

6G-SDI Extender Over UTP with Ethernet

500733

Installation & Operation Manual



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1. Overview

1.1. Description

The 6G-SDI Extender over UTP with Ethernet is a unique new solution from MuxLab for extending SDI cameras or other SDI sources up to 4K resolution with the added benefit of extending the signal up to 330ft (100m) using UTP cable, see table of “Input Signals & Distances vs UTP Cable Types” for further details. This multichannel extender supports up to 6Gbps of data transfer over the UTP link, and allows for versatile combinations of sources, including one 6G-SDI source, two 3G-SDI sources or four HD-SDI sources.

In addition Ethernet may be transmitted over the same UTP data link between Transmitter and Receiver. This Ethernet path may be used as a video Return Channel for AV monitoring and talk-back with the use of devices such as the MuxLab 3G-SDI / RS232 over IP Extender (model 500756) to transmit a 3G-SDI video return signal (typically a resulting edited video) from the sink back toward the source. Two Ethernet ports are available on both the Transmitter and Receiver. The devices also support bi-directional RS232 pass-through between Transmitter and Receiver for control of end devices, and can also be used to return tally light and camera control unit (CCU) signals.

Cat5e/6/6A UTP cable may be used for the extension depending on distance requirements, see table of “Input Signals & Distances vs UTP Cable Types” for further details. The 6G-SDI Extender with Ethernet supports PoE, whereby the Transmitter may be powered by the Receiver via the UTP link. The Ethernet Port A provides

PoE (PSE) to a connected device supporting PoE (PD), such as the above mentioned 3G-SDI / RS232 over IP Extender (model 500756). See an example of this on the following diagram.

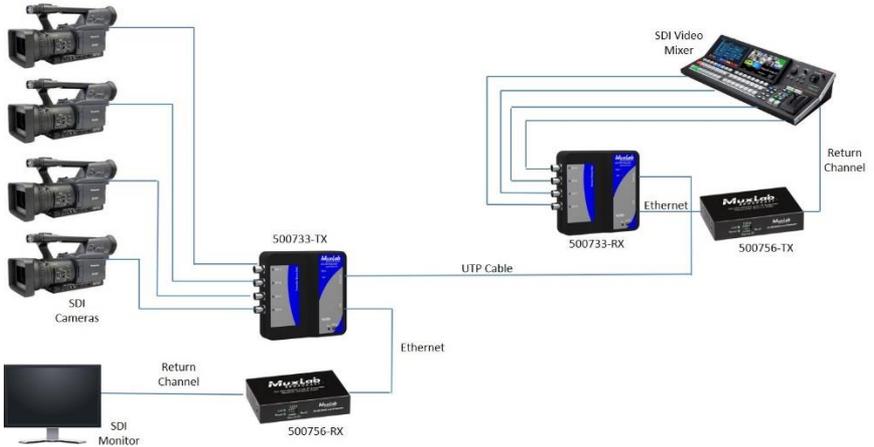


Figure 1: System Overview

Applications:

- Cinema recording
- Movie making
- Studio video production
- News media coverage / live reporting

1.2. Features

- Extend up to 4K @ 30Hz resolution to 330ft (100m) over UTP cable.
- Supports multichannel transmission of one 6G-SDI source, two 3G-SDI sources, or four HD-SDI sources.
- Supports the transmission of two Ethernet ports. Port A supports 100Mbps and Port B 10Mbps.
- Supports bi-directional RS232 pass-through for remote control of end devices, and as a return for tally light and camera control unit (CCU) signals.
- Maximum resolution supported: 4096x2160 @ 24/25Hz, 3840x2160 @ 30Hz.
- Supported SMPTE Standards:
SMPTE-292M, SMPTE-296M, SMPTE-372M,
SMPTE-424M, SMPTE-425M
- Supports all 6G channel configurations (1, 2, or 4 BNC).
- Automatic SDI Link recognition and configuration.
- Automatic activation of long reach mode 500ft (150m) when a 3G signal is detected.
- USB interface for field upgradable firmware and diagnostics.
- The Receiver supplies PoE (PSE) to power the Transmitter.

- Ethernet Port A of both the Transmitter and Receiver is capable of supplying PoE (PSE) power to a connected MuxLab Over IP PoE (PD) device.
- Ethercon connectivity and solid Aluminum enclosure for ruggedized use.
- Multiple ¼”-20 threads for Camera mounting or equipment attachment.

