

6G-SDI EXTENDER OVER FIBER

500734

500734-SM10

500734-SM40

500734-SM80

Installation & Operation Manual



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Table of Contents

1. Overview	4
1.1. Description	4
1.2. Features	7
2. Technical Specifications	9
3. Installation Procedure	11
3.1. Parts List	11
3.2. Product Overview	12
3.3. Physical Installation	14
3.4. Installation & Power-up Procedure	18
3.5. Supported Video Modes.....	20
3.6. SDI Input Connections.....	21
3.7. SDI Output Connections	21
4. Firmware Upgrade Procedure.....	22
4.1. Firmware Upgrade Procedure	22
4.2. USB Driver Setup	25
5. Unit Control and Status.....	28
6. Troubleshooting	29
7. Appendix.....	31
A. ASCII Command Set.....	31
8. Product Warranty Policy	37

1. Overview

1.1. Description

The 6G-SDI Extender over Fiber Optic with Return Channel is a unique solution from MuxLab for extending SDI cameras or other SDI sources up to 4K resolutions at 30Hz to a distance of up to 1300ft (400m) using OM4 multi-mode fiber (model 500734), 33,000ft (10km) using single-mode fiber (model 500734-SM10), 132,000ft (40km) using single-mode fiber (model 500734-SM40), and 264,000ft (80km) using single-mode fiber (model 500734-SM80).

The product supports multichannel transmission, and can simultaneously transmit up to 9Gbps of data throughput over the fiber link, and allows for versatile combinations of sources, including 6G-SDI, 3G-SDI and HD-SDI. The unit supports simultaneous transmission of mixed signals such as one 6G-SDI signal + one 3G-SDI, or three 3G-SDI signals, or two 3G-SDI signals + two HD-SDI signals, and many other combinations up to 9Gbps. The device supports one input and one output SDI port, plus three directional SDI ports that can be individually configured as input or output, or set to automatic direction detection. This flexibility allows for up to four source ports and one return channel, or up to one source port and four return channels, or anything in between. The SDI return channel may be used for AV monitoring and talk-back, while the RS232 pass-through supports return of tally light, camera control unit (CCU) and control of end devices.

