEDs indicate normal operation, while Red LEDs indicate a failure condition. If a failure occurs; potentially related to no power, inoperative fan, or temperature range, please disconnect power and contact UTSCI support for assistance.

Installation

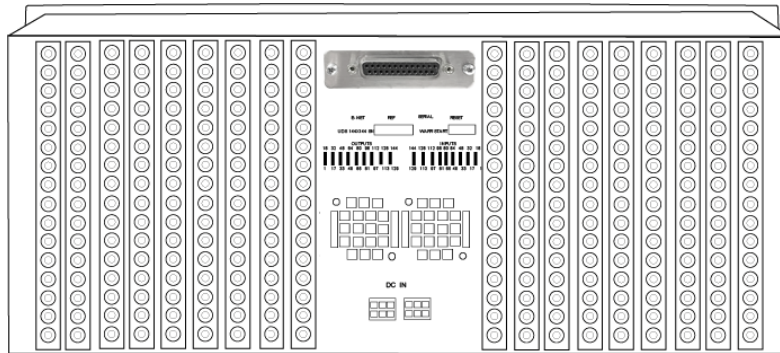## *32x and 144x Systems*

Primary Crosspoint

Redundant Crosspoint

Primary Power Supply

Redundant Power Supply

Figure 1-2. UHD 12 Front

Input Cards

Output Cards

Figure 1-3. UHD 12G Rear

Contents

- 1 Primary Crosspoint card

- 1 Redundant Crosspoint card

- 18 Input card Slots.

- 18 Output card Slots.

- 1 Primary Control Card Slot

- 1 Redundant Control card slot

- 1 12V Power Supply with chassis

- 1 Redundant 12V Power Supply slot

- 4 internal cooling fans located near the chassis top. Air is drawn from the front and exhausted through the sides.

This system is only capable of being controlled via MX Bus, as the internal controller option is not available for this frame. When encoding an SC-4, 400 or 40 to utilize this frame, you must first set the MX-BUS level of the router as described in the MX-Bus Based Systems section of this manual.

Rear Panel Considerations

Dip Switches

MX Bus

Video Ref

Figure 1-4.

MX Bus

This is the control bus between the UHD 12G and SC-4 controller. Each chassis contains two connectors, fed through either side, then distributed to the next piece of equipment from either side.

Determining and Setting Router Signal Levels

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

By definition, a signal level represents distinct elements of the broadcast system. These individual elements include, but are not limited to, High Definition Video, SDI Video, Digital Audio, Analog Video, Analog Audio and Data Routers. For additional information relating to signal levels, refer to "Signal Levels," on page 1-4.

Connecting Cables

Video Cables

Use high quality coaxial cable with HDBNC ends to connect to the UHD 12G system. The input and output numbers are silk-screened on the rear of the chassis.

> **IMPORTANT NOTE:** *SC4 and SC400 control systems are zero based. This means that SC4 input 0 corresponds to the input labeled 1 on the router, 1 corresponds to 2, etc. Make sure to take that into account when connecting cables.*

MX Bus Cables

The UHD 12G routing system utilizes the MX-Bus control system. It must be connected to the SC-4 control system to switch its inputs and outputs. In addition, the proper levels and offsets must be set on the UHD 12G routing system(s) so they will operate on the proper signal levels.

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

Your UHD 12G router is shipped standard with one MX-Bus Cable - 10 ft. (USI Part Number: 80299-10). Other lengths are available and may be ordered through Utah Scientific sales at 1 (800) 453-8782.
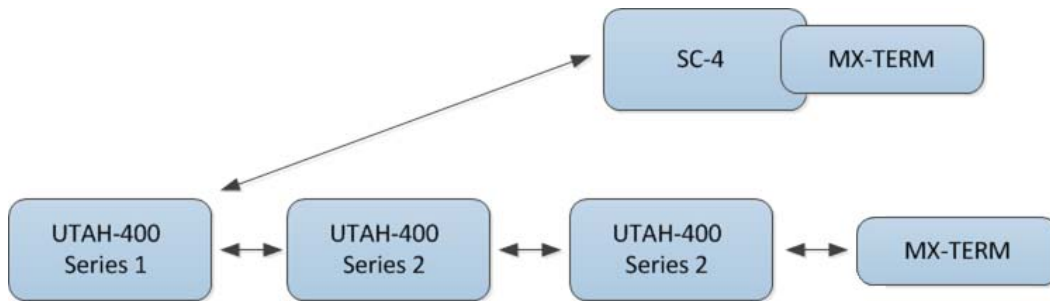

Figure 1-5.