2. Technical Specifications

Specifications	
Environment	6G-SDI Digital Signal Transmission
Enclosure	Aluminum casing : Tx & RX: 110mm (4.3”) x 110mm (4.3”) x 32mm (1.250”)
Color	Tx & RX: Black
Control	Serial Console Emulation with USB Interface
Compliance	FCC, CE, RoHS
Power	48VDC, 0.7Amp External Power Supply with US, UK and Euro blades
Temperature	Operating: 0° to 40°C Storage: -20° to 85°C Humidity: Up to 95% non-condensing

Table 1 - Specifications

Input Signals & Distances vs UTP Cable Types	
Cat 5e @ 300ft (91m)	2x HD-SDI, or 1x 3G-SDI
Cat 5e @ 250ft (76m)	4x HD-SDI, 2x 3G-SDI, or 1x 6G-SDI
Cat 6 @ 330ft (100m)	2x HD-SDI, 1x 3G-SDI, or 1x 6G-SDI
Cat 6 @ 250ft (76m)	4x HD-SDI, 2x 3G-SDI, or 1x 6G-SDI
Cat 6A @ 330ft (100m)	2x HD-SDI, 1x 3G-SDI, or 1x 6G-SDI
Cat 6A @ 300ft (91m)	4x HD-SDI, 2x 3G-SDI, or 1x 6G-SDI

Table 2 – Input Signals & Distances vs UTP Cable Types

Connectivity - Transmitter	
Front Side	4x BNC Connectors for SDI Input (0.8V pp, 75Ohms)
Rear Side	1x RJ-45 Ethercon Connector (Compatible with NE8MC) 2x RJ45 Jacks for Ethernet (may be used as a return channel) (Note: Port A supports 100Mbps and is capable of supplying PoE to a connected device – up to 5Watts)
Top Side	1x Mini USB for firmware updates (and control & status)
Bottom Side	1x 3-pin termination block for RS232 1x locking 2.1mm power connector

Table 3 – Connectivity Transmitter

Connectivity - Receiver	
Front Side	4x BNC Connectors for SDI Output
Rear Side	1x RJ-45 Ethercon Connector (Compatible with NE8MC) 2x RJ45 Jacks for Ethernet (may be used as a return channel) (Port A supports 100Mbps and is capable of supplying PoE to a connected device – up to 5Watts)
Top Side	1x Mini USB for firmware updates (and control & status)
Bottom Side	1x 3-pin termination block for RS232 1x locking 2.1mm power connector

Table 4 – Connectivity Receiver

3. Installation Procedure

3.1. Parts List

The 6G-SDI Extender over UTP with Ethernet Kit (500733) comes with the following parts:

- 1x Transmitter Unit (Tx)
- 1x Receiver Unit (Rx)
- 1x 48VDC Wall-mount Power Supply for the Receiver. The Transmitter can accept power from the Receiver via PoE, however an optional power supply (sold separately) is available for the Transmitter when not using PoE.
- US/UK & EU Blades for the Wall-mount Power Supply

3.2. Product Overview

3.2.1. Transmitter

The external connections and light indicators of the transmitter unit are detailed in Figure 2. Please familiarize yourself with them before installing the unit.