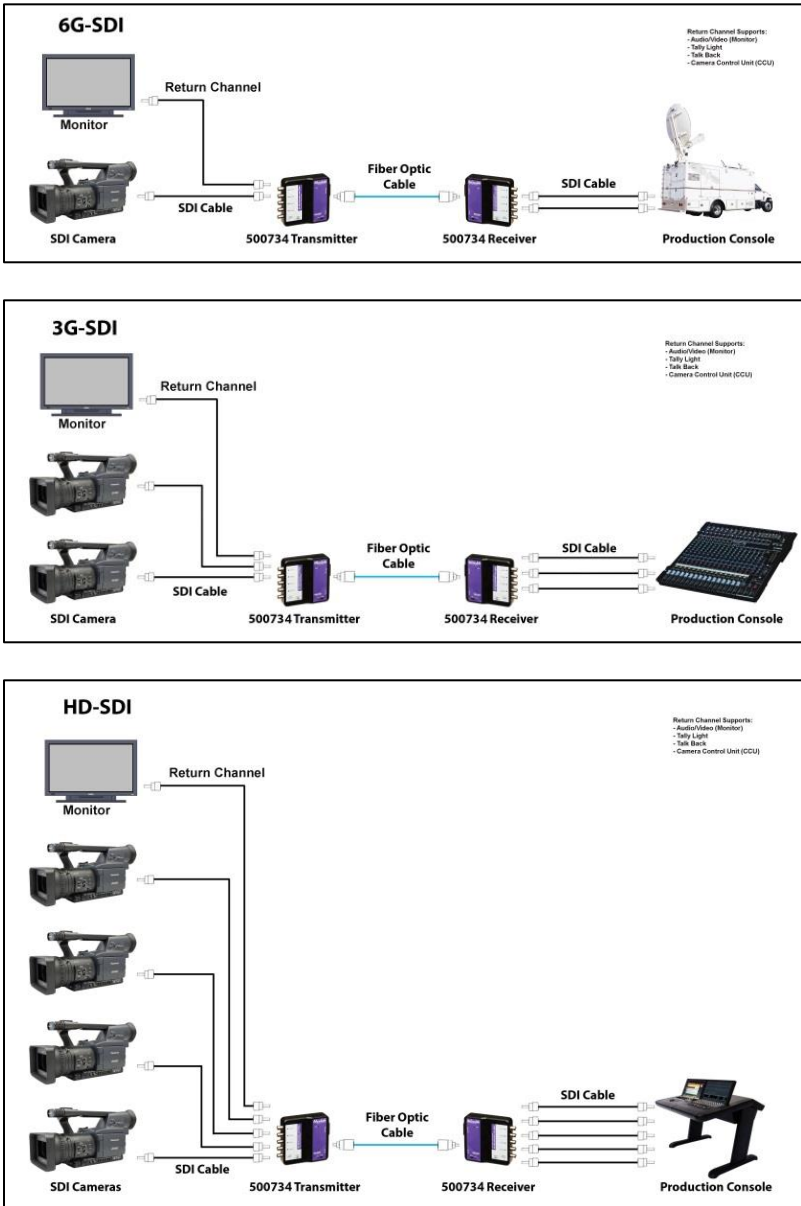


Figure 1 System Connectivity Overview

Typical Applications:

- Video (cinema) production
- Studio broadcasting production
- Studio to Studio
- Mobile video (broadcasting vehicle)
- News coverage and live events
- Post production

1.2. Features

- Up to 1300ft (400m) via multimode OM4 fiber and up to 264,000ft (80km) via singlemode fiber.
- Supports multichannel transmission, and can simultaneously transmit up to 9Gbps of data traffic on the fiber link.
- Accepts mixed signal transmission of up to one 6G-SDI signal + one 3G-SDI signal, three 3G-SDI signals, or two 3G-SDI signals + two HD-SDI signals, and many other combinations up to 9Gbps, and in any direction, including the return channels.
- Supports one input and one output SDI port, plus three configurable directional SDI ports that can be individually configured as input or output, or set to automation direction detection.
- Supports up to four source ports and one return channel, or up to one source port and four return channels, or any combination in between. The SDI return channel may be used for AV monitoring and talk-back.
- Supports RS232 pass-through for remote control, and as a return channel for tally light and for a camera control unit (CCU).
- 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.
- USB interface may be used for setting the three directional SDI ports to a fixed direction, or to set them to automatic direction detection mode. The USB port is also used for diagnostics, and upgrading the unit firmware.
- Supports a standard 10G SFP+ module for the optical fiber interface.
- Supports an aluminum casting enclosure for ruggedized use.
- Multiple ¼”-20 threads for Camera mounting or equipment attachment.

2. Technical Specifications

Specifications	
Environment	HD/3G/6G-SDI Digital Signal Transmission
Enclosures Measurements	Tx: 110mm (4.3”) x 110mm (4.3”) x 32mm (1.25”) Rx: 110mm (4.3”) x 110mm (4.3”) x 32mm (1.25”)
Color	Black
Control	Serial Terminal Emulation with USB Interface
Distance	<ul style="list-style-type: none"> • Model 500734: Up to 985ft (300m) via OM3 multimode fiber and 1300ft (400m) via OM4 multimode fiber. • Model 500734-SM10: Up to 33,000ft (10km) via singlemode fiber. • Model 500734-SM40: Up to 132,000ft (40km) via singlemode fiber. Requires a 5dB attenuator for distances less than 33,000ft (10km). • Model 500734-SM80: Up to 264,000ft (80km) via singlemode fiber. Requires a 10dB attenuator for distances less than 115,500ft (35km).
Compliance	FCC, CE, RoHS
Power	12VDC, 1.25Amp External Power Supply with US, UK & Euro blades

