

thinklogical[®]

A **BELDEN** BRAND

TLX12

10G MATRIX SWITCH
PRODUCT MANUAL



Full 4K @ 60Hz Video and KVM Hybrid Switching & Extension Solutions in a Single 1 RU Chassis

Rev. G, May 2021

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Subject: TLX12 10G Matrix Switch Product Manual
Revision: G, May 2021



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PREFACE

About Thinklogical A BELDEN BRAND



thinklogical®
A BELDEN BRAND
100 Washington St.
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Thinklogical, a Belden Brand, is the leading manufacturer and provider of fiber-optic and CATx video, KVM, audio, and peripheral extension and switching solutions used in video-rich, big-data computing environments.

Thinklogical offers the only fiber-optic KVM Matrix Switches in the world that are accredited to the Common Criteria EAL4, TEMPEST SDIP 24 Level B, and NATO NIAPC Evaluation Scheme: GREEN and the U.S. DoD DISA JITC UCR 2013 APL information assurance standards. And Thinklogical Velocity products are the first system with both KVM and video matrix switching capabilities to be placed on the Unified Capabilities Approved Product List (UC APL) under the Video Distribution System (VDS) category.

Thinklogical products are designed and manufactured in the USA and are certified to the ISO 9001:2015 standard.



Thinklogical is headquartered in Milford, Connecticut and is owned by Belden, Inc., St. Louis, MO (<http://www.belden.com>). For more information about Thinklogical products and services, please visit <https://www.thinklogical.com>.

About this Product Manual

This product manual is divided into four sections: **TLX System Features**, **Set-Up & Installation**, **Regulatory & Safety Requirements** and **Thinklogical Support**. These are sub-divided to help you find the topics and procedures you are looking for. This manual also contains Appendices.

Section 1 – TLX System Features: Pg. 1. Details the features and functions of your equipment.

Section 2 – Set-Up and Installation: Pg. 10. Contains all the requirements and procedures necessary to connect and install your equipment, including FPGA updates.

Section 3 – Safety & Regulatory Requirements: Pg. 20. Thinklogical® strongly recommends that you read this section prior to starting the hardware assembly.

Section 4 – How to Contact Us: Pg. 22. Thinklogical provides the best customer support available. If you have any questions or need to contact us for any reason, please refer to this section of the manual.

Note and Warning Symbols

Throughout this manual you will notice certain symbols that bring your attention to important information. These are **Notes** and **Warnings**. Examples are shown below.



Note: Important Notes appear in blue text preceded by a yellow exclamation point symbol, as shown here.

A **note** is meant to call the reader's attention to **helpful or important** information at a point in the text that is relevant to the subject being discussed.



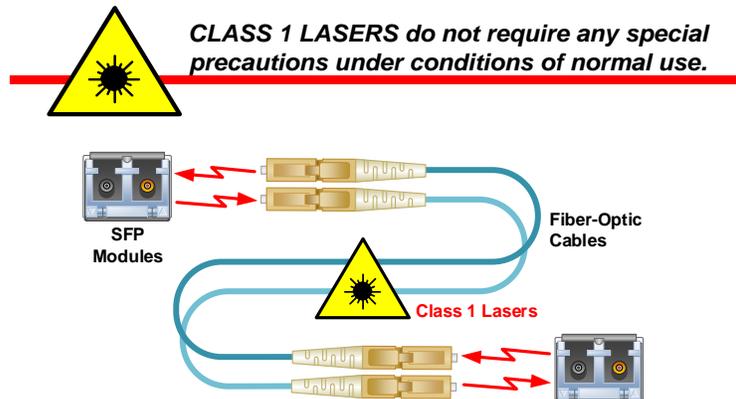
Warning! All Warnings appear in red text, followed by blue text, and preceded by a red stop sign, as shown here.

A **warning** is meant to call the reader's attention to **critical** information at a point in the text that is relevant to the subject being discussed.

**READ THE INSTRUCTIONS THOROUGHLY
BEFORE STARTING ANY PROCEDURE!**

Class 1 Laser Information

The TLX12, like all Thinklogical® products, is designed and identified as a **Class 1 LASER product**. This means the maximum permissible exposure (MPE) cannot be exceeded when viewing the laser with the naked eye or with the aid of typical magnifying optics (e.g. magnifying glass, etc.).



Section 1: TLX System Features

The Logical Solution

The TLX12 is an ultra-compact 10G high performance non-blocking matrix switch that supports full, uncompressed 4K video with full color depth at 60Hz frame rate for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber-optic cable in a single 1 RU Chassis.

The TLX12 provides mission critical dependability and unrivalled signal integrity. Being protocol agnostic, the switch supports DVI, SDI, HD-SDI, Dual-link DVI, Dual-link SDI, USB HID, USB 2.0 and audio.

The TLX12 Matrix Switch is available with 12 LC-type fiber connectors or 12 RJ45 CATx connectors.

HYBRID SWITCHING SOLUTION

For Uncompressed, High Resolution Video & KVM Systems

Thinklogical's TLX Matrix Switches are *high performance, non-blocking switches* for complete end-to-end switching of video, audio and peripheral signals **over multi-mode or single mode fiber-optic cable or CATx cable**.

TLX switches are *protocol agnostic*, supporting most video, audio and peripheral signals and allow users to consolidate all system switching requirements in a single chassis. TLX Matrix Switches are ideal for small or large system applications, with switch sizes ranging from **12 ports to 1280 ports**. Each port supports **10Gbps** bandwidth, preserving signal integrity to provide *uncompressed, high resolution video* with no artifacts, latency or lost frames. Thinklogical's re-clocking technology ensures that every video and data stream is delivered in perfect synchronization.

SECURITY

Creating physical separation between potential threats (users) and the target (secure data) is essential to a secure system design. Thinklogical's system permits users to **access sources up to 80 kilometers away, with no performance degradation**. System administrators can safeguard sources in a centralized location, allowing users to maintain remote access to the sources, but with no means to breach the system, either accidentally or intentionally (such as downloading sensitive information onto a USB drive).

PARTITIONED AND RESTRICTED SWITCHING

To protect data between multiple networks, partitioning allows the switch resources to be divided to support more than one network without allowing switching between networks. Restricted switching allows the administrator to manage access on a port-by-port basis. Partitioned and restricted switching is enabled through the switch's firmware, which means a threat would have to physically access the switch to tamper with the settings. (See *Appendix C, Secure Applications* on 29.)

CATx Matrix Switching applications, not available on all Thinklogical Matrix Switch models, do not offer an EAL4 rated level of security.

THE TLX12 MATRIX SWITCH DESIGN

The ultra-compact design of the TLX12 10G Matrix Switch (sometimes referred to as a Switch or Router) supports up to 12 ports of full, uncompressed 4K video with full color depth at 60Hz frame rate in a single 1 RU chassis for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber-optic cable or CATx cable, thus minimizing critical rack space.

Thinklogical's TLX12 10G Matrix Switch includes:

- A 1 RU Chassis with 12 fiber-optic or 12 CATx Transmit/Receive Ports
- Front Panel LCD and Navigation Buttons
- Front Panel Source, Destination and Control Buttons
- Desktop or Rack Mountable
- Power Supply Module with over-current, over-voltage and over-temperature protection
- RS-232 and Console Serial Ports
- RJ45 LAN Port
- USB Mini-B Update Port
- Custom Button-less versions are operated through a GUI

REAR PANEL CONFIGURATIONS



FRONT PANEL CONFIGURATIONS



TLX12 Matrix Switch Ordering Information

TLX-MSC-C00012	TLX Matrix Switch Chassis with 12 CATx Ports, 10G
TLX-MSC-M00012	TLX Matrix Switch Chassis with 12 Multi-Mode Fiber Ports, 10G
TLX-MSC-MV0012	TLX Matrix Switch Chassis with 12 Multi-Mode Fiber Ports, 6G+
TLX-MSC-S00012	TLX Matrix Switch Chassis with 12 Single-Mode Fiber Ports, 10G
TLX-MSC-SV0012	TLX Matrix Switch Chassis with 12 Single-Mode Fiber Ports, 6G+
TLX-MSC-M00A12	TLX Matrix Switch Chassis with 12 Multi-Mode Fiber Ports, 10G+ Custom
TLX-MSC-MV0A12	TLX Matrix Switch Chassis with 12 Multi-Mode Fiber Ports, 6G+ Custom
TLX-MSC-S00A12	TLX Matrix Switch Chassis with 12 Single-Mode Fiber Ports, 10G+ Custom
TLX-MSC-SV0A12	TLX Matrix Switch Chassis with 12 Single-Mode Fiber Ports, 6G+ Custom

(Custom versions are designated with A, B, C... in the part numbering system.)

DESIGN FEATURES

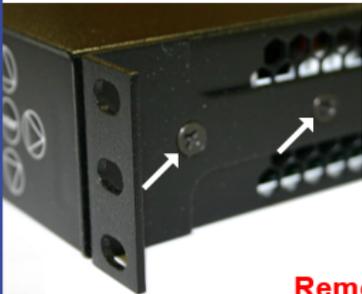
Each **TLX12** includes the following features:

- 12 fiber or 12 CATx ports - In and Out, non-blocking matrix switching
- Each connection supports 10Gbps / 6.25 Gbps with re-clocking input
- Single-mode, multi-mode fiber and BNC coaxial capability
- Comprehensive system setup and control via Thinklogical's SMP software
- Multicasting and macros supported
- SNMP control protocol
- Controllable via LAN or serial connection

Desktop or Rack Mount

You may choose to place your **TLX12 Chassis** on or under a shelf or desktop (rubber feet included, under-desk mounting brackets, Kit ENCA000797, available), or rack mount it using the supplied EIA 19" mounting brackets. In any mounting configuration, the front panel should be visible and unobstructed so that the navigation buttons and LCD display are accessible. All connections are made on the rear of the chassis. The TLX12 chassis does not need to be opened or accessed. The sturdy metal case allows units to be stacked as needed (**maximum of four units per stack, with a minimum of two inches of clearance between stacks for adequate ventilation**).

REMOVING THE RACK-MOUNTING BRACKETS:



Your chassis will have 1 of 2 bracket types.

2 screws per bracket.

2 brackets per chassis.



Remove power from the unit first!

Each mounting bracket is secured by two Philips screws that can be safely removed for desk-top mounting without removing the cover.

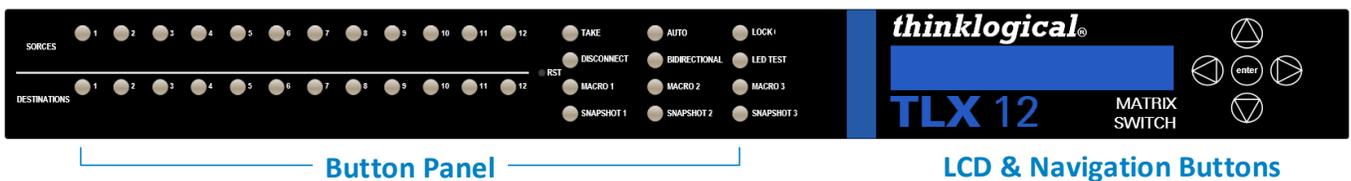
All screws should be reinstalled after the brackets have been removed.

Retain the brackets for future use.

Front Panel Display and Navigation Buttons

The LCD and Navigation Buttons are used to view and modify System and Network settings, assign IP addresses, monitor the temperature and fans, and to reboot or power down the unit. The TLX12 front-panel LCD should be visible and accessible for system setup.

TLX12 FRONT PANEL



Navigating the Menus

Main Root Menu: Once the system is powered up, the initial chassis display is shown as follows:



Your chosen *Host Name* is listed on the first line of the display. The model and software version (VX.XX) of the unit are displayed on the second line.