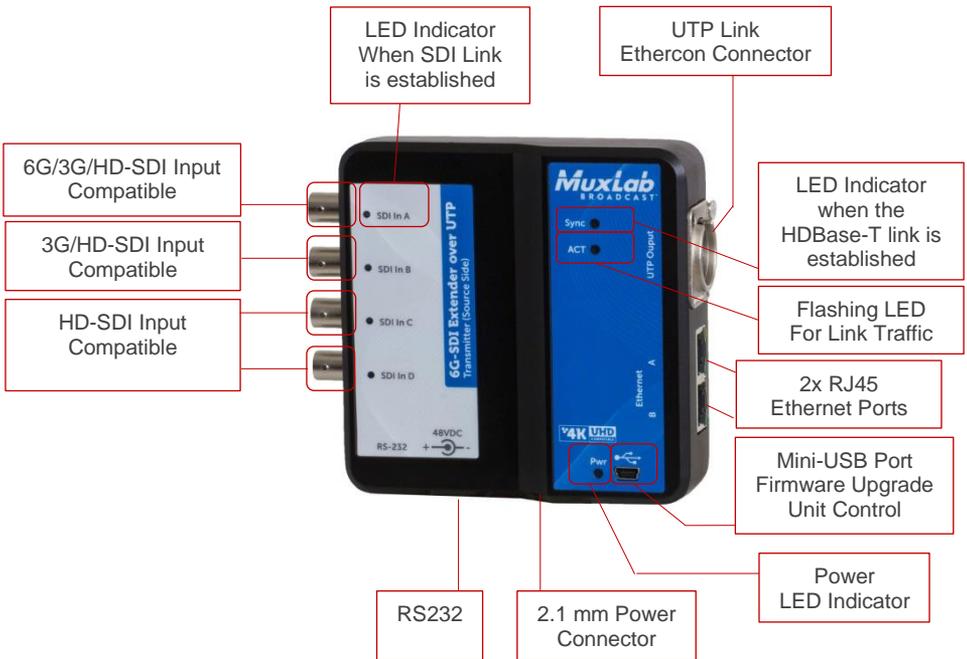


Figure 2: Transmitter Unit

3.2.2.Receiver

The external connections and light indicators of the receiver unit are detailed in Figure 3. Please familiarize yourself with them before installing the unit.