Table 1 Specifications

Transmitter Connectivity	
Front Side	1x BNC SDI Input Connector (0.8V pp, 75 ohms) 1x BNC SDI Output Connector (0.8V pp, 75 ohms) 3x BNC SDI Directional Connectors (0.8V pp, 75 ohms)
Rear Side	1x SFP+ Module Connector 1x Terminal Block for RS232 Interface
Lower Side	1x Power Connector (12VDC, 1.25Amp)
Top Face	1x Mini USB for Firmware Updates, plus Control & Status

Table 2 Transmitter Connectivity

Receiver Connectivity	
Front Side	1x BNC SDI Input Connector (0.8V pp, 75 ohms) 1x BNC SDI Output Connector (0.8V pp, 75 ohms) 3x BNC SDI Directional Connectors (0.8V pp, 75 ohms)
Rear Side	1x SFP+ Module Connector 1x Terminal Block for RS232 Interface
Lower Side	1x Power Connector (12VDC, 1.25Amp)
Top Face	1x Mini USB for Firmware Updates, plus Control & Status

Table 3 Receiver Connectivity

3. **Installation Procedure**

3.1. Parts List

The 6G-SDI Extender over FIBER Kit with Return Channel (500734, 500734-SM10, 500734-SM40 & 500734-SM80) come with the following parts:

- 1x Transmitter Unit (Tx)
- 1x Receiver Unit (Rx)
- 2x 12VDC Wall-mount Power Supply
- US, UK & Euro Blades for the Wall-mount Power Supply
- 2x 10G SFP+ modules with LC connectors

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.

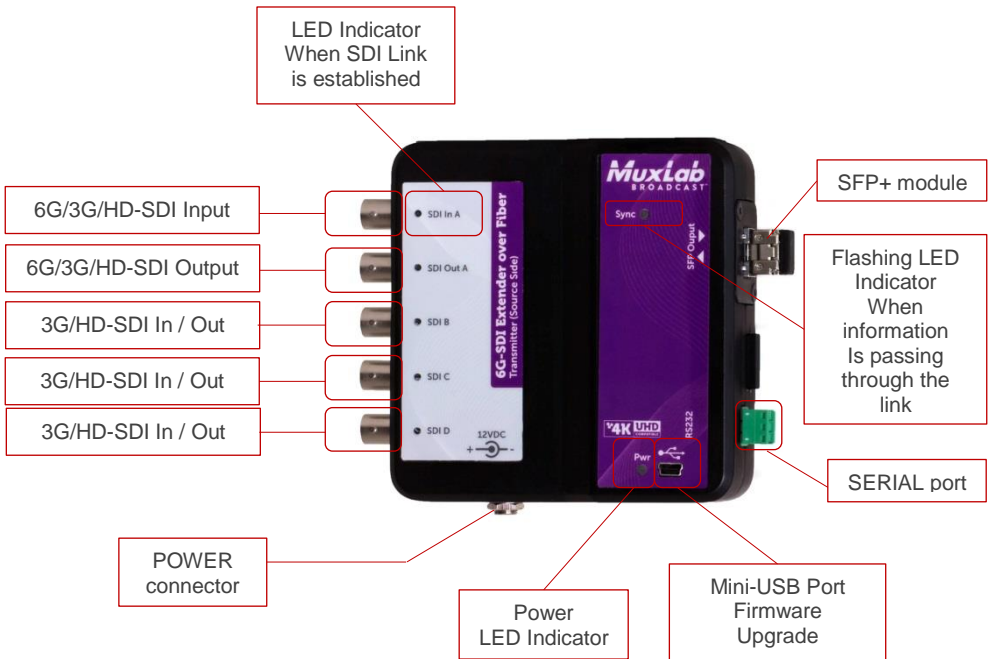


Figure 2 Front View of Transmitter

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.