Note the necessary termination on the MX-Bus in the above illustration.

Coax Input Card 121415-1 (up to 12G)

General

The SDI Coax input card is responsible for receiving, reclocking, and presenting the input signals to the crosspoint card. It has 16 HDBNC connectors, 16 SDI Cable equalizers, with reclockers. The reclocking components automatically detect, lock to and re-time the incoming SDI signals. If a non-standard signal is presented to the card, the reclocker will automatically bypass and allow the signal thru without re-timing it.
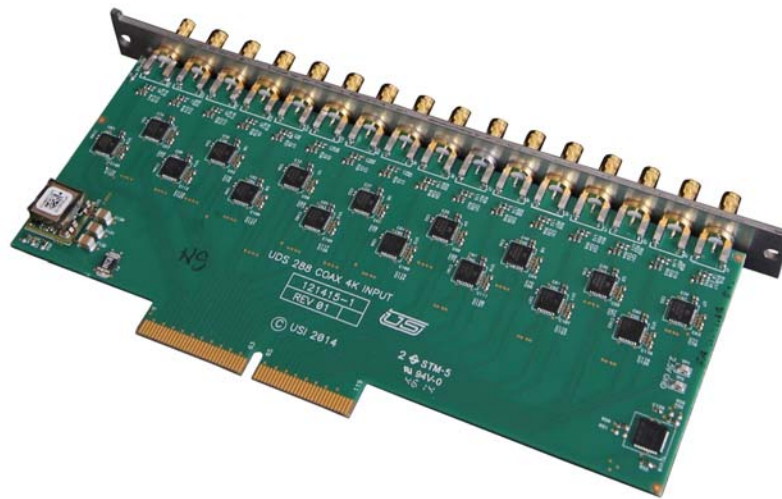
Figure 1-6.

Circuit Description

12 V is received by this card and regulated down to 2.5V.

SDI cable equalizers are capable of equalizing more than 50 meters of 1694A cable when using 11.88 Gbps signals.

There is an I2C based IO expander that identifies the card to the control system. This component also allows the system to provide status of IO card functionality to the user interface.

Controls and Indicators

This card has a single Power OK indicator, DS1, which shines thru the rear of the chassis to indicate the card is active.

Fiber Input Card 121423-1 (up to 3G)

General

This card can be populated with a variety of SFP receiver devices to allow for different functionality. It allows for 8 dual DFP connections, allowing 16 total inputs. The list of SFP module types is –

1.   DUAL Single mode 1220-1620nM SFP – 94061-01.

2.   DUAL CVBS to SDI Converter (HDBNC) – 94061-06.

3.   DUAL SDI Receiver with reclocking – 94061-09.

4.   DUAL Multi Mode 850nM SFP – 94061-11.

5.   HDMI Receiver with HDMI connectors. 14003-40

6.   HDMI Receiver with DVI connector. 140033-41

The HDMI Receiver occupies both ports in the SFP cage, making 1 input inaccessible. The receiver uses the upper input. (i.e., if the slot corresponds to inputs 1 and 2, the signal will display on the router input 2).
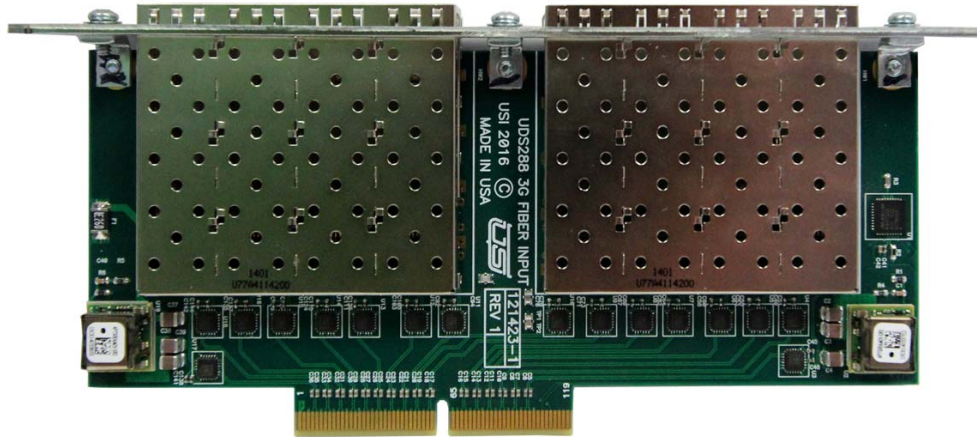

Figure 1-7.