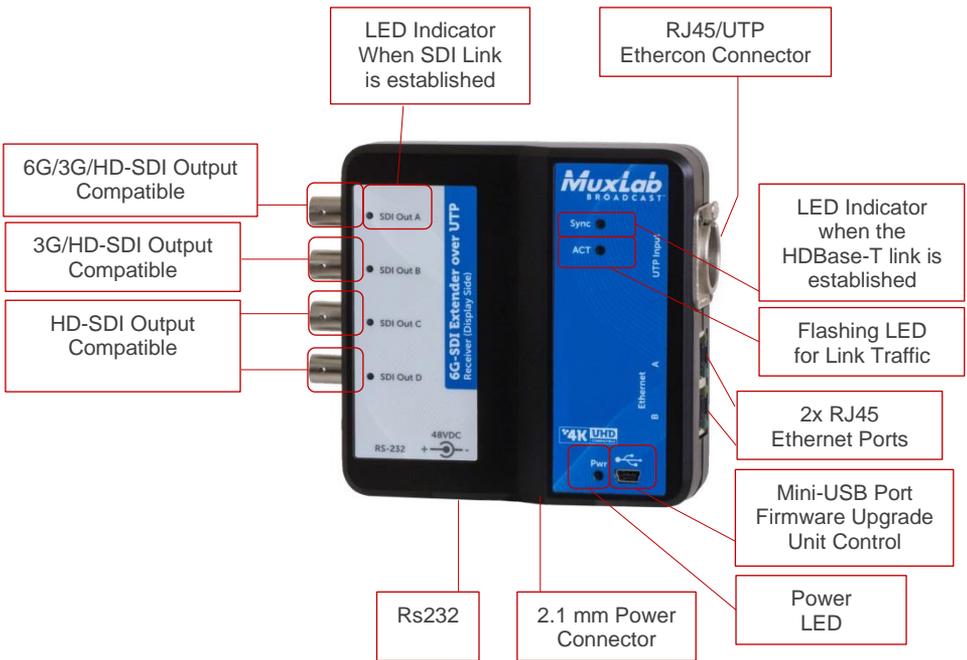


Figure 3: Receiver Unit

3.3. Physical Installation

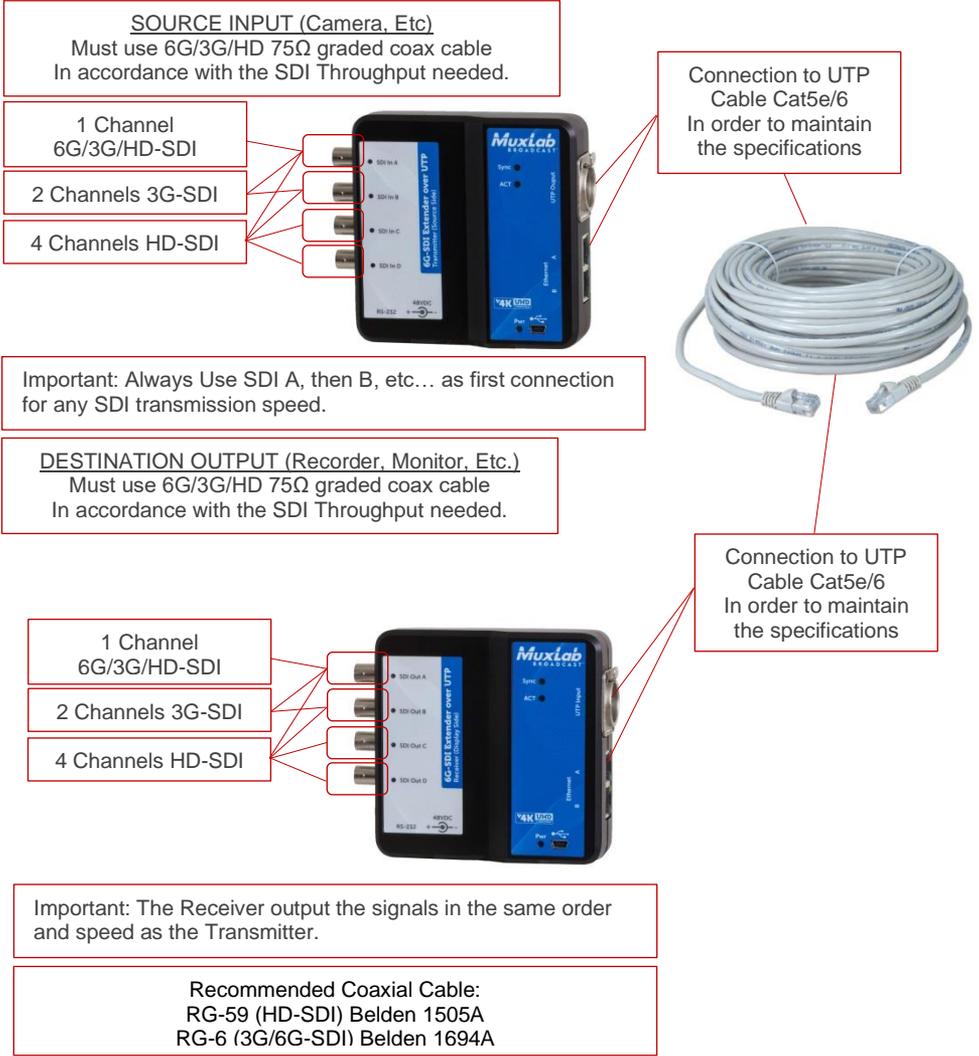


Figure 4: Physical Installation

3.4. Installation & Power-up Procedure

In order to install the product, please follow the steps below:

1. First, install the Transmitter unit by attaching it by its mounting holes or by other means close to the SDI generating source.
2. Then, connect the necessary number of SDI Compatible 75Ω Coax cable in order to carry the video/audio signal. Always start by connecting the first cable to the BNC A, then B and so on.
3. When the Transmitter is installed and connected with the SDI coax cables then connect and run the Cat5e/6 UTP to the Receiver unit, Supports 330ft (100m) max for a 6G signal, and 500ft (150m) max for a 3G/HD signal.
4. After hooking up the UTP cable to the RJ-45 port on the Receiver unit. Connect the SDI coax cables from the Receiver unit to the destination devices (e.g.: Recorder, Monitor, Capture card, Etc.)
5. If RS232 pass-through is to be used, then connect an RS232 cable from the end devices to the 3-pin terminal block RS232 port of both the Transmitter and Receiver.
6. If Ethernet based end devices are to be connected to one or both of the Ethernet ports on both the Transmitter and Receiver, then proceed to connect these end devices to one or both of the Ethernet ports on both the Transmitter and Receiver. A device supporting PoE (PD) may be connected to Ethernet Port A (up to 5Watts), which supports PoE (PSE).

7. Now that all the cabling is installed, the only thing left to do is to plug the 48VDC wall-mount power supply to the Receiver.
8. Each unit will power up and automatically initialize. The Receiver unit is supplying PoE power to the Transmitter through the UTP cable.
9. The next step is for the UTP link to connect, the link indicator on each unit will blink when the negotiation process is complete.
10. If the source is generating a video signal at the Transmitter unit, then the Receiver will output the same signal.