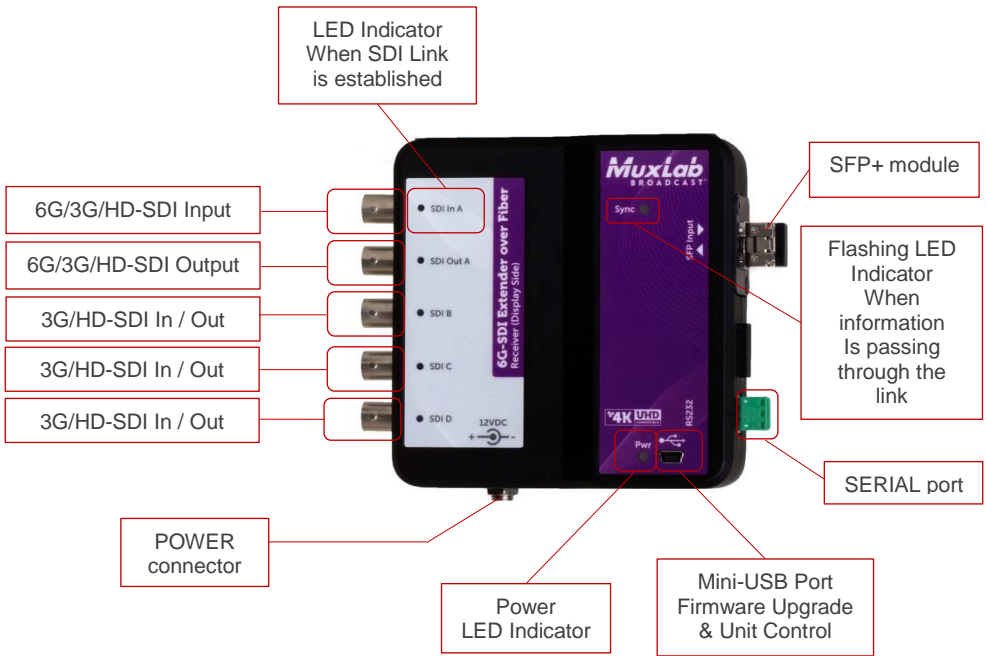


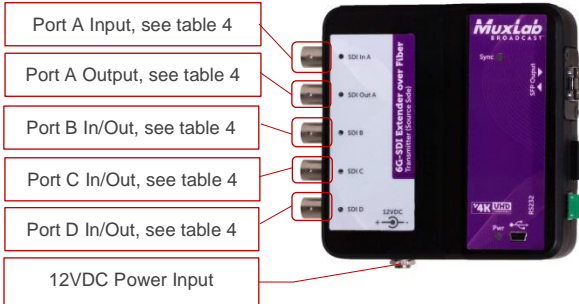
Figure 3 Front View of Receiver

3.3. Physical Installation

Duplex Connection:

SOURCE INPUT (Camera, Etc)

Must use 6G/3G/HD 75Ω graded coax cable
In accordance with the SDI Throughput needed.

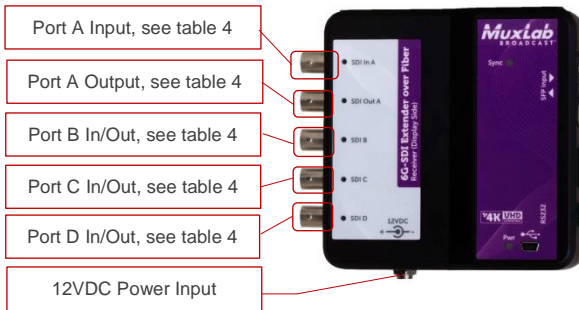


Connection to FIBER
(Duplex Connection)

Important: Always Use SDI A, then B, etc... as first connections for any SDI transmission speed, see table 4.

DESTINATION OUTPUT (Recorder, Monitor, Ect.)

Must use 6G/3G/HD 75Ω graded coax cable
In accordance with the SDI Throughput needed.



Connection to FIBER
(Duplex Connection)

Important: Keep the Receiver outputs and signals in the same order and speed as the Transmitter, see table 4.