From the Main Menu, press the down arrow ▼ to:

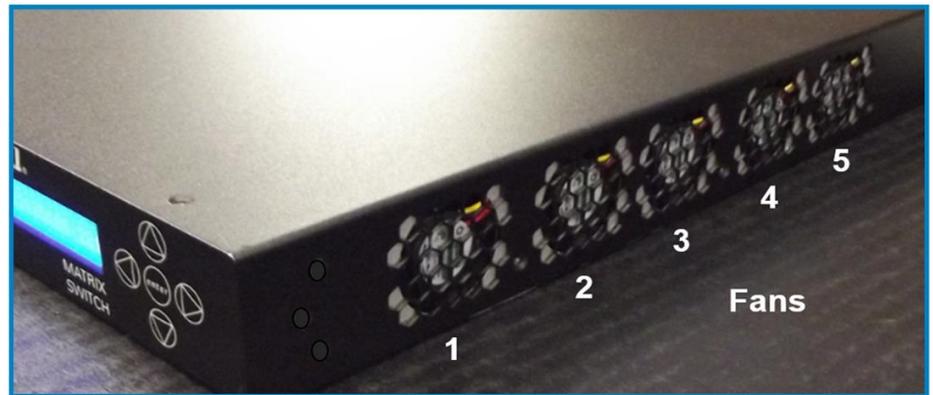
- **View System Menu:** FPGA Version, Ambient Temp, Physical Temp, Alarm Status
- **View Network Menu:** IP Address, Network Mask, Gateway, MAC Address
- **Program Network:** IP Address, Network Mask, Gateway
- **Reboot/Power Off:** Press **enter** to reboot or power off the system (See pg. 18)

Alarms Displayed on the LCD

- **Temperature:** 0 = OK, 1 = exceeds 70° Celsius
- **Card:** 0 = OK, 1 = software or hardware failure
- **Fans:** 0x000 = All fans OK 0x010 = Fan 1 failure 0x008 = Fan 2 failure
0x004 = Fan 3 failure 0x002 = Fan 4 failure 0x001 = Fan 5 failure

Fan status, in hex, as displayed on the LCD:

- 0x000 = All fans OK
- 0x010 = Fan 1 failure
- 0x008 = Fan 2 failure
- 0x004 = Fan 3 failure
- 0x002 = Fan 4 failure
- 0x001 = Fan 5 failure



The physical locations of Fans 1-5 inside the TLX12 Chassis

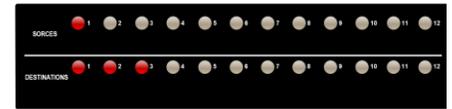
The Button Panel

The Button Panel is used to select sources and destinations, make new switch connections and to review existing switch connections.



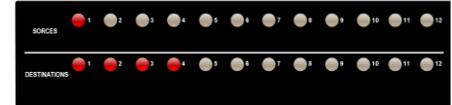
The Button Panel, located on the front of the TLX12, provides Matrix Switch control via the RS232 port's API interface. The following pages provide a functional description of each of the 36 buttons.

SOURCES 1-12 Used to select any one of the 12 Matrix Switch inputs. Only one input can be selected per action. (Pressing a button illuminates it to confirm the selection.) A previously selected input will be deselected upon selecting a new input. To deselect, simply press the illuminated button and the button shall no longer be illuminated/selected. **When an input is selected, all the corresponding connected DESTINATION ports shall illuminate, reporting the full connection map of the selected input.** If no DESTINATION ports illuminate, then the input is not connected.

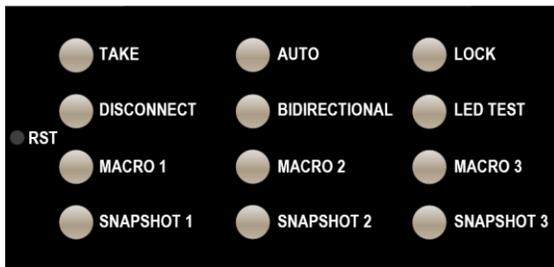


Source 1 is connected to Destinations 1, 2 & 3.

DESTINATIONS 1-12 Used to select Matrix Switch outputs. If an input and output(s) are illuminated, then selecting another output will enable an additional output to the connection map. If no prior input or output(s) are illuminated, then selecting an output will illuminate the corresponding connected input and output(s). To deselect, simply press the illuminated button and the button shall no longer be illuminated/selected.



Pressing Destination 4 when the LEDs are lit adds it to Source 1's outputs.



TAKE In **MANUAL** mode (as opposed to **AUTO** mode), connections/disconnections require pressing the **TAKE** button. After the connection/disconnection is performed, the selected **SOURCE** and **DESTINATION(S)** will no longer remain illuminated.

AUTO In **AUTO** mode, connections are made or broken immediately after a **DESTINATION** button is selected (so the **TAKE** button will not be required) or deselected (so the **DISCONNECT** button will not be required).

- Any selection of an unilluminated **DESTINATION** while a **SOURCE** is selected (illuminated) will cause that **SOURCE** to be connected to the **DESTINATION**.
- Pressing a **DESTINATION** while illuminated (which means it is connected to the currently illuminated **SOURCE**) will cause that **DESTINATION** to be disconnected and no longer illuminated.

LOCK Press the **LOCK** button to disable the following action buttons: **MACRO**, **SNAPSHOT**, **AUTO**, **TAKE** and **DISCONNECT**. Selecting the **SOURCE** or **DESTINATION** will continue to provide connection status information only. Creating **MACRO(S)** and **SNAPSHOT(S)** will be performed in the **LOCK** mode.

DISCONNECT In **MANUAL** mode, after illuminating a **SOURCE** and one or more **DESTINATION (S)**, press the **DISCONNECT** button to disconnect all illuminated **DESTINATION (S)** from the illuminated **SOURCE**. After the disconnect is performed, the selected **SOURCE** and **DESTINATION (S)** will no longer remain illuminated.

BIDIRECTIONAL This is a special **TAKE** button which supports full duplex connectivity. For example, in **MANUAL** mode when **SOURCE 1** and **DESTINATION 2** are illuminated, pressing the **BIDIRECTIONAL** button connects both the selected **SOURCE 1** to **DESTINATION 2** as well as **SOURCE 2** to **DESTINATION 1**.

LED TEST Runs an automatic test of all LEDs collectively and individually for color and functionality.

MACRO n When in **LOCK** mode, holding one of the **MACRO** buttons for >5 seconds will capture currently connected **DESTINATION (s)** (but not those that are disconnected). When in **NORMAL** mode, selecting that **MACRO** button will 'add' the **MACRO** connections to the existing connection map.

SNAPSHOT *n* When in **LOCK mode**, holding one of the SNAPSHOT buttons for >5 seconds will capture the full connection map including those DESTINATION(S) that are disconnected. When in **NORMAL mode**, pressing that SNAPSHOT button will replace all the connections with the SNAPSHOT connection map (not an additive action).

RESET The reset button is recessed behind the front panel and can be pressed with a fine tipped tool. **This will reset the entire unit and is used only in extreme cases.** Preferred ways of resetting the unit use the front panel menus.

PRODUCT COMPATIBILITY

TLX Matrix Switches are compatible with the following Thinklogical® products:

- Single & Multi-Mode **TLX 10G KVM and Video Extenders** (10G to 10G only)
- Single & Multi-Mode **Velocity 6G KVM and Video Extenders** (6G to 6G only)
- **SDI Xtreme 3G+ Extenders**
- **System Management Portfolio**
- Standard **VX Matrix Switch ASCII Interface** (via RS-232 port or via Network port)
- Standard **VX Matrix Switch IP Address Configuration Procedure**
- Standard **VX Matrix Switch SNMP Traps**

THE POWER SUPPLY MODULE



The TLX12 Power Supply is a high efficiency, 650-watt supply (100-240VAC, 50-60Hz input) with a **12V main output** and a **12V standby**. The supply includes an internal cooling fan, status LEDs on the outer panel and over-current, over-voltage and over-temperature protection. The supply is NOT hot pluggable. (See pg. 18 for the *Poweroff* procedure.)

INPUT LED: 

Green=OK

Blinking Green=OV/UV Warning

Off=Off

OUTPUT LED: 

Green=Power OK

Blinking Green=Standby

Amber=Fault

Blinking Amber=Warning

THE PROCESSOR – i.MX 6 QUAD (Freescale)

The Processor platform key features:

- ARM Cortex-A9 MPCore 4 x CPU
- Memory Interfaces
 - 64-Bit DDR3-1066
 - SD (Memory Card Specification, v3.0 including high-capacity SDHC cards up to 32 GB.
 - Serial NAND Flash (SPI)
 - SATA II, 3.0 Gbps HDD
 - EIM Bus (FPGA Parallel Bus I/F)
- HDMI 1.4 port
- USB 2.0 Host (2 ports)
- UART (4 ports)
- Gigabit Ethernet Controller (RGMII)
- GPIO (32 bits)
- I2C Masters (3 ports)
- Internal 100 Megabit Ethernet Interface for Controller to Controller communications

THE NETWORK INTERFACES

The default subnet used by the TLX12 is 192.168.13.xxx. Users may change to their own subnet by reconfiguring the switch's network startup.

This is detailed in the document: [Manual_How_To_Change_A_TLX_Matrix_Switch's_IP_Address](#)

The switch uses several network ports for control and status. Port 17567 accepts commands to control the switch.

The command API is described in the document: [Manual_TLX_Matrix_Switch_ASCII_API_V5](#)

There are other ports that can be read to access system configuration and operating data. The actual data format varies by model and is described in the following sections. There are five blocks of data available for reading.

These ports are documented in: [Manual_TLX_Matrix_Switch_Interfaces](#)

1. Switch connection status (broadcast over port 17564 every few seconds)

- The primary CPU IP address
- First port number in this block
- Last port number in this block
- 'N' port number values

2. Port settings (UDP port 17565, matrix switch localhost only)

- Port output level value
- Port input enable status
- Input port number (big-endian format)

3. Hardware sensor status (TCP port 17566)

- Reserved for future use.

4. Inventory and Power Supply Status (TCP port 17600)

- Card Inventory
- Power Supply Status (internal TL use only)
- Switch card temperature readings

5. I/O data (TCP port 17601)

Refer to the document: [Manual_TLX_Matrix_Switch_Interfaces](#)

6. Service Request (LOS) Signaling (UDP port 17560)

The TLX12 10G Matrix Switch can broadcast a message over the network when a remote receiver requests attention. When enabled, the receiver will toggle its TX pin, causing a LOS (loss of signal) event to occur at the switch. When detected, the switch broadcasts an 'Attention Request' message over the network. This message contains the IP address of the switch and the port number that detected the request. It is left up to an external system to detect, decode and act upon this request.

- 32-bits, switch 's primary IP address
- 16-bits, set to 0
- 16-bits, port number (list starts from 1, not 0)
- 16-bits, key code in bits 0 - 7, 0x00 and 0xff are ignored

SNMP SUPPORT

The switch can be monitored via **SNMP Simple Network Management Protocol** (supports version V2c and V3 USM). Please call our technical support staff at 1-203-647-8700 for downloadable **MIB Management Information Base definition files**.