3.5. Supported SDI Modes

OUTPUT MODES						
INPUT MODES	Single 6G-SDI	Single 3G-SDI	Dual 3G-SDI	Single HD-SDI	Dual HD-SDI	Quad HD-SDI
Single 6G-SDI	YES	---	---	---	---	---
Single 3G-SDI	---	YES	---	---	---	---
Dual 3G-SDI	---	---	YES	---	---	---
Single HD-SDI	---	---	---	YES	---	---
Dual HD-SDI	---	---	---	---	YES	---
Quad HD-SDI	---	---	---	---	---	YES

Table 5 – Supported SDI Modes Matrix

3.6. Supported Video Modes

SUPPORTED VIDEO MODES (10Bits Color)			
HD (1.5GBits)	720P50	720P59.94	720P60
[4:2:2]	1080i50	1080i59.94	1080i60
	1080PsF23.98	1080PsF24	1080PsF25
	1080PsF29.97	1080PsF30	1080P23.98
	1080P24	1080P25	1080P29.97
	1080P30	---	---
3G (3GBits)	1080P50	1080P59.94	1080P60
[4:2:2]	2Kx1556	2Kx1556	2Kx1556
	PsF23.98	PsF24	PsF25
Support HD Modes in [4:4:4]	2Kx1556P23.98	2Kx1556P24	2Kx1556P25
Support 3D Modes			
6G (6GBits)	3840x2160	3840x2160	3840x2160
	P23.98	P24	P25
[4:2:2]	3840x2160	3840x2160	4096x2160
	P29.97	P30	P23.98
Support 3G Modes in [4:4:4]	4096x2160	4096x2160	---
	P24	P25	

Table 6 – Supported Video Modes

3.7. SDI Input Connection

SDI, Input BNC Connector (Transmitter)				
Input Modes	SDI A	SDI B	SDI C	SDI D
Single 6G-SDI	Link A	---	---	---
Single 3G-SDI	Link A	---	---	---
Dual 3G-SDI	Link A	Link B	---	---
Single HD-SDI	Link A	---	---	---
Dual HD-SDI	Link A	Link B	---	---
Quad HD-SDI	Link A	Link B	Link C	Link D

Table 7 – SDI Input Connections Matrix

3.8. SDI Output Connection

SDI, Input BNC Connector (Receiver)				
Input Modes	SDI A	SDI B	SDI C	SDI D
Single 6G-SDI	Link A	---	Link A'	---
Single 3G-SDI	Link A	---	Link A'	---
Dual 3G-SDI	Link A	Link B	Link A'	Link B'
Single HD-SDI	Link A	---	Link A'	---
Dual HD-SDI	Link A	Link B	Link A'	Link B'
Quad HD-SDI	Link A	Link B	Link C	Link D

Table 8 – SDI Output Connections Matrix

Notes: Link A' and Link B' are redundant outputs of Link A & B.

3.9. Ethernet Connection

There are two Ethernet ports available on both the Transmitter and Receiver, allowing for connectivity of Ethernet devices, and for their signal to be sent over the UTP Link Port. Ethernet Port A supports PoE (PSE) and can be used to power a PoE (PD) attached device (up to 5Watts).

Both Ethernet ports may be used for various application purposes, including as a return channel to return edited video originating from the Receiver side and being displayed on the Transmitter side. The MuxLab 3G-SDI/RS232 over IP Extender Kit (model: 500756) can be used to return 3G-SDI video over these Ethernet ports. See an example application diagram of this in Figure 1.

4. Firmware Upgrade Procedure

4.1. Firmware Upgrade Procedure

1. Make sure the USB device driver has been installed (see section 4.2 for more details).
2. Download the latest version of the firmware upgrade on the MuxLab website.
3. Unzip the firmware upgrade executable in a directory of your choice.
4. Connect the mini-USB cable to the unit and to the PC.
5. When the device driver has recognized your device to be upgraded, you can double click on the “upgrade application” to execute it.

6. The output should look like below:

```
You are about to upload the firmware version 1.x.x  
Detecting COM port and Baud Rate.....OK  
COM PORT Number : 3  
Baud rate       : 115200  
  
Checking product ..... RX OK  
Muxlab 6G SDI EXT 500733 RX  
>>  
Preparing to Upload Programmable Logic ..... OK  
Sending Programmable Logic data ..... 100%OK  
Preparing to Upload Firmware ..... OK  
Sending data ..... 100% OK  
  
Please wait while the unit is rebooting ..... 100%  
Press any key to exit
```

7. The behavior of the unit (Rx & Tx) should be as follow during upgrade. The device uses the SDI LEDs to indicate the actual status.
 - SDI A/B/C/D Blinking: Download phase. Clear memory space and write new image.
 - SDI A (only) Blinking: Erasing previous programmable logic memory.
 - SDI B (only) Blinking: Copying programmable logic from secondary memory to primary memory.
 - SDI C (only) Blinking: Copying firmware from secondary memory to primary memory.
8. After completion, the firmware will start and the SDI A/B/C/D LEDs will cycle.