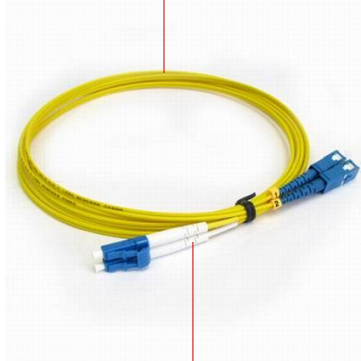


Figure 4 Physical Installation

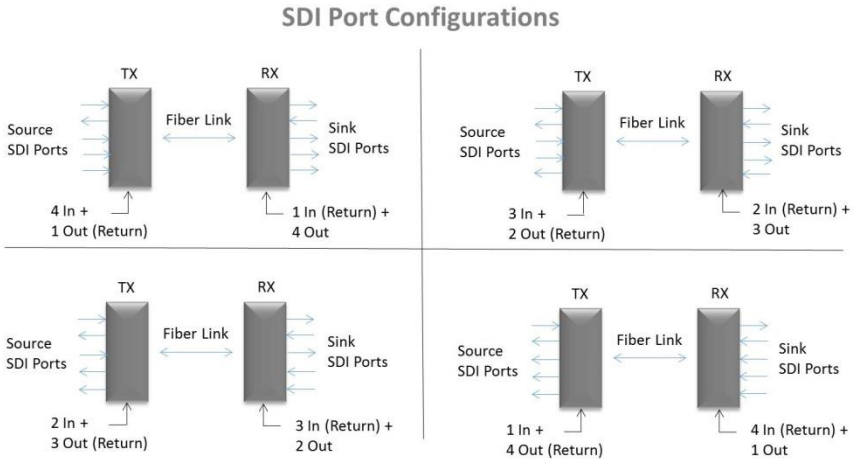


Figure 5 Input / Output Combinations

Figure 5 highlights one example of the port direction combinations that are possible, but other combinations are also possible.

Table 4 below shows the combination of signals that can be transmitted/received over the fiber link, based on the Figure 5 example, and based on the number of ports used for transmission/reception in a given direction. The total bandwidth available is 9Gbps, so varying combinations of transmission/reception rates totaling 9Gbps are possible.

Case	Port A Signal
1	6G-SDI
2	3G-SDI
3	HD-SDI

Table 4a For 1 port used (Port A)

Case	Port A Signal	Port B Signal
1	6G-SDI	3G-SDI
2	6G-SDI	HD-SDI
3	3G-SDI	3G-SDI
4	3G-SDI	HD-SDI
5	HD-SDI	HD-SDI

Table 4b For 2 ports used (Ports A & B)

Case	Port A Signal	Port B Signal	Port C Signal
1	6G-SDI	HD-SDI	HD-SDI
2	3G-SDI	3G-SDI	3G-SDI
3	3G-SDI	3G-SDI	HD-SDI
4	3G-SDI	HD-SDI	HD-SDI
5	HD-SDI	HD-SDI	HD-SDI

Table 4c For 3 ports used (Ports A, B & C)

Case	Port A Signal	Port B Signal	Port C Signal	Port D Signal
1	3G-SDI	3G-SDI	HD-SDI	HD-SDI
2	3G-SDI	HD-SDI	HD-SDI	HD-SDI
3	HD-SDI	HD-SDI	HD-SDI	HD-SDI

Table 4d For 4 ports used (Ports A, B, C & D)

Simplex Connection:

If transmission is only required in one direction, this device can be connected with a single fiber in a simplex arrangement as indicated in the following steps.

1. While looking at the unit from the top, connect the single fiber cable to the Transmitter right most LC connector as shown below.
2. While looking at the unit from the top, connect the opposite end of the fiber cable to the Receiver left most LC connector as shown below.



Figure 6 Connecting the Fiber Cable

3. The unused LC connector on both the Transmitter and Receiver must be protected from dust. This can easily be accomplished by cutting the protective rubber plug in half and inserting the plug into the unused LC connectors.



Figure 7 Plug Unused Fiber Port

Important note: The serial port is not available when only using a single fiber cable in a simplex arrangement.