There are certain entries in the **SNMP configuration file** ([/etc/snmp/snmpd.conf](#)) that users may wish to modify:

- `syslocation` Text to aid in locating the unit
- `syscontact` Name/ Phone/ Email address of a contact
- `trap2sink` IP address/ Name of a system to receive SNMP traps

The default name used by trap2sink is 'snmp.trap' and is defined in the file [/etc/hosts](#) as pointing to 127.0.0.1. The easiest method to change the trap address is to modify the [/etc/hosts](#) entry and not change the trap2sink setting in the configuration file. Users may have multiple trap2sink entries in the configuration file to specify multiple trap destinations. See: [Manual_TLX_Matrix_Switch_SNMP_Traps](#)

NTP SUPPORT

NTP, or Network Time Protocol, is used to keep the internal clock on the switch set to the correct time. By enabling this service, users keep the switch's clock synchronized to an external time reference. To use the service, users must have a time server running on their network or allow the switch to access a public time server. NTP configuration is contained in the file [/etc/ntp.conf](#)

Details about NTP configuration may be found at:

<http://tldp.org/LDP/sag/html/basic-ntp-config.html>

SYSTEM LOG FILES SUPPORT

The switch records system events into files located in the directory [/var/log/](#). If you wish to preserve log files, you may redirect the logs to another system(s). This is a standard feature of Linux's rsyslogd program. Redirection is enabled by entries in **rsyslog** configuration files located in [/etc/rsyslog.d/](#)

Details about syslog configuration file entries may be found at: <http://www.rsyslog.com/doc/>

SERIAL/RS-232 INTERFACES

The TLX12 has two RS-232 serial ports. One is for the Linux command line interface (labeled CONSOLE), and the other is for the switch's ASCII command interface (labeled RS232).

Linux Command Console (Console)

- Baud Rate: 115200
- Data Bits: 8
- Parity: none
- Stop Bits: 1
- Flow Control: none
- DB9 DCE
 - A straight cable is needed to connect to a PC (*not* a null-modem).

ASCII API (RS232)

- Baud Rate: 9600
- Data Bits: 8
- Parity: none
- Stop Bits: 1
- Flow Control: XON/XOFF (Software)
- DB9 DCE
 - A straight cable is needed to connect to a PC (*not* a null-modem).

PORT NUMBERING

Port numbering starts with Port 1 on the left. Each port has a number designation, 1 through 12, printed below it for easy reference.

SFP PORT LABELS: T=Transmit, R=Receive

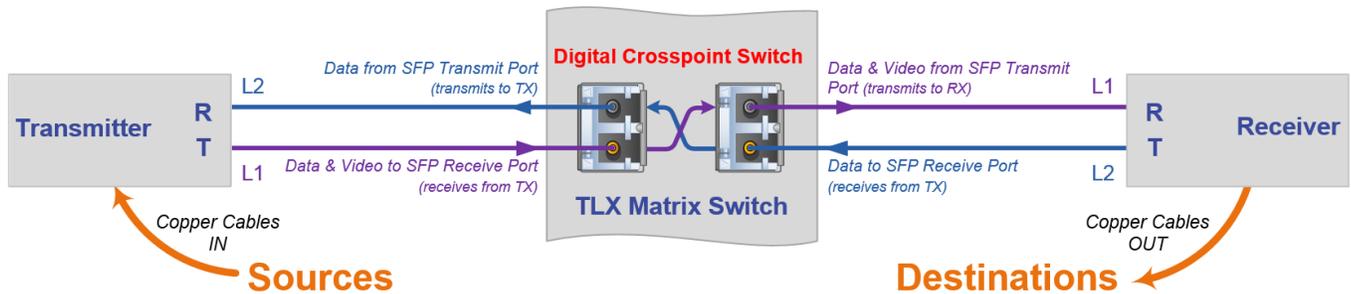


12 LC Fiber-Optic Ports

PORTS 1 through 12 →

THE DIGITAL CROSSPOINT SWITCH

The Digital Crosspoint Switch is a non-blocking, asynchronous switch that can connect any input to any output of Thinklogical's TLX, VX and MX Matrix Switches. Video and Data signals are routed in both directions and the data stream is de-multiplexed at the receiver to deliver uncompressed, high resolution video, audio and peripheral data at the end-user's workstation.



TLX12 TECHNICAL SPECIFICATIONS

PHYSICAL	
TLX12 Chassis	Dimensions: Rack Size: EIA 19" Height (1 RU): 1.75" (44.5 mm) Depth: 15.50" (393.7 mm) Width: 17.47" (443.7 mm) Weight: 11.0 lbs. (5.0 kg) Shipping Weight: 15.0 lbs. (6.8 kg)
Ports	12 fiber or 12 CATx
ENVIRONMENTAL	
Temperature	Operating: 0° to 50°C Storage: -20°C to 70°C
Humidity	Operating: 5% to 95%, non-condensing Storage: Unlimited
Altitude	Operating: Thinklogical products are rated for operation to 1000m elevation without degradation of performance. Maximum operating temperature derates by 1% for every 110m above 1000m. Storage: Unlimited
ELECTRICAL	
Alarm Relay Contacts	Maximum DC: 1A at 30VDC Maximum AC: 0.3A at 125VAC
Input Rating	100-240VAC, 1A, 50-60Hz
Maximum Power Consumption	100W
Thermal Load	341 BTU/Hr
WARRANTY	One Year from date of shipment. Extended warranties available.

Section 2: Set-Up & Installation

Contents

When you receive your Thinklogical® TLX12 KVM Matrix Switch, you should find the following items in the quantities specified in your order:

- TLX12 Chassis (*includes 1 Power Module*)
- Power Cord – PWR-000006-R (International connections may differ)
- Product Manual CD
- Product Quick Start Guide

Unpacking the TLX12 Matrix Switch

The TLX12 Matrix Switch is designed to be mounted in a standard EIA 19” rack. All physical connections to the product use industry-standard connectors. Non-supplied cables that may be needed are commercially available. All connections are found on the rear of the unit.

**READ THE INSTRUCTIONS THOROUGHLY
BEFORE STARTING ANY PROCEDURE!**

- 1** Carefully remove the TLX12 from its shipping package and inspect it to make certain that it is in good condition.
- 2** Ensure that all the SFP modules are sealed with a removable dust plug.
- 3** Verify that the power supply is fully seated in the chassis and that the locking latch is secure.
- 4** When the device has been inspected and found to be in suitable condition, the installation process can begin.

Connecting to the TLX12 Matrix Switch

Thinklogical’s line of TLX Extenders come in both fiber-optic cable and CATx cable versions.

Thinklogical’s proprietary multiplexing technology combines video, audio and peripheral data on a single data stream for up to 80km over a single fiber or up to 100m over a single CATx cable.

TLX Matrix Switches are compatible with the following Thinklogical® products:

- Single & Multi-Mode **TLX 10G KVM and Video Extenders** (10G to 10G only)
- Single & Multi-Mode **Velocity 6G KVM and Video Extenders** (6G to 6G only)
- **SDI Xtreme 3G+ Extenders**
- **System Management Portfolio**
- Standard **VX Matrix Switch ASCII Interface** (via RS-232 port or via Network port)
- Standard **VX Matrix Switch IP Address Configuration Procedure**
- Standard **VX Matrix Switch SNMP Traps**

External Control CPU Minimum Requirements

The External Control CPU must meet the following minimum requirements (including requirements for using Thinklogical's System Management Portfolio):

- **RAM (minimum): Linux: 1GB Windows: 4GB OSX: 4GB**
- **VIDEO:** Works with all video adapters. (Not required if the computer is used as a headless server.)
- **KEYBOARD/MOUSE:** Works with any keyboard/mouse/touchpad. (Not required if the computer is used as a headless server.)
- **NETWORK:** One port minimum, although two ports are recommended for security considerations.
- **DISK SPACE:** Thinklogical programs typically use less than 40 MB.
- **SERIAL PORT:** 1 optional RS-232 serial port (Crestron/AMX serial access)

Pluggable SFP+ Modules

Each Fiber-Optic Chassis contains rows of SFP+ modules that serve as the fiber-optic couplers for the fiber cables to and from the Thinklogical Transmitter and Receiver Extenders.

The SFP+ Optical Module is an 8Gbs Short-Wavelength Transceiver designed for use in bi-directional Fiber-Optic Channel links. The modules have LC-type connectors, are hot-pluggable and operate on 3.3VDC.

Always use **dust caps** to protect against dust and damage when a fiber-optic connector is not attached to its coupling device (fiber-optic equipment, bulkheads, etc.). All Thinklogical Matrix Switch SFPs are fully populated with dust plugs upon shipment.



Note: It is good practice to immediately install dust plugs in unused SFP modules and on the ferrules of unconnected fiber-optic cables.

Each fiber-optic TLX12 Chassis has 12 SFP+ Modules, each mounted within a grounded metal enclosure. Each SFP is locked into its enclosure with a built-in latch handle that can be opened for removal or locked for installation (right).

The latch handle spans the two LC ports. Arrows printed on the handle indicate which port is an INPUT (▶) and which is an OUTPUT (◀).



SFP+ Latch Closed



SFP+ Latch Open

LC-Type Fiber-Optic Cable

Installing Fiber-Optic Cable: The TLX12 switching matrix connects any SFP's optical output port (Transmit) to any other SFP's optical input port (Receive) with LC-type connectors.



Requirements: Thinklogical recommends LC-type, SX+ Laser Enhanced (50 or 62.5µm) fiber for your TLX12 KVM Matrix Switch and Velocity Extension System. Multi-mode fiber can extend up to a maximum of 400m and Single-mode fiber can extend up to 80km.



Thinklogical recommends SX+ Laser Enhanced Fiber-optic Cable, 50 or 62.5 microns, terminated with LC type connectors.

Multi-Mode: Up to 33 meters with Type OM1
 Up to 82 meters with Type OM2
 Up to 300 meters with Type OM3
 Up to 400 meters with Type OM4
Single Mode: Up to 80km with Type OS2 9/125

Handling Fiber-Optic Cable: Unlike copper cabling, fiber-optic cable requires special handling. A small speck of dust or a scratch to the ferrule tip (the end of the connector) can attenuate the optical signal, rendering the cable inoperable.



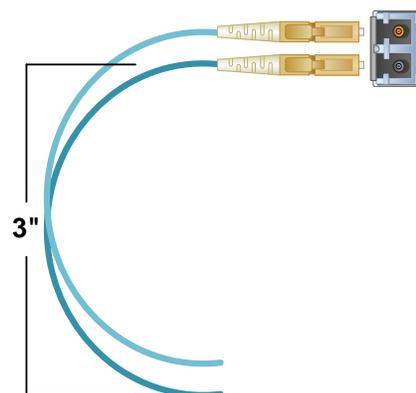
Warning! The ends of the connectors (the ferrule) should never come in contact with any foreign object, including fingertips. Always install a dust cap on the ferrule of any unused fiber immediately to protect the tip.



Dust cap installed on the ferrule.

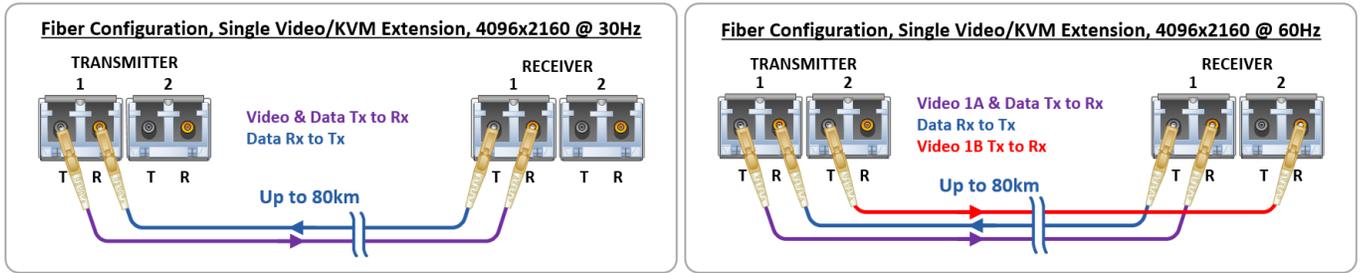


Warning! Minimum bend diameter must be no less than 3". Be careful not to kink or pinch the fiber when using ties. Always follow the manufacturer's installation instructions.