4.2. USB Driver Setup

When interfacing a MuxLab device with the USB port on Windows XP, Windows 7, 8 or 10 operating systems, a driver setup file will be required. For Linux and Mac OS X operating systems, no driver is necessary.

To install the USB serial driver, download the SC-000032-A USB to serial driver file from the MuxLab website and save it to the local hard drive. NOTE: If the downloaded file is compressed, it will have to be uncompressed before using it.

Plug the USB cable between the device and the PC, and power up the device. The **Found New Hardware** wizard will open (Figure 5). Select **Locate and install driver software (recommended)**.



Figure 5: Found New Hardware Wizard

A new dialog box will open (Figure 6). Select **Browse my computer for driver software (advanced)**.



Figure 6: Found New Hardware Dialog Box

Another dialog box will open (Figure 7). Click **Browse** and locate the SC-000032-A USB to serial driver file downloaded earlier. Once found, click **Next**.

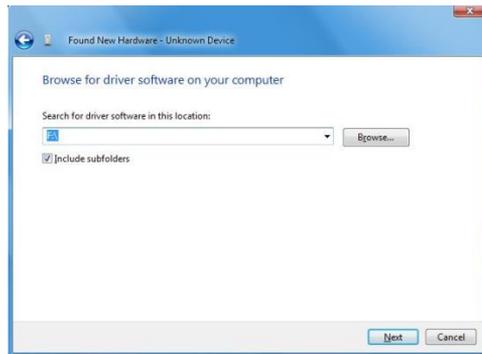


Figure 7: Browsing for Unknown Device

A security window will now appear, indicating that the driver software is unsigned (Figure 8). Select **Install this driver software anyway**.



Figure 8: Windows Security

A window will appear instructing that the software for the driver has been successfully installed (Figure 9). Click **C**lose.



Figure 9: Successful Installation Dialog Box

5. Unit Control and Status

USB Control & Status

Commands from an ASCII terminal (e.g. PUTTY) may be sent directly to the device via a USB connection (serial connection emulation). Maintenance can be performed with a terminal emulator, such as the one available under windows with the ASCII Command set described in the Appendix of this manual.

Troubleshooting

The following table describes potential problem symptoms, the probable causes and possible solutions. If the information below does not solve the problem, then technical support contact information can be found at the end of this section.

PROBLEM	POSSIBLE SOLUTIONS
<i>No Power @ Transmitter</i>	Verify UTP Cable and connectors (TX unit power is supplied through the UTP Cable by the Receiver PoE). Make sure the Receiver unit is powered.
<i>4K Misaligned Quadrant</i>	Disorder in the SDI Links either at the Receiver or Transmitter. Check for inversion. Try to reboot the system.
<i>No Link</i>	Check the grade of the UTP cable (e.g.: Cat5e/6, etc.), including the quality of the cable and connectors. Verify that you have not exceeded the maximum allowed cable length.
<i>No SDI Link @ 3G/6G</i>	Verify that the quality of the cable and its connector used, are the correct grade to allow for transport of the bandwidth required. Recommended Cable: RG-59 (HD-SDI) Belden 1505A – RG-6 (3G/6G-SDI) Belden 1694a
<i>1x 6G-SDI to 2x 3G-SDI is not working</i>	In order to transform 1x 6G link into 2x 3G links, or vice-versa, one of the units needs to be programmed through the USB port. Only then, will the 2:1 or 1:2 work. (Refer to the appendix for more information). The default mode is 1:1.

When contacting your nearest MuxLab dealer or MuxLab Technical Support at 877-689-5228 (toll free in North America) or (+1) 514-905-0588 (International), please have the following information ready:

- Unit model number.
- Cabling layout. Please include the model of the SDI source and sink devices, cable length and type (e.g.: Cat 5e/6 UTP and RG-6 Coax at both ends).
- Description of problem.
- List of tests performed.

Appendix

A. ASCII Command Set

Ensure that the terminal emulation program parameters are set to the following:

BAUD Rate:	115200
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

It should be noted that commands are case sensitive and arguments must be separated by a single space. Commands must be entered in the following way and end with a carriage return.