3.4. Installation & Power-up Procedure

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

1. First, install the Transmitter near the SDI signal source equipment and Return Channel sink (destination) equipment. Attach the unit via the mounting holes or by other appropriate means.
2. Transmitter: Follow the procedure in section 5 (Unit Control and Status) to individually configure Ports B, C & D of the Transmitter as either Inputs, Outputs, or as Auto-detect (to automatically detect the transmission direction). Note that Auto-detect is the default setting.
3. Install the Receiver near the SDI signal sink (destination) equipment and Return Channel source equipment. Attach the unit via the mounting holes or by other appropriate means.
4. Receiver: Follow the procedure in section 5 (Unit Control and Status) to individually configure Ports B, C & D of the Receiver as either Inputs, Outputs, or as Auto-detect (to automatically detect the transmission direction). Note that Auto-detect is the default setting. Make sure that a given Transmitter Port set as an Input is set as an Output on the Receiver, and vice versa.
5. Connect the necessary number of SDI Compatible 75Ω Coax cables in order to carry the video/audio signal. Connect the source equipment to the Transmitter ports configured as SDI Inputs, and connect the Return Channel sink (destination) equipment to the Transmitter ports configured as

SDI Outputs. Always start by connecting the first cable to the BNC A, then B and so on.

6. Once the Transmitter is installed and connected with the SDI coax cables, then connect and run the fiber optic cable from the Transmitter to the Receiver unit, using either multimode or singlemode fiber depending on the 6G-SDI Extender model being installed. Respect the distance specification listed on Table 1.
7. After hooking up the fiber optic cable to the SFP+ port on the Receiver, proceed to connect the SDI coax cables from the Receiver to the destination device (e.g.: Recorder, Monitor, Mixer, Capture card, etc.). Connect the sink (destination) equipment to the Receiver ports configured as SDI Outputs, and connect the Return Channel source equipment to the Transmitter ports configured as SDI Inputs.
8. Once all the cabling is installed, next plug the 12VDC wall-mount power supplies to both the Transmitter and Receiver.
9. Each unit will power up and auto-initialize.
10. Next the fiber link will sync, and the link indicator on each unit will blink after the negotiation process has successfully completed.
11. If the source is generating a video signal at the Transmitter end, then the Receiver will output the same signal which can be terminated on a Recorder, Monitor, Mixer, Capture card, etc.

3.5. Supported Video Modes

Resolution	10Bit 4:2:0 10Bit 4:2:2	12Bit 4:2:0 12Bit 4:2:2 12Bit 4:4:4 10Bit 4:4:4:4
2160p @ 30/29.97Hz	6Gbit/s	
2160p @ 25Hz	Single Link 6G	
2160p @ 24/23.98Hz	Dual Link 3G	
1080p @ 60/59.94Hz	3Gbit/s	6Gbit/s
1080p @ 50Hz	Single Link 3G	Single Link 6G
	Dual link 1.5G (HD)	Dual Link 3G
1080i @ 60/59.94Hz	1.5Gbit/s	3Gbit/s
1080i @ 50Hz	Single Link 1.5G	Single Link 3G
1080p @ 30/29.97Hz	(HD)	Dual Link 1.5G (HD)
1080p @ 25Hz		
1080p @ 24/23.98Hz		
720p @ 60/59.94Hz	1.5Gbit/s	3Gbit/s
720p @ 50Hz	Single Link 1.5G	Single Link 3G
720p @ 30/29.97Hz	(HD)	
720p @ 25Hz		
720p @ 24/23.98Hz		
3D: 1080p @ 60/59.94Hz	6Gbit/s	
3D: 1080p @ 50Hz	Single Link 6G	
	Dual Link 3G	
3D: 1080i @ 60/59.94Hz	3Gbit/s	6Gbit/s
3D: 1080i @ 50Hz	Single Link 3G	Single Link 6G
3D: 1080p @ 30/29.97Hz	Dual Link 1.5G (HD)	Dual Link 3G
3D: 1080p @ 25Hz		
3D: 1080p @ 24/23.98Hz		
3D: 720p @ 60/59.94Hz	3Gbit/s	6Gbit/s
3D: 720p @ 50Hz	Single Link 3G	Single Link 6G
3D: 720p @ 30/29.97Hz	Dual Link 1.5G (HD)	Dual Link 3G
3D: 720p @ 25Hz		
3D: 720p @ 24/23.98Hz		