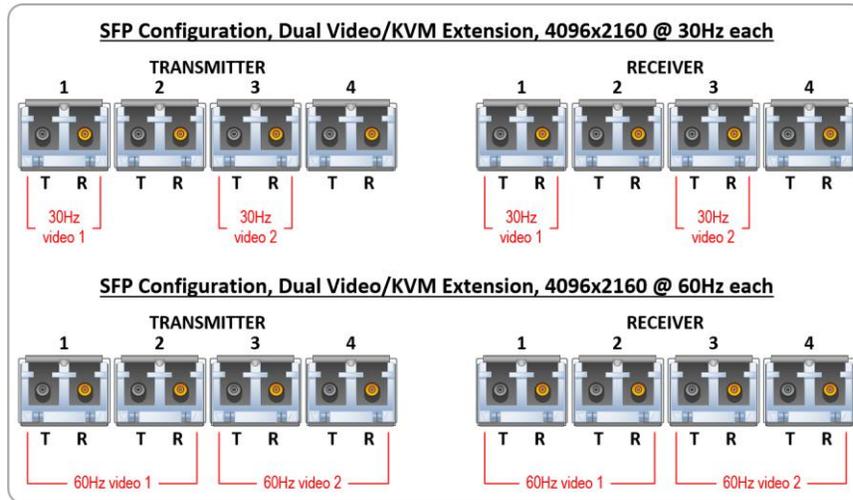


TLX Extender Fiber-Optic Cable Configurations

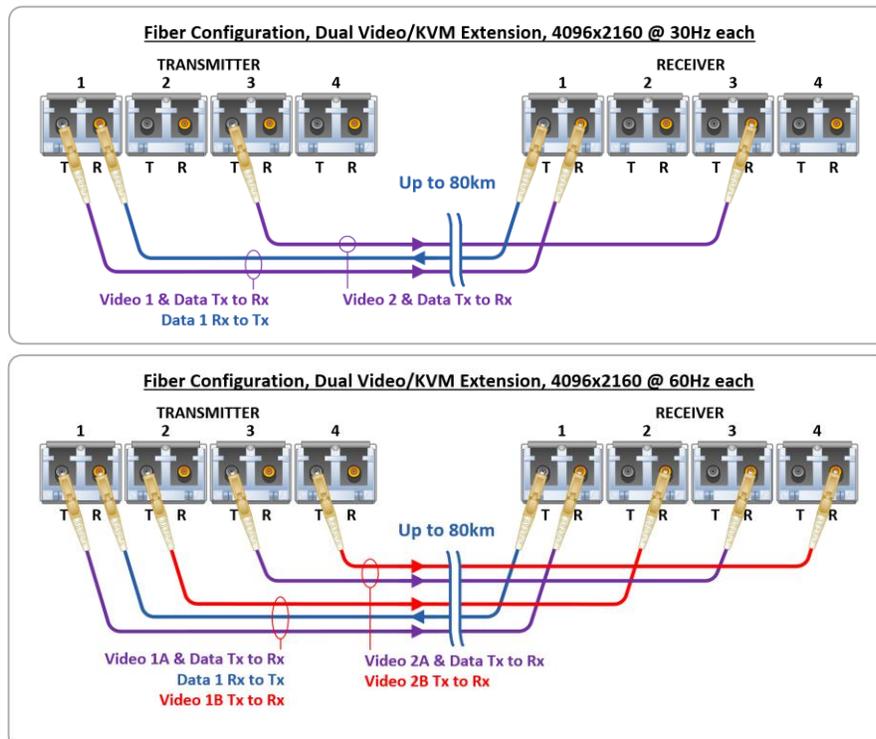
INGLE VIDEO MODULES



DUAL VIDEO MODULES

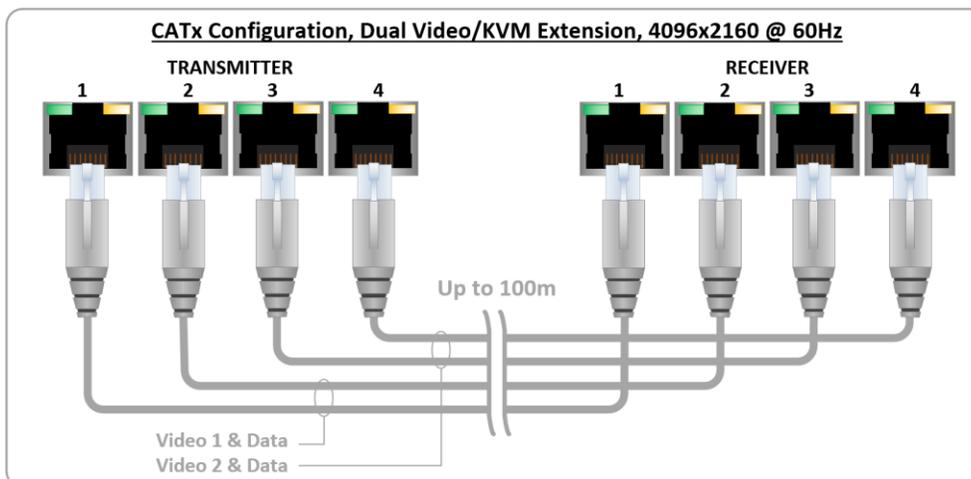
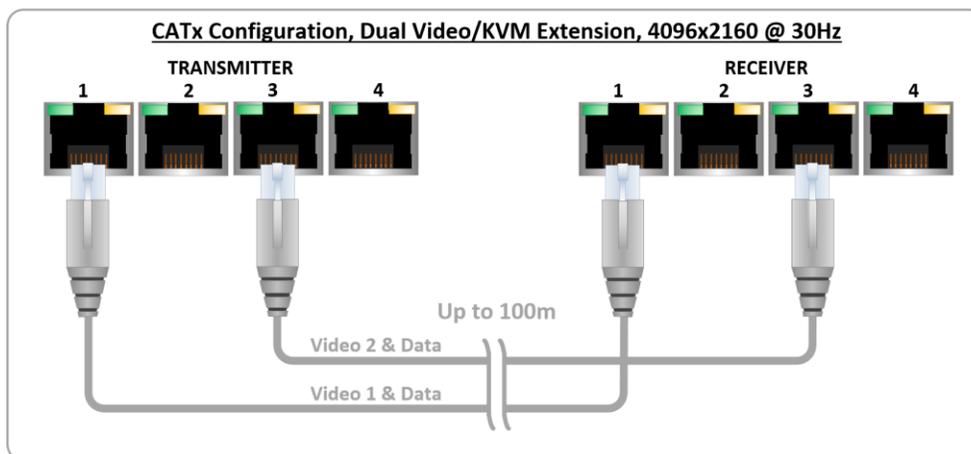
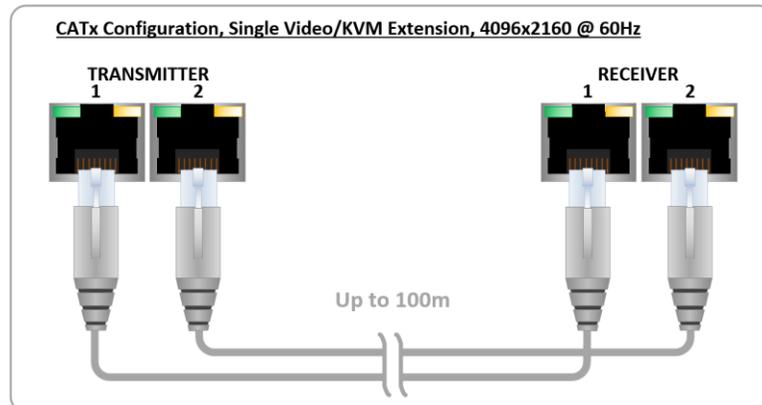
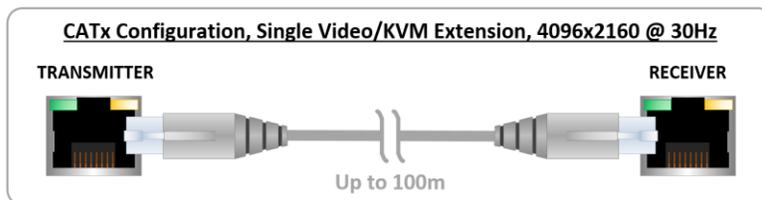


Note: On Dual Video models, SFPs 1 & 2 are Video 1 and SFPs 3 & 4 are Video 2.



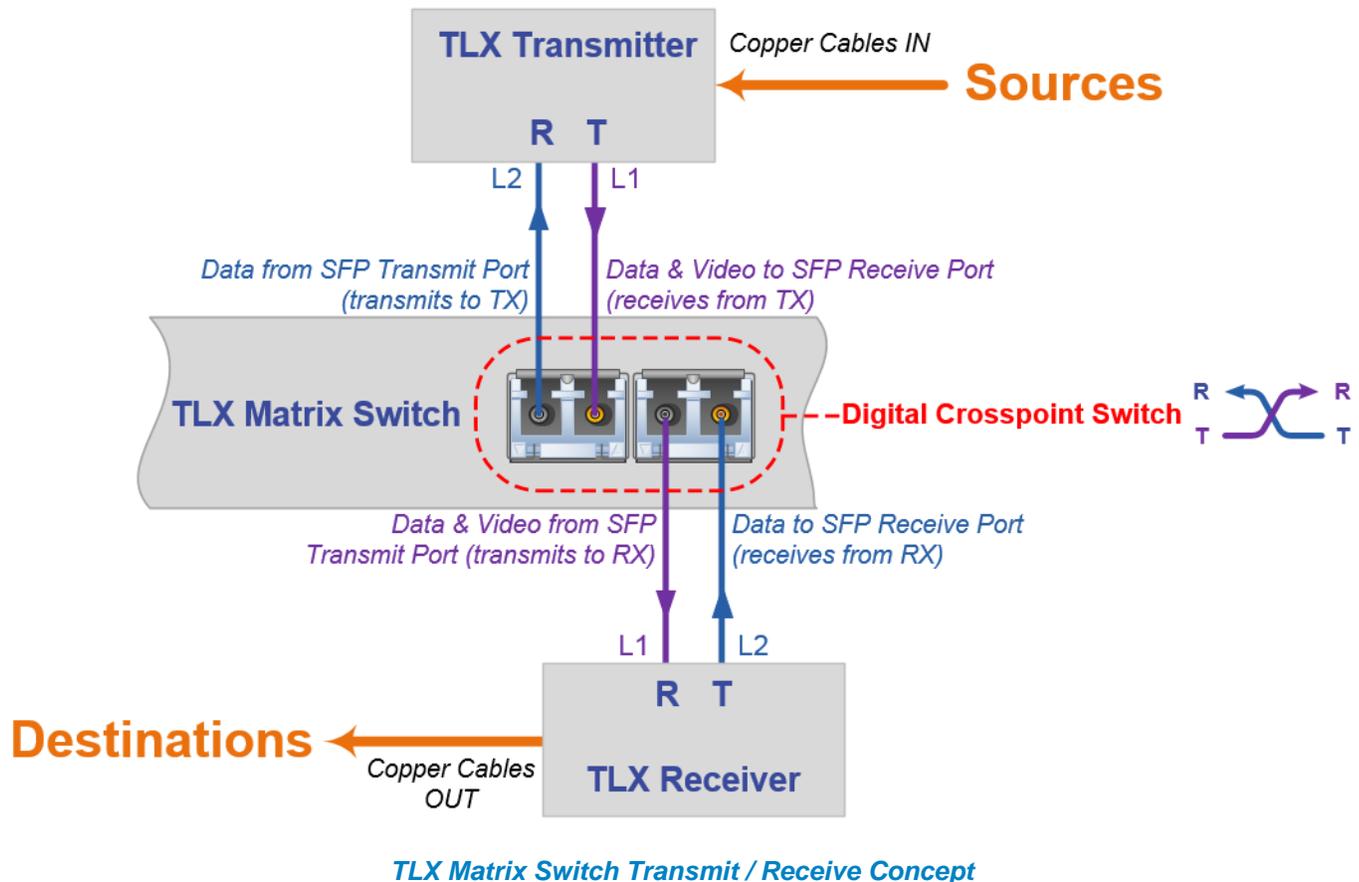
TLX Extender CATx Cable Configurations

There are currently several versions of CATx (category 5/5a/6/6a/etc.) cables on the market. **Thinklogical recommends using a minimum of CAT6 for your TLX KVM Matrix Switch and Extension System (CAT6a 23 AWG recommended).** All cables CAT6 or higher can extend up to a maximum of 100m.