Serial/USB Port Commands

1. HELP Command

help

Description: Display all the command list definition available

Response: List all available commands

help -c <command>

Description: Help for a specific command

Response: List the specifics of the demanded command

2. RESET Command

reset -f

Description: Reset the unit and restore the default factory settings

Response: "ok"

3. STATUS Command

status

Description: Report current operation condition

Response:

```
`Master firmware version: x.x.x
User variable Version : 2
FPGA Version : RX 1.002 4
Status
SDI MODE : 3G SDI on 1 channel
SDI ratio : 0
SDI ref. : 148.5 MHz
SDI freq. : 148.505 MHz
HDMI freq.: 148.504 MHz

UTP version : 13090C10
```

```
UTP Bit Error Rate (10 exp -N) : (10=best, 0=worst )
Total : 10
Video : 0
Audio : 0
blank : 0
Ctrl : 0
```

```
UTP lane Status ( lower number = better )
Lane [ 41 , 48 , 39 , 37 ]
Lane [ 34 , 39 , 31 , 29 ]
Lane [ 32 , 37 , 32 , 30 ]
Lane [ 35 , 42 , 31 , 30 ]
```

```
UTP operating mode : 6"
```

4. VERSION Command

version

Description: Report firmware version of the microcontroller

Response: "Master firmware version: x.x.x"

8. Product Warranty Policy

Items Under Warranty - Company Policy

MuxLab guarantees its products to be free of defects in manufacturing and workmanship for the warranty period from the date of purchase. If this product fails to give satisfactory performance during this warranty period, MuxLab will either repair or replace the product at no additional charge, except as set forth below. Repair and replacement parts will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and products become the property of MuxLab. This limited warranty does not include repair services for damage to the product resulting from accident, disaster, misuse, abuse, or unauthorized modifications or normal decay of battery driven devices. Batteries, if included with the product, are not covered under this warranty.

Limited warranty service can be obtained by delivering the product during the warranty period to an authorized MuxLab dealer from whom you purchased the product, or by sending it to MuxLab. MuxLab will not accept any such product for repair without a Return Material Authorization number (RMA#) issued by its Customer Service Department, along with a dated proof of purchase. If this product is delivered to MuxLab by mail, you agree to assume risk of loss or damage in transit, to prepay shipping charges to the warranty service location, and to use the original shipping container or equivalent.

THE ABOVE LIMITED WARRANTY IS THE ONLY WARRANTY COVERING YOUR MUXLAB PRODUCT. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SOME STATES DO NOT ALLOW LIMITATIONS ON IMPLIED WARRANTIES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

IF THIS PRODUCT IS NOT IN GOOD WORKING ORDER, YOUR SOLE REMEDY SHALL BE REPAIR OR REPLACEMENT AS PROVIDED FOR ABOVE. IN NO EVENT SHALL MUXLAB BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING ANY LOSS OF PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR INABILITY TO USE THIS PRODUCT, EVEN IF MUXLAB OR AN AUTHORIZED MUXLAB DEALER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES; NOR WILL MUXLAB BE LIABLE FOR ANY CLAIM BY ANY OTHER PARTY. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

Warranty Periods

Any product found to be defective within three (3) months of invoice, including one (1) month shelf life, may be returned for replacement by a new unit or a satisfactory repair within one (1) month of receiving any returned product. The customer must provide MuxLab with the serial number and proof of purchase of the defective unit being returned. All R.M.A.'s issued are subject to inspection by MuxLab, and will be returned to the customer if not properly packaged – units must be returned in the original container or equivalent. MuxLab will not accept any such product for repair without an authorization from its Technical Support department and without a return authorization number issued by the MuxLab Customer Service department. For a credit & replace R.M.A., the customer will be liable to pay replacement invoice if defective products are not returned.

For Products more than six months old, including shelf life.

The defective unit must be returned prepaid to MuxLab and then the unit will be repaired or if repair is not possible, replaced by an equivalent unit and returned to the customer within one (1) month of receiving any returned product. There is no charge for repair (parts and labor) during the full warranty period of two (2) years.

Items Defective and not under Warranty

For products which are no longer under warranty the policy is repair and return. An amount of 25% of the products published list price at the time of purchase will be charged. Customers must issue a purchase order to cover the cost of repair.

Each unit will be returned to the customer within one (1) month from receipt of the unit by MuxLab. The defective unit must be returned prepaid to MuxLab. The repaired unit will be returned to the customer FOB MuxLab. The repaired unit has a 90 day warranty.



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