Circuit Description

Component U2 receives and regulates 12V into 3.3V to be used by the SFP's and 2x2 crosspoint 2G.

Component U19 receives and regulates 12V into 1.2V to be used by the 2x2 crosspoint 2G.

Component U1 is the system identifier I2C based IO expander, which allows board presence to be communicated to the user.

Controls and Indicators

None.

Control Interface

Figure 1-8.   HDMI SFP

Fiber Output Card 121424-1 (up to 3G)

General

This card can be populated with a variety of SFP transmitter devices to allow for different functionality. It allows for different functionality. It allows for 8 dual DFP connections, allowing 16 total outputs. The list of SFP module types is -

- DUAL Single mode 1310nM SFP - 94061-02

- DUAL SDI to CVBS Converter (HDBNC) - 94061-03

- DUAL SDI Transmitter reclocking - 94061-06

- DUAL Multi Mode 850nM SFP - 94061-12

- CWDM Modules of different frequencies are also available.

- HDMI Transmitter with HDMI connector - 140033-42

- HDMI Transmitter with DVI connector - 140033-43

Note: *The HDMI transmitter occupies both slots in the SFP cage, making 1 output inaccessible. The transmitter uses the lower port. (i.e., if the slot corresponds to router outputs 1 - 2, the SFP will output the signal switched to output 1.*

Figure 1-9.

Circuit Description

Component U2 receives and regulates 12V into 3.3V to be used by the SFP's.

Component U19 is the system identifier I2C based 1.2V expander, which allows board presence to be connumicated to the user.

Controls and Indicators

None.

Control Interface

Figure 1-10.   HDMI SFP

Section 1

Coax Output Card 121417-1 (up to 3G)

General

The SDI Coax Output card is responsible for driving the switched video signals down coaxial cables in a SMPTE compliant fashion. It has 16 HDBNC connectors and 16 SDI Cable drivers on it.
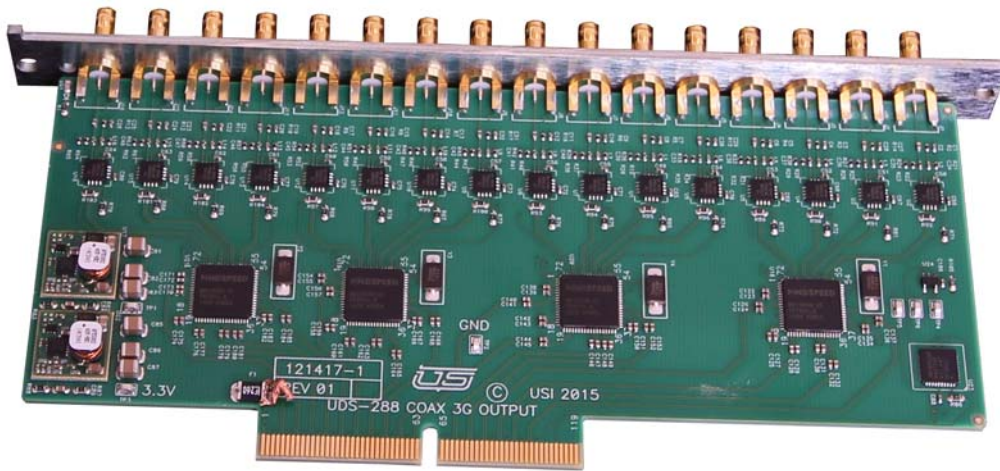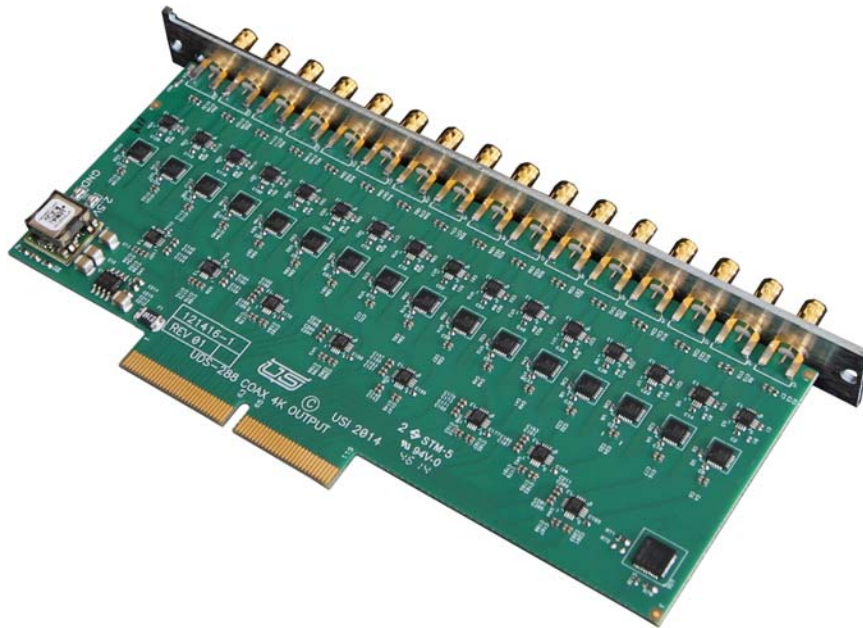