Routing Thinklogical Extenders through the TLX12

Comprised of a fiber-optic or CATx Matrix Switch and fiber-optic or CATx Transmitter and Receiver Extenders, this complete system provides transparent and secure routing, switching and extension of video and high-speed data peripherals to remote destinations with ease.

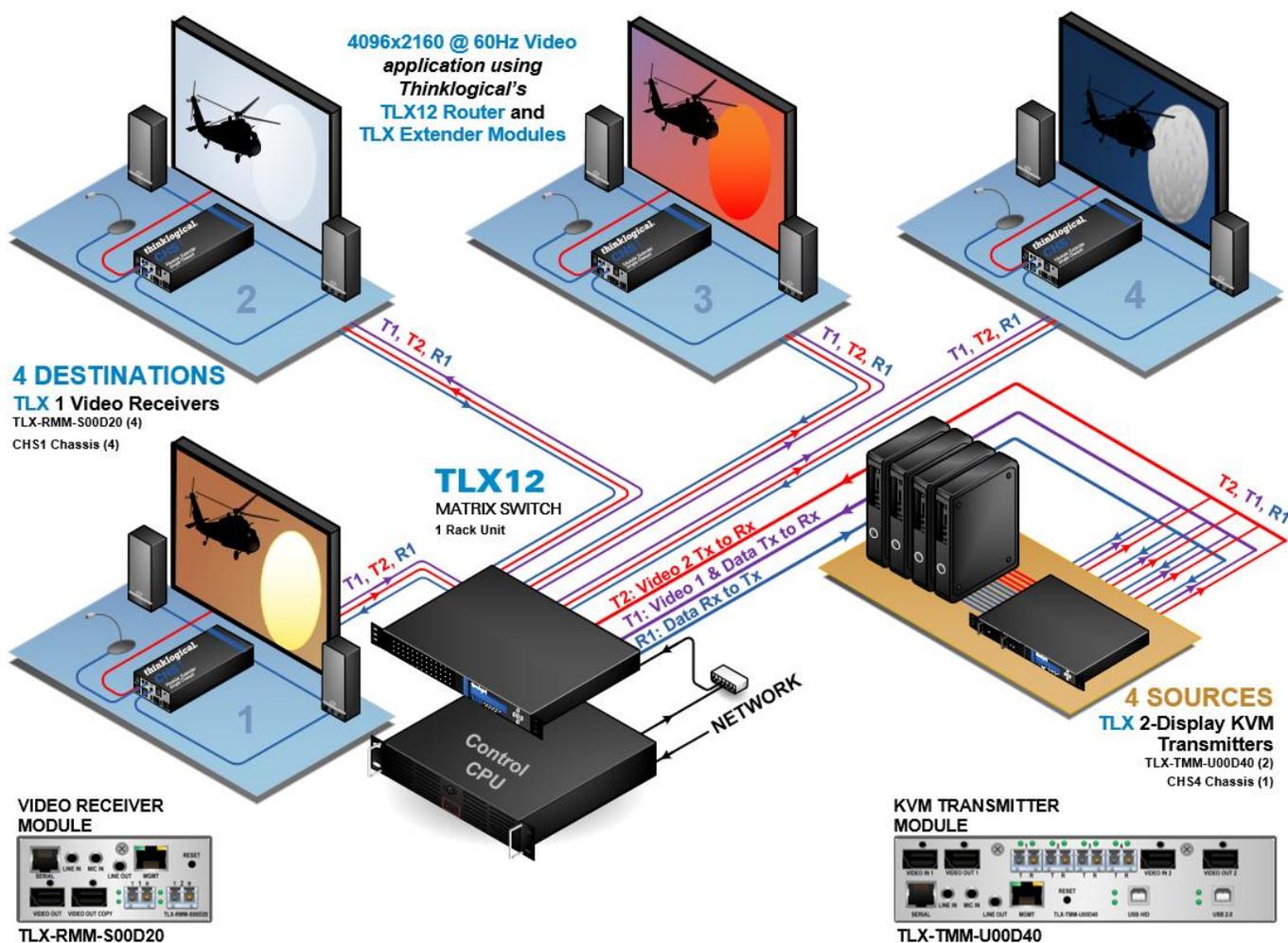


Connecting to a Receiver

The Velocity Receiver serves as the Destination (desktops, theaters, conference rooms, editing suites, control consoles, video walls, etc.). Depending on your configuration, your KMASS devices (audio, keyboard, mouse, etc.) are connected to the Receiver first, using standard cables. Power can then be applied to the unit. The Receiver then connects to the TLX12 using fiber-optic cable (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).

Connecting to a Transmitter

The Transmitter serves as the Source (computer and video entities). If the source includes a workstation, depending on your configuration, your local KMASS devices (audio, keyboard, mouse, etc.) should be connected first. The video sources (e.g. computers, tape decks, etc.) are connected next, followed by any local video devices. Power can then be applied to the unit. The Transmitter connects to the TLX12 Transmitter ports using fiber-optic cables (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).



Connecting to a Control CPU

The TLX12 is controlled via a dedicated external Control CPU. This allows for customization as well as ease of control and administration. Access is provided via a network connection or serial RS-232 port.



Note: The Control CPU (Computer) is supplied separately.

The network and serial RS-232 connection both use the same low-level ASCII API syntax. This command syntax is defined in the document: [Manual_TLX_Matrix_Switch_ASCII_API_V5](#). Each line contains only one command and must end with a carriage return (CR) and line feed (LF), or just a line feed (LF). The characters are not echoed.

The serial port is configured for 9600 baud, 1 stop bit, no parity, and no flow control. The network interface listens on TCP (Transmission Control Protocol) port **17567**. It accepts the same commands as the serial interface. You may use telnet to manually open a connection and control the TLX Matrix Switch using port 17567.

Third-party controllers will control the Matrix Switch by connecting to either the serial or network port. Using the network is the only means to take advantage of our automatic fail-over facility.

Thinklogical offers a web-based control program called 'SMP'. This program is described in greater detail in the document: [Manual_System_Management_Portfolio](#), available on the Thinklogical web site.

Operating System Default Users / Passwords

TLX Matrix Switch Operating Systems:

Debian 7

Installed on V5.07.XX (and earlier)

- OS default username/password
 - debian/temppwd
 - root/root

Debian 8

Installed on V5.08.XX

- OS default username/password
 - debian/temppwd
 - root/root (cannot remote into OS as root user)

Centos 7

Installed on V5.09.XX

- OS default username/password
 - centos/temppwd
 - root/root (cannot remote into OS as root user)

Linux Command Console (Console)

- Baud Rate: 115200
- Data Bits: 8
- Parity: none
- Stop Bits: 1
- Flow Control: none
- DB9 DCE
 - A straight (NOT a null-modem) cable is needed to connect to a PC.

ASCII API (RS-232) Settings

- Baud Rate: 9600
- Data Bits: 8
- Parity: none
- Stop Bits: 1
- Flow Control: XON/XOFF (Software)
- DB9 DCE
 - A straight (NOT a null-modem) cable is needed to connect to a PC

Order of Installation Events

Please refer to the **Quick Start Guide** included with your products for detailed instructions. The **TLX12 Quick Start Guide** is also available in **Appendix A** (pg. 23).

Firmware Updates

See **APPENDIX B: FPGA Program Code Update Procedure**, pg. 24 and **APPENDIX C: FPGA Download Installation Procedure** on pg. 25.

Firmware updates are available through Thinklogical®. For technical assistance, please call us at 1-203-647-8798.



Note: If mounting the chassis in a rack, insure that air flow to the fans is not restricted (minimum 2" of free space on all sides).



Note: If any of the sensors detect an over temperature condition, power will be removed from all sensitive components and the system will shut down.

System Reboot or Power Off at the Chassis

From the Chassis' LCD Main Menu, press the **down arrow** ▼ 4 times to get to **Reboot/Power Off**.



From the **Reboot/Power Off** menu, press the ▼ **arrow** once to choose **Reboot** or twice to **Poweroff**. Press ▲ to **Cancel**.



Press **enter** to **execute either choice**.



You will be given another chance to either **Enter** or **Cancel** your choice. If no selection is made within ~30 seconds, the display will revert to the Main Menu.



For **Poweroff**, press **Enter**. The shut-down process will begin (displayed). When **OK to power off** is displayed, **remove the AC power cord** from the chassis. The system is now fully powered down.



Note: When rebooting via the LCD, Console Port, or an SSH connection, the chassis power on the TLX12 will NOT be turned off and existing switch connections will remain. To clear the switch connections, use the `pwrOff` command line or the LCD menu.

System Shut-Down at the Command Line

The following commands allow a safe shut-down of the system:



Note: During normal operation, the Controller can be managed via the Console Port or an SSH connection.

The PWROFF Command

- Typing `pwrOff` at the command line prompt will halt the Controller *but will NOT turn off the power to the entire base board, including the SFPs.*
- Once the Controller is inactive, the display will indicate “**OK to power off**” and the system must then be fully powered down by unplugging the Matrix Switch’s AC power cord.



Note: Chassis power on the TLX12 cannot be turned off via the LCD, Console Port, or an SSH connection. To clear the switch connections, the AC power cord must be removed, as described above.

How to Remove and Replace a Power Supply

**READ THE INSTRUCTIONS THOROUGHLY
BEFORE STARTING ANY PROCEDURE!**

The Power Module is universal input 100-240VAC, 50-60Hz. Use the proper power cords for your region (PWR-000006-R, supplied with the unit). See the **Power Off** procedure, above.

1 Perform a *Poweroff* as shown, previous page. Ensure the power cord is removed from the power supply module.



Warning! Do not proceed to Step 2 until the Poweroff has been completed.

2 Press the green latch in (to the left) with your right hand while grasping the handle with your left.

3 Pull the Power Module straight out of the chassis by the handle.

4 Insert the new Power Module into the chassis and slide it in until it reaches the backplane connector. At this point, use just enough force to firmly engage the module with the mating connector and lock the latch. Install the AC cord.



Warning! If the module does not slide easily into the connector, do not force it! Damage may occur. Remove the module and start over.



Section 3: Regulatory & Safety Requirements

Symbols Found on Our Products

Markings and labels on our products follow industry-standard conventions. Regulatory markings found on our products comply with all required domestic and many international requirements.



Regulatory Compliance

Thinklogical's® products are designed and made in the U.S.A. These products have been tested by a certified testing laboratory and found compliant with the following standards for both domestic USA and many international locations:

North America

Safety

UL 62368-1:2014Ed.2

CSA C22.2#62368-1:2014Ed.2

LASER Safety

CDRH 21 CFR 1040.10

Class 1 LASER Product

Canadian Radiation Emitting Devices Act, REDR C1370

IEC 60825:2001 Parts 1 and 2

Class 1 LASER Product

Electromagnetic Interference

FCC 47CFR Part 15 Subpart B: 2013 Class A

Industry Canada ICES-003: 2016 Ed. 6

Australia & New Zealand

This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take corrective action.