Table 4 Supported Video Mode Matrix

3.6. SDI Input Connections

SDI, Input BNC Connector (Transmitter)				
Input Modes	SDI A	SDI B	SDI C	SDI D
One SDI Signal	Link A	---	---	---
Two SDI Signals	Link A	Link B	---	---
Three SDI Signals	Link A	Link B	Link C	---
Four SDI Signals	Link A	Link B	Link C	Link D

Table 5 SDI Input Connections Matrix

3.7. SDI Output Connections

SDI, Output BNC Connector (Receiver)				
Input Modes	SDI A	SDI B	SDI C	SDI D
One SDI Signal	Link A	---	---	---
Two SDI Signals	Link A	Link B	---	---
Three SDI Signals	Link A	Link B	Link C	---
Four SDI Signals	Link A	Link B	Link C	Link D

Table 6 SDI Output Connection Matrix

4. Firmware Upgrade Procedure

4.1. Firmware Upgrade Procedure

1. Make sure the PC USB device driver has been installed (see section 4.2 for more details)
2. Download the latest version of the appropriate firmware upgrade from 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 the below:

```
You are about to upload the firmware version x.x.x

Detecting COM port and Baud Rate.....OK
COM PORT Number : 3
Baud rate       : 115200

Checking product ..... RX OK
Muxlab 6G SDI EXT 500732 RX/TX
>>
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 Transmitter and Receiver unit should be as outlined below 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 Blinking: Erasing previous programmable logic memory
 - SDI B Blinking: Copying programmable logic from secondary memory to primary memory.
 - SDI C Blinking: Copying firmware from secondary memory to primary memory.
8. Once the process is completed, the upgraded firmware will automatically 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, Windows 8 or Windows 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 (or later version) 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 need to be uncompressed before it may be utilized.

Plug the USB cable between the MuxLab device and the PC, and power up the device. The **Found New Hardware** wizard will open (see Figure 8). Select **Locate and install driver software (recommended)**.



Figure 8 Found New Hardware Wizard

A new dialog box will open (see Figure 9). Select **Browse my computer for driver software (advanced)**.



Figure 9 Found New Hardware Dialog Box

Another dialog box will open (see Figure 10). Click **Browse** and locate the SC-000032-A USB to serial driver file downloaded earlier. Once found, click **Next**.

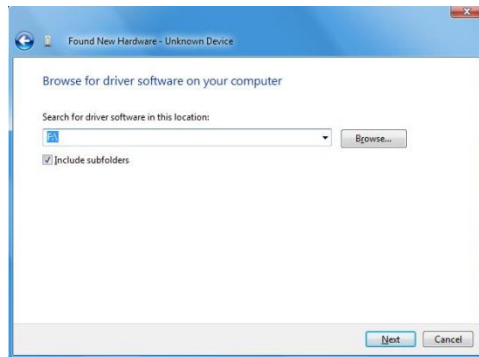


Figure 10 Browsing for Unknown Device

A security window will appear, indicating that the driver software is unsigned (see Figure 11). Select **Install this driver software anyway**.



Figure 11 Windows Security

A window will appear instructing that the software for the driver has been successfully installed (see Figure 12). Click **Close**.



Figure 12 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.

6. Troubleshooting

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

PROBLEM	POSSIBLE SOLUTIONS
<i>No Power @ Transmitter or Receiver</i>	Verify the power adapter and connectors
<i>4K Misaligned Quadrant</i>	Wrong order in the SDI Links either at the receiver or transmitter. Check for cable inversion. (reboot the system when ordered properly)
<i>No Link</i>	Check the fiber for damage, check if the fiber connectors are clean Verify that you have not exceeded the maximum length.

If the above Troubleshooting does not resolve the problem, contact 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 SDI source and receiver, cable length and type (e.g.: Fiber and Coax at both ends).
- Description of problem.
- List of tests performed.

7. 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 as outlined here-in and end with a carriage return:

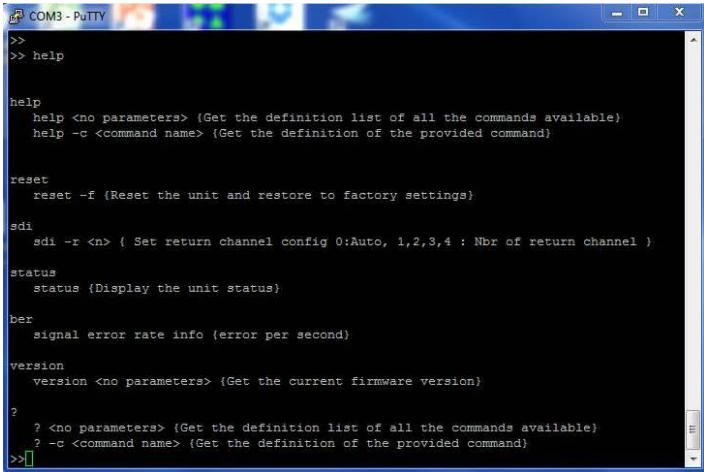
Serial/USB Port Commands

1. HELP Command

help

Description: Display all command lists available

Response: List all available commands