Figure 1-11.

Circuit Description

12 V is received by this card and regulated down 3.3V and 1.2V.

There are four Quad Reclockers that supply high quality signals to the cable drivers for a nominal output of 800 MV. There is a I2C based IO expander that identifies the card to the control system. Controls and Indicators.

This card has a single Power OK indicator, DS1, which shines thru the rear of the chassis to indicate the card has power (3.3V).

Coax Output Card 121416-1 (up to 12G)

General

The SDI Coax Output card is responsible for driving the switched video signals down coaxial cables in a SMPTE compliant fashion. It has 16 HDBNC connectors and 16 SDI Cable drivers on it.

Figure 1-12.

Circuit Description

12 V is received by this card and regulated down 3.3V and 2.5V. There are eight high bandwidth switches that route signals from the active crosspoint card to reclockers and cable drivers for a nominal output of 800 MV. There is an I2C based IO expander that identifies the card to the control system. Controls and Indicators.

This card has a single Power OK indicator, DS1, which shines thru the rear of the chassis to indicate the card has power (3.3V).

Section 2

Specifications and Alarms

Frame Specifications

Width

19" Rack Mount

Depth

3.4"

Sizes

1RU -- Capacity: 32 inputs, 32 outputs

Power Consumption: <30W

4RU -- Capacity: 144 inputs, 144 outputs

Power Consumption: <100W

Power Supply

AC Input Specifications

Power Consumption - 720 watts per module

Voltage - 900-240

Frequency - 50-60Hz

Redundancy - optional (shares load)

DC output specifications

12VDC - 60 Amps max (typically 25 Amps)

Noise

Series UHD	dbA
UT-100 / UHD-32	45
UT-100 / UHD 144	52

I/O Module Specifications

Multi-Rate Digital Input Card

Number of ports per card: 16

Formats supported: From 18Mbps up to 3Gbps

Connector Type: HD-BNC

Multi-Rate Digital Output Card

Number of ports per card: 16

Formats supported: From 18Mbps up to 3Gbps

Reclocking: All SDI rates up to 3Gbps

Connector Type: HD-BNC

Conforms to SMPTE 259C, 292, and 424

FLEX-I/O Option

Number of ports per card: 16 (8 SFP cages)

Dual-Channel SFPs support the following:

SDI up to 3Gbps on coax

SDI up to 3Gbps on fiber

PAL / NTSC Analog composite video

DVI/HDMI (single-port SFP)

IP-encapsulated DVB-ASI signals

Fiber Input/Output Card

Number of ports per card: 16 (8 SFP cages)

Dual-Channel SFPs support the following:

SDI up to 3Gbps on fiber

DVI/HDMI (single-port SFP)

Alarm Conditions

The UHD 12G will enter a *temperature alarm* condition when the internal temperature exceeds the allowable limit. A temperature alarm is most likely caused by fan failures.

The Blue LED on the front left of the unit will turn Red when the UHD enters a temperature alarm condition. The alarm will clear when the temperature drops below the limit. The left LED will remain Blue when the UHD is not in temperature alarm.

The UHD will enter a *power supply* alarm condition when a redundant power supply fails. The alarm will clear on a system reset, or when the redundant supply returns to normal operation.

The Blue LED on the front right of the unit will turn Red when the UHD has entered a power supply alarm. The right LED will remain Blue when the UHD is not in a power supply alarm condition.