European Union

Declaration of Conformity

Manufacturer's Name & Address:

Thinklogical, A BELDEN BRAND

100 Washington Street

Milford, Connecticut 06460 USA

Thinklogical's products comply with the requirements of the Low Voltage Directive 2006/95/EC, the EMC Directive 2004/108/EC, the RoHS Directive 2011/65/EU, the WEEE Directive 2012/19/EU and carry the CE marking accordingly.

Standards with Which Our Products Comply

Safety

IEC 62368-1:2014Ed.2+C1

CB Scheme Certificate

Electromagnetic Emissions

CENELEC EN 55022:2010 +AC:2011

Electromagnetic Immunity

EN 55024:2011+A1

CENELEC EN 55032:2015

EN 61000-3-2:2000 Harmonics

EN 61000-3-3:2008 Flicker

EN 61000-4-2:2009 Electro-Static Discharge Test

EN 61000-4-3:2006 A1:2008, A2:2010 Radiated Immunity Field Test

EN 61000-4-4:2004 Electrical Fast Transient Test

EN 61000-4-5:2006 Power Supply Surge Test

EN 61000-4-6:2009 Conducted Immunity Test

EN 61000-4-11:2004 Voltage Dips & Interrupts Test

Supplementary Information

The following statements may be appropriate for certain geographical regions and might not apply to your location:

- This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations. *Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.*
- This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective action.
- This equipment has been tested and found compliant 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 in which case the user may be required to make adequate corrective measures at their own expense.
- This Class A digital apparatus complies with Canadian ICES-003 and has been verified as compliant within the Class A limits of the FCC Radio Frequency Device Rules (FCC Title 47, Part 15, Subpart B CLASS A), measured to CISPR 22:1993 limits and methods of measurement of Radio Disturbance Characteristics of Information Technology Equipment.
- The user may notice degraded audio performance in the presence of electro-magnetic fields.

Product Serial Number

Thinklogical products have a unique serial number, which includes a date-code, printed on an adhesive label that is affixed to the unit. The format for the date-code is *2 digits for the month*, dash, *2 digits for the year*, plus *at least four digits for a unique unit number*. For example:

05-210028 indicates the unit was built in the **5th** month of **2021**, and is unit number **28**.

Connection to the Product

Connections and installation hardware for our products use industry-standard devices and methods. All wiring connections to the customer equipment are designed to minimize proprietary or customized connectors and cabling. Power connections are made with regionally appropriate power cords and approved methods.

Section 4: How to Contact Us

Customer Support

Website: <https://www.thinklogical.com>

Check out our website for current products, support documents and useful information about all the products and services we offer, including:

- **Technical Specification Sheets**
- **Quick-Start Guides**
- **Product Manuals** (for viewing online or for download)
- **Chat live with a Technical Service Representative**

Email: <mailto:support@thinklogical.com>

For product support, technical issues or questions, product repairs and request for Return Merchandise Authorization.

Telephone: [1-203-647-8700](tel:1-203-647-8700)

Please contact our expert sales staff in Milford, CT **Monday - Friday from 8:30am to 5:00pm**, Eastern Time Zone. If leaving a voice message, please provide a preferred time to call back.

Fax: [1-203-783-9949](tel:1-203-783-9949)

Please indicate the nature of the fax on your cover sheet and provide contact information.

Product Support

Warranty

Thinklogical warrants this product against defects in materials and workmanship for a period of one year from the date of delivery, with longer terms available at time of purchase on most products. Thinklogical and its suppliers disclaim all other warranties. Please refer to your product invoice for the Warranty Terms & Conditions.

Defect remedy shall be the repair or replacement of the product, provided that the defective product is returned to the authorized dealer within a year from the date of delivery.

If you wish to return your device, contact the Thinklogical authorized dealer where you purchased the device, or if you purchased directly, call Thinklogical at **1-800-647-8700**.

Return Authorization

If you must return a product to Thinklogical directly, please contact us at **1-203-647-8700**. Customer Support will ask you to describe the problem and will issue you a **Return Merchandise Authorization number** (RMA#). Pack the device in its original box, if possible, and return it with the RMA# printed on the outside of the box. **DO NOT return a product to Thinklogical without a Return Merchandise Authorization.**

Our Address

If you have any product issues or questions or need technical assistance with your Thinklogical system, please call us at **1-203-647-8700** and let us help. If you need to write us or return a product, please use the following address:

Please include the Return Merchandise Authorization number: **Thinklogical, A BELDEN BRAND**
100 Washington Street
Milford, CT 06460 USA
Attn: RMA#

Appendix A: TLX12 Quick Start Guide

QUICK-START GUIDE

As used with Thinklogical's Q-Series & TLX Video Extension Systems

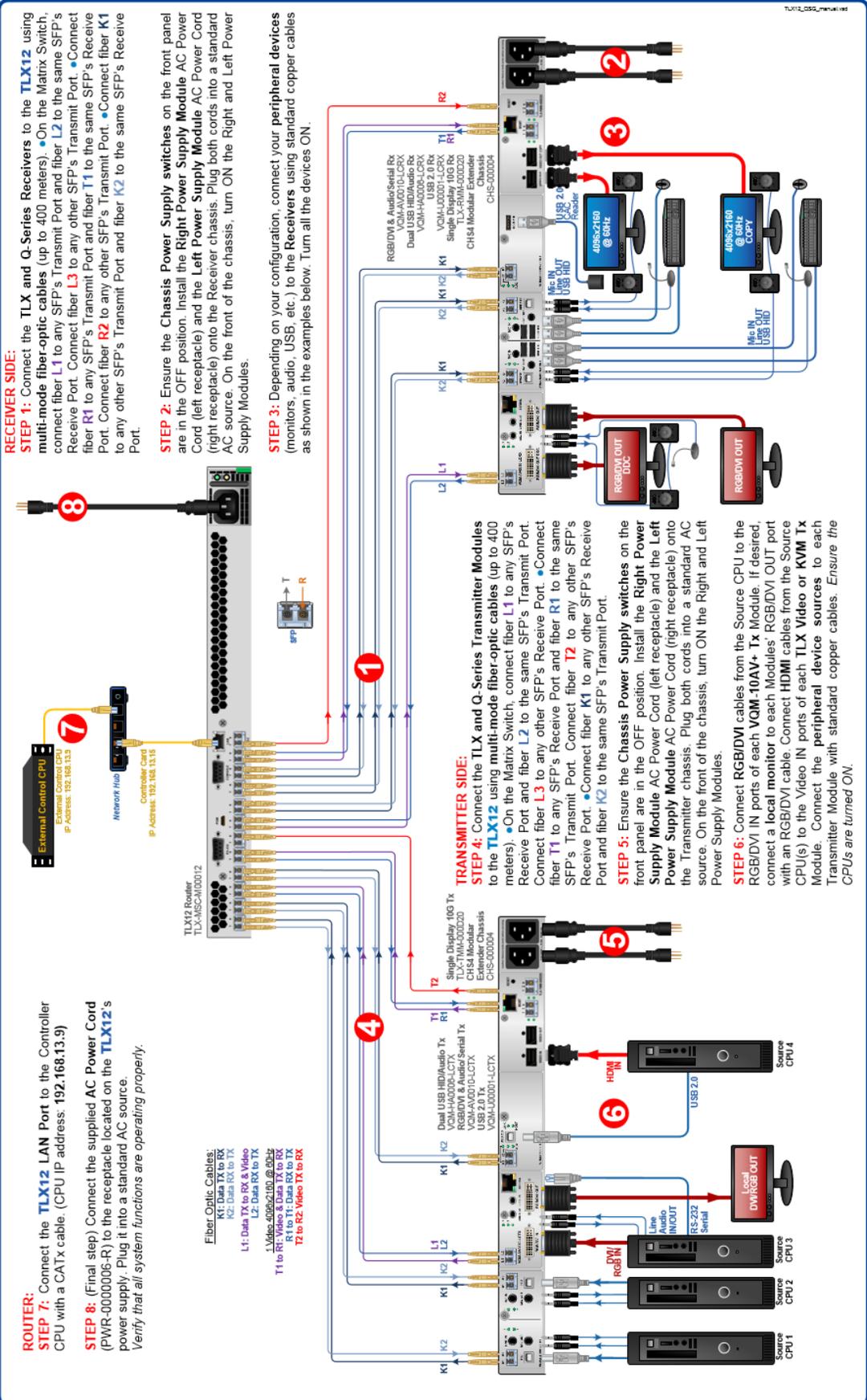
With VQM-HA6, VQM-10A1/4, VQI-HU1 and TLX-D20 Transmitter & Receiver Modules

TLX12 10G MATRIX SWITCH

Thinklogical's CHS4 Modular Extender Chassis can accommodate either two, three or four modules (depending on the model) in any combination of Transmitter, Receiver or both. The CHS4 Modular Extender Chassis will also accommodate up to four Q-Series Transmitter and Receiver Modules. Ask your sales representative for more information or visit us on the web at www.thinklogical.com

ROUTER:
STEP 7: Connect the TLX12 LAN Port to the Controller CPU with a CATx cable. (CPU IP address: 192.168.13.9)
STEP 8: (Final step) Connect the supplied AC Power Cord (PWR-0000006-R) to the receptacle located on the TLX12's power supply. Plug it into a standard AC source. Verify that all system functions are operating properly.

Fiber Optic Cables:
K1: Data TX to RX
K2: Data RX to TX
L1: Data TX to RX & Video
L2: Data RX to TX
T1 to R1: Video & Data TX to RX
T2 to R2: Video TX to RX



RECEIVER SIDE:

STEP 1: Connect the TLX and Q-Series Receivers to the TLX12 using multi-mode fiber-optic cables (up to 400 meters).
• On the Matrix Switch, connect fiber L1 to any SFP's Transmit Port and fiber L2 to the same SFP's Receive Port. Connect fiber L3 to any other SFP's Transmit Port.
• Connect fiber R1 to any SFP's Transmit Port and fiber T1 to the same SFP's Receive Port. Connect fiber R2 to any other SFP's Transmit Port.
• Connect fiber K1 to any other SFP's Transmit Port and fiber K2 to the same SFP's Receive Port.

STEP 2: Ensure the Chassis Power Supply switches on the front panel are in the OFF position. Install the Right Power Supply Module AC Power Cord (left receptacle) and the Left Power Supply Module AC Power Cord (right receptacle) onto the Receiver chassis. Plug both cords into a standard AC source. On the front of the chassis, turn ON the Right and Left Power Supply Modules.

STEP 3: Depending on your configuration, connect your peripheral devices (monitors, audio, USB, etc.) to the Receivers using standard copper cables as shown in the examples below. Turn all the devices ON.

TRANSMITTER SIDE:

STEP 4: Connect the TLX and Q-Series Transmitter Modules to the TLX12 using multi-mode fiber-optic cables (up to 400 meters).
• On the Matrix Switch, connect fiber L1 to any SFP's Receive Port and fiber L2 to the same SFP's Transmit Port. Connect fiber L3 to any other SFP's Receive Port.
• Connect fiber T1 to any SFP's Receive Port and fiber R1 to the same SFP's Transmit Port. Connect fiber T2 to any other SFP's Receive Port and fiber R2 to the same SFP's Transmit Port.

STEP 5: Ensure the Chassis Power Supply switches on the front panel are in the OFF position. Install the Right Power Supply Module AC Power Cord (left receptacle) and the Left Power Supply Module AC Power Cord (right receptacle) onto the Transmitter chassis. Plug both cords into a standard AC source. On the front of the chassis, turn ON the Right and Left Power Supply Modules.