```
COM3 - PuTTY
>>
>> help

help
help <no parameters> {Get the definition list of all the commands available}
help -c <command name> {Get the definition of the provided command}

reset
reset -f {Reset the unit and restore to factory settings}

sdi
sdi -r <n> { Set return channel config 0:Auto, 1,2,3,4 : Nbr of return channel }

status
status {Display the unit status}

ber
ber
signal error rate info {error per second}

version
version <no parameters> {Get the current firmware version}

?
? <no parameters> {Get the definition list of all the commands available}
? -c <command name> {Get the definition of the provided command}
>>
```

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:

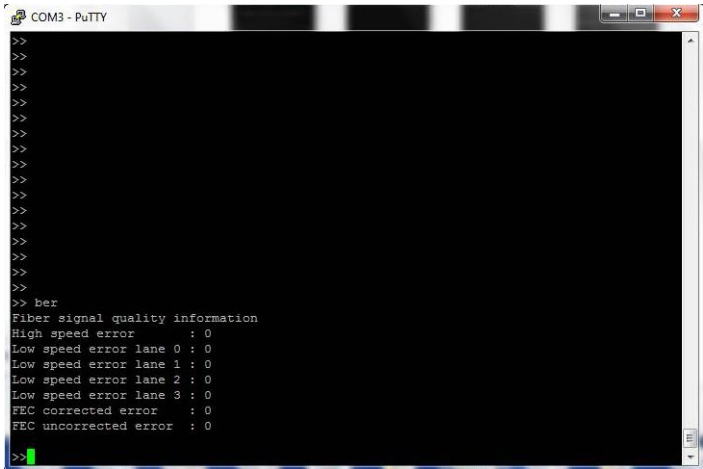
```
"Master firmware version: x.x.x
User variable Version : 2
FPGA Version : RX 1.000 4
Status
SDI MODE : 3G SDI on 1 channel
SDI ratio : 0
SDI ref. : 148.5 MHz
SDI freq. : 148.505 MHz
HDMI freq. : 148.504 MHz
```


5. **Bit Error Rate Command**

ber

Description: Report bit error rate during transmission

Response:



6. **SDI Port Direction Command**

***Sdi -r n* (n for number of return channels)**

Description: Determine the number of return channels, where n={0 to 4}, 0=Auto Direction Detection, or 1, 2, 3, or 4 Return Channels.

Response: n SDI Return Channels



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 this 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 the 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 and a proof of purchase date. 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 RMA's issued are subject to inspection by MuxLab, and will be returned to customer if not properly packaged – units must be returned in original container or equivalent. MuxLab will not accept any such product for repair without an authorization from its Technical Support department and without an RMA# issued by MuxLab Customer Service department. For a credit & replace RMA, the customer will be liable to pay replacement invoice if defective products are not returned.

For Product 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.

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. Customer 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 includes a 90 day warranty.



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