STEP 6: Connect RGB/DVI cables from the Source CPU to the RGB/DVI IN ports of each VQM-10AV+ Tx Module. If desired, connect a local monitor to each Module's RGB/DVI OUT port with an RGB/DVI cable. Connect HDMI cables from the Source CPU(s) to the Video IN ports of each TLX Video or KVM Tx Module. Connect the peripheral device sources to each Transmitter Module with standard copper cables. Ensure the CPUs are turned ON.

Appendix B: TLX12 FPGA Program Code Update Procedure

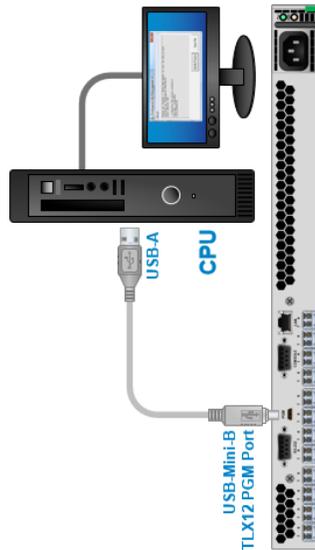
thinklogical TLX12 KVM Matrix Switch FPGA Program Code Update Procedure

STEP 1: FPGA Update Preparation:
Please contact your **thinklogical** Sales Representative or Customer Service (1-203-647-8700) for access to the FPGA Download Update application.

Perform steps 1-8 as described:

The following procedure documents the steps necessary to update the FPGA program code on a TLX12 10G KVM Matrix Switch using a Windows-based computer.

STEP 2: Save the FPGA program code update file provided by Thinklogical to a known location on the PC. The program code update file will have a file extension of **.lbf**. This is the file that will be retrieved in Step 6.



STEP 3: Connect a **USB A to USB mini-B cable** between the TLX12's PGM UPGRADE port and the CPU as shown above.



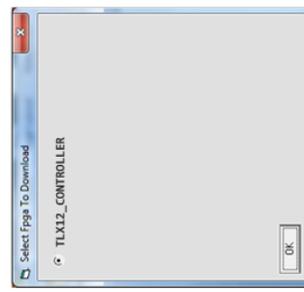
STEP 4: Run the Thinklogical **FPGA Upgrade** application. You will see the following window. Click on **Identify Product**.



STEP 5: You may see a window similar to this, identifying the desired file name. Click **Open File**.



STEP 6: Select **OK**. A dialog box similar to this will open.



STEP 7: Verify the response below during the process. The spinning bar to the left of the progress bar will stop when the download is complete.



STEP 8: When **FPGA download is complete**, you will see the window below. The Upgrade Procedure is now complete. Remove the USB cable from the PGM Update Port and exit the application.



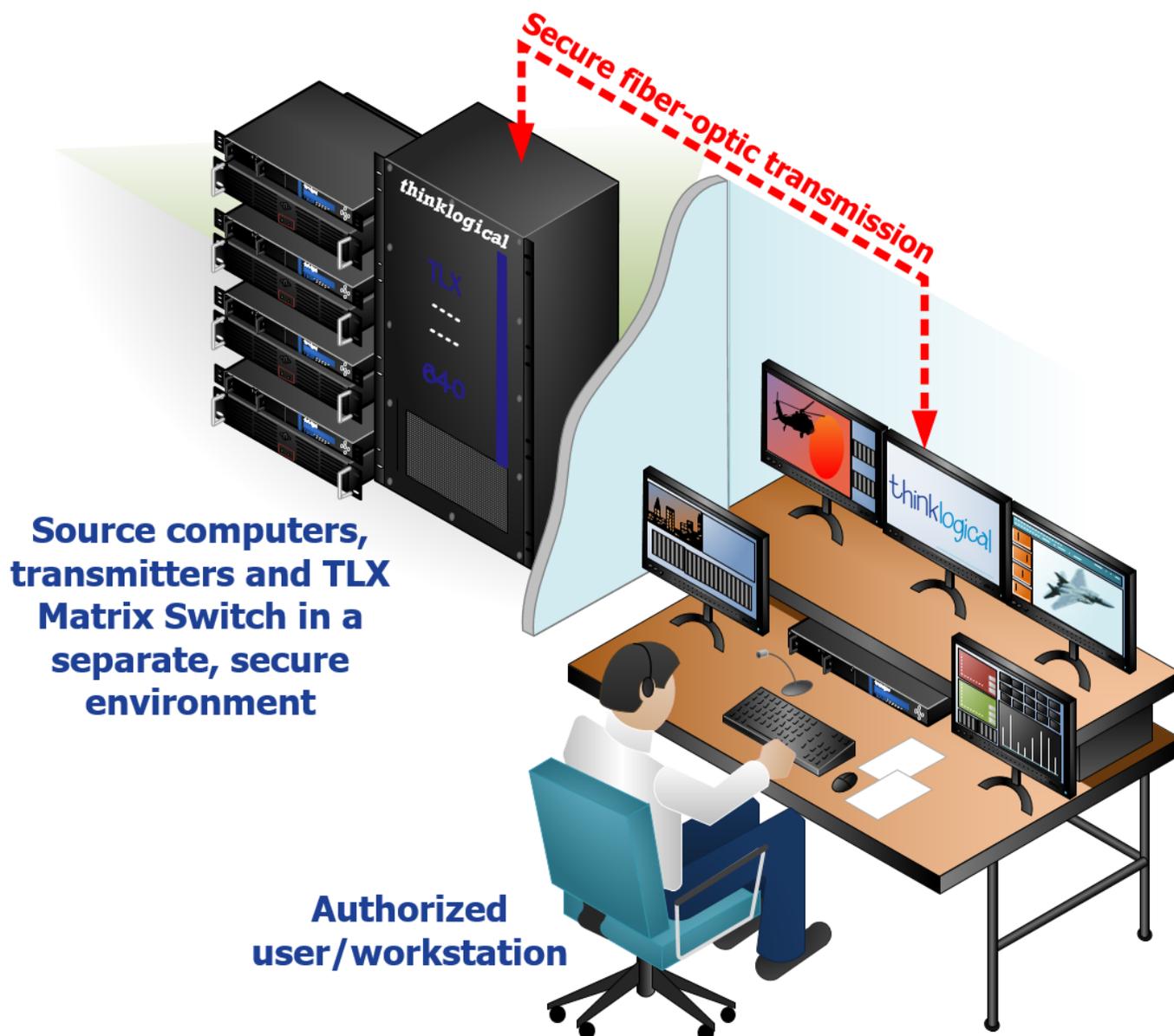
Browse to and select the file: **tlx12_ctrl_fpga.lbf** (This is the file saved in Step 2.) and press **OPEN** to begin.

TLX12_fpga_upgrade_instructions_0406_manual

Appendix C: Secure Applications

TLX12 Matrix Switch Control

When used in a secure application, the Matrix Switch and External Computer (server) used to manage the system must be in a physically secure environment to which only trusted administrators have access. Similarly, the server used to manage the Matrix Switch must be physically protected and have suitable identification/authentication mechanisms to ensure that only trusted administrators have access.



Thinklogical's TLX, VX and MX Matrix Switches use two methods for secure routing. One is known as **Restricted Switching** and the other is known as **Partitioning**. These methods can be deployed singularly or jointly, depending on security requirements.

CATx Matrix Switching applications, not available on all Thinklogical Matrix Switch models, do not offer an EAL4 rated level of security.

Restricted Switching

Restricted Switching provides multiple levels of security classification domains on the same Matrix Switch. Each destination must ensure that no unauthorized content is displayed or accessed. Therefore, every input and output must be prioritized. Priorities can range from 1 to the total number of ports in the Matrix Switch. An output can connect to an input with a priority greater than, or equal to, its own. Thus, a priority level of 1 on an output can connect to any input (priority 1, 2, 3...).

The user must provide a table defining the priorities for each input and output of the switch matrix. This table is in the form of a comma separated value (csv) file. This file contains the values in three columns: **Port Direction** (i=input, o=output), **Port Number** and **Port Priority**. For example:

```
root@imxswitch:/var/local/router/restrict# cat upstream.csv
"i", 1, 1
"i", 2, 2
"i", 3, 3
"i", 4, 1
"i", 5, 3
"o", 1, 1
"o", 2, 3
"o", 3, 2
"o", 4, 4
"o", 5, 1
```

Output 1 can connect to ports 1-5.
 Output 2 can connect to ports 3 and 5.
 Output 3 can connect to ports 2, 3, and 5.
 Output 4 cannot connect to any ports.
 Output 5 can connect to ports 1-5.

Note that Port Direction (i or o) is in quotes and that the table must use only the following ASCII printable characters:

Double quotes (or speech marks)	character code = 34	(")
Lower case i	character code = 105	(i)
Lower case o	character code = 111	(o)
Comma	character code = 44	(,)
Carriage Return	character code = 13	(CR)
Line Feed	character code = 10	(LF)

The Restricted Switching Table files are stored on the iMX6 processor at:

`/var/local/router/restrict/upstream.csv`

At system power up, after initial boot-up completes, the processor will only evaluate its Restricted Switching Table (upstream.csv file) once upon becoming active. If an **upstream.csv** file is found, a log entry to the **daemon.log** file is made indicating "Restricted Switching ENABLED." If no file is found, then a log entry of "Restricted Switching DISABLED" is made.

Any errors that occur during the Restricted Switching Table evaluation process will be logged as "error" with a *field and line invalid* identifier. The **daemon.log** file will be at the following location:
`/var/log/daemon.log`.

For access to the *daemon.log* file via SSH, refer to THE NETWORK INTERFACES section of this document (pg. 7).

To verify the system's **Restricted Switching policy**, Thinklogical recommends the following:

- 1) Review the **daemon.log** file and correct any errors in the Restricted Switching Table before implementing multiple levels of security classification domains on the same Matrix Switch.
- 2) Fully test the **Restricted Switching** before implementing multiple levels of security classification domains on the same Matrix Switch.

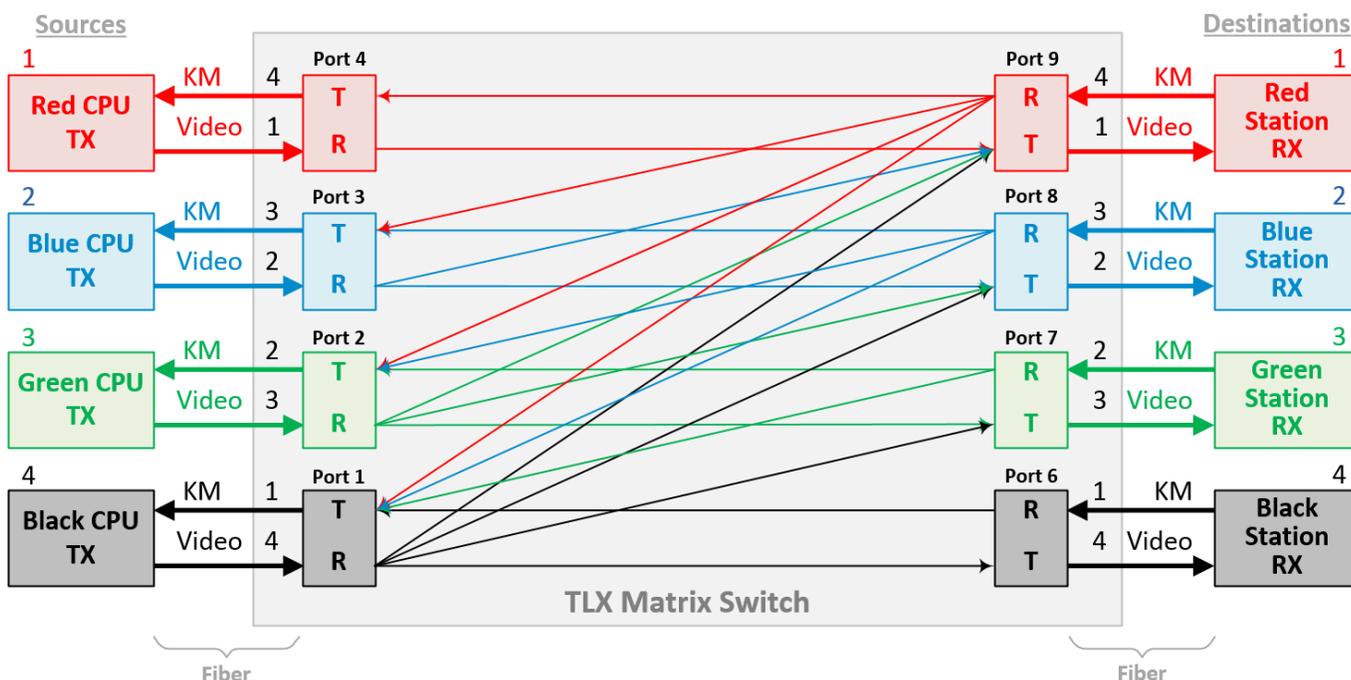
There are cases where updates to the Restricted Switching Table must be made in an active system. When an update is made to the table, the processor will not evaluate the updated table until the LAN connection is restored.

Restricted Switching is disabled when Restricted Switching Table files are removed. By default, when there are no Restricted Switching Table files, all input and output ports will have a priority of 1. All Switches are shipped without Restricted Switching Table files stored on the processor and therefore do not restrict any connection.

Restricted Switching with TLX, VX and MX Matrix Switches

Restricted Switching Priority Scheme

The following example shows a priority scheme for four levels of security managed by one TLX Matrix Switch:



VIDEO:

Destination Workstation Network

- RED
- BLUE
- GREEN
- BLACK

Source Computer Network Transmissions That Can Be Seen

- BLACK, GREEN, BLUE, RED
- BLACK, GREEN, BLUE
- BLACK, GREEN
- BLACK

KEYBOARD/MOUSE:

Destination Workstation Network

- RED
- BLUE
- GREEN
- BLACK

Source Computer Networks That Can Be Controlled

- BLACK, GREEN, BLUE, RED
- BLACK, GREEN, BLUE
- BLACK, GREEN
- BLACK

I/O	Number	Priority
"i"	1	4
"i"	2	3
"i"	3	2
"i"	4	1
"i"	6	1
"i"	7	2
"i"	8	3
"i"	9	4
"o"	1	1
"o"	2	2
"o"	3	3
"o"	4	4
"o"	6	4
"o"	7	3
"o"	8	2
"o"	9	1

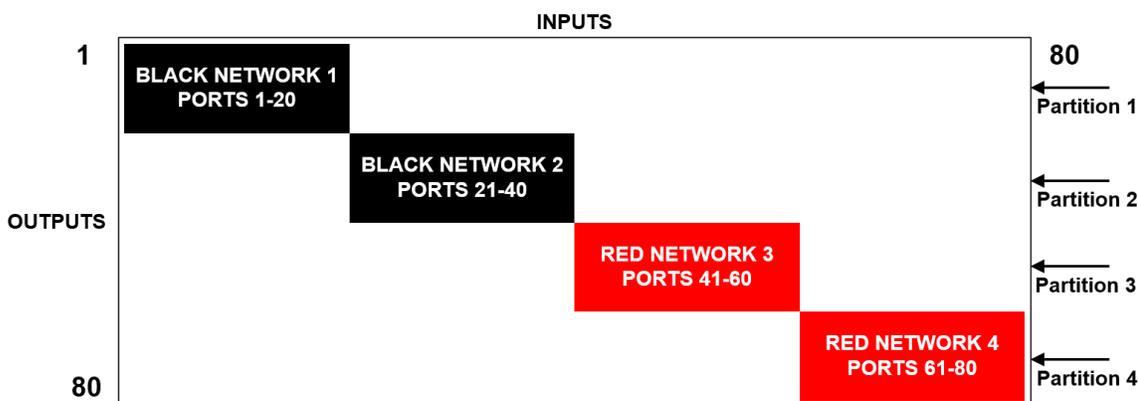
Restricted switching is configured via firmware loaded into the Matrix Switch. The configuration file for this scenario will appear like the table at right. →

Partitioning

Partitions allow TLX, VX and MX Matrix Switch sources and destinations to be segregated. Therefore, destination work stations will only receive signals that are transmitted from source computers in the same partition. In addition, it is impossible for a source computer to be inadvertently routed outside of its designated partition as the signals will not be transmitted.

The user must provide a table defining the partitions. This table is in the form of a Comma Separated Value (CSV) file located in `/var/local/router/partition` on the Switch. This file contains the port number and the partitions to which it belongs.

Example: VX80 Matrix Switch with four distinct partitions:

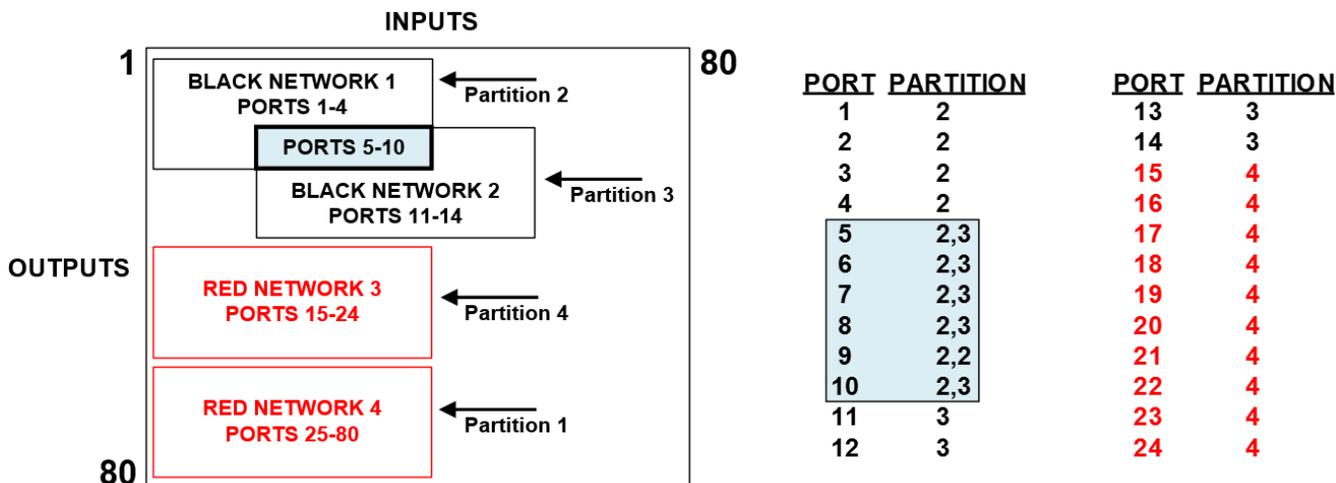


Four partitions set up for secure routing and extension applications. Signals are only capable of transmitting and receiving within a single partition and not across partitions

The maximum number of partitions is the number of ports that make up the Switch (12-1280). A TLX80, for example, can be configured with up to 80 partitions, a TLX160 with up to 160, and so forth. There are also overlapping partition configurations.

A TLX80 with four partitions: Ports 5-10 are accessible to both partitions 2 and 3.

The following example shows a TLX80 Switch with an overlapping partition:



The TLX12 Partition Table files are stored on the iMX6 at:
`/var/local/router/partition/upstream.csv`

At system power up, after initial boot-up, the processor will only evaluate its Partition Table (upstream.csv file) once upon becoming active. If an **upstream.csv** file is found, a log entry to the **daemon.log** file is made indicating “Partition ENABLED.” If no file is found, then a log entry of “Partition DISABLED” is made.

Any errors that occur during the Partition Table evaluation process will be logged as “error” with a *field and line invalid* identifier. The **daemon.log** file will be at the following location on the processor: **/var/log/daemon.log**.

For access to the *daemon.log* file via SSH, refer to THE NETWORK INTERFACES section of this manual (pg. 7) for correct IP addresses.

To verify the system’s **Partitioning policy**, Thinklogical recommends the following:

- 1) Review the **daemon.log** file and correct any errors in the Partition Table before implementing multiple levels of security classification domains on the same Matrix Switch.
- 2) Fully test the **Partitioning** before implementing multiple levels of security classification domains on the same Matrix Switch.

There are cases where updates to the Partition Table need to be made in an active system. When an update is made to the table, the processor will not evaluate the updated table until the LAN connection is restored.

Partition Switching is disabled when Partition Table files are removed. By default, when there are no Partition Table files, all ports not listed will default to partition 1. All Switches are shipped without Partition Table files stored on the processor and therefore do not restrict any connection.

Administration Access

There are two methods by which the administrator can access the Switch Control Configurations:

1. **The Serial Console directly connected to the Switch.** (It should be noted that, while no administrator password is required to use the Serial Console, physical access to the Switch is required. Therefore, the Switch should be stored in a physically secure location to avoid unauthorized access.)
2. **SSH access.** The Switch allows SSH connections to the Switch for management purposes. SSH sessions are authenticated using an encrypted password file.

Password Security

For security purposes, the Switch defaults to using the Message-Digest Algorithm (MD5) and shadow passwords. **It is highly recommended that you DO NOT alter these settings.** If you select the older Data Encryption Standard (DES) format, passwords will be limited to eight alphanumeric characters (disallowing punctuation and other special characters) with a modest 56-bit level of encryption. **The single most important thing you can do to protect the Switch is create a strong password.**

Creating Strong Passwords:

The password can contain up to 127 characters and cannot contain a space.

MAKE THE PASSWORD AT LEAST EIGHT CHARACTERS LONG. The longer the password, the more effective it will be. If you are using an MD5 password, it should be approximately 15 characters long. With DES passwords, use the maximum eight-character length.

Mix UPper AnD LowER CASE LETTERS. Passwords are case sensitive, so mixing will multiply the number of possible combinations.

Mix LETTER5 AND NUM8ER5 within the password to enhance its strength.

Include NON-ALPHANUMERIC CH@RACTER\$. Special characters (& \$ % >) and punctuation marks (? “ - !) increase the strength of a password.

Secure Application Examples

The Diagram on pg. 31 shows the TLX12 Matrix Switch in a secure application. **The highly secure components are described as the Red Network and the other, lower security components are described as the Black Network.** The Red Network, containing the computers (sources), is shown in a physically secure environment along with the TLX Matrix Switch, the computer server used to manage the Switch, and the Network Hub. The Network Hub is a dedicated network used only to connect the TLX Switch to the computer server. This dedicated network does not connect to any other components and does not extend beyond the physically secure environment. The dedicated network connection may be replaced by a direct serial connection (RS-232) between the TLX Switch and the computer server.

The TLX Matrix Switch can be configured to prevent accidental connection from the Red Network to the Black Network using the Restricted Switching feature. For example, the TLX Matrix Switch Network Diagram should be configured with the following csv file:

Direction	Number	Priority
I	1	2
I	2	2
O	2	2
I	42	2
O	41	2
O	42	2
I	5	1
O	5	1
I	45	1
O	45	1

The following connection rules apply:

- SOURCE 2 can be connected only to DESTINATION 2
- SOURCE 1 can be connected to both DESTINATION 1 and DESTINATION 2



Note: The TLX Matrix Switch and the computer server used to manage the Switch must be protected according to the highest security classification of any component in the entire network application. The optical connections and Destination Receiver designated as *Red Network* must be kept physically secure.

The configuration of the TLX Matrix Switch should be reviewed regularly to ensure that it continues to meet organizational security policies concerning:

- Changes in the TLX Matrix Switch configuration
- Changes in the organizational security policy
- Changes in the threats presented from non-trusted network interfaces
- Changes in the administration, operation staff or the physical environment of the TLX Matrix Switch



TLX12 Matrix Switch Secure Application

