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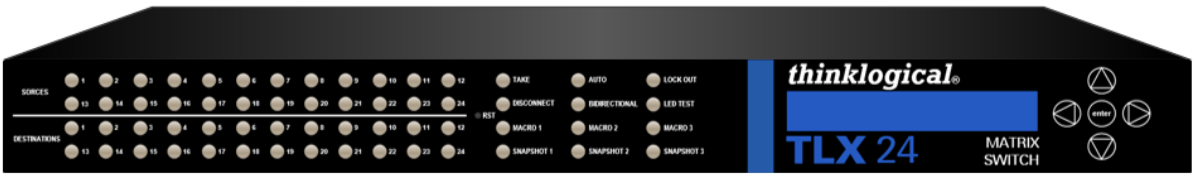
TLX24

10G MATRIX SWITCH PRODUCT MANUAL



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

Rev. J, May 2021

Thinklogical, A BELDEN BRAND • 100 Washington Street • Milford, Connecticut 06460 U.S.A.

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Subject: TLX24 10G Matrix Switch Product Manual
Revision: J, May 2021

thinklogical®

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MADE IN USA

PREFACE

About Thinklogical A BELDEN BRAND

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100 Washington St.
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TOP WORK PLACES
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THE NEWS-TIMES
THE ADVOCATE
thinklogical

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.

CERTIFIED ISO 9001:2015 COMPANY | Common Criteria | TEMPEST | NATO Information Assurance Product Catalogue NIAPC

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

Section 2 – Set-Up and Installation: **Pg. 11**. Contains all the requirements and procedures necessary to connect and install your equipment, including FPGA updates.

Section 3 – Safety & Regulatory Requirements: **Pg. 21**. Thinklogical® strongly recommends that you read this section prior to starting the hardware assembly.

Section 4 – Thinklogical Support: **Pg. 23**. 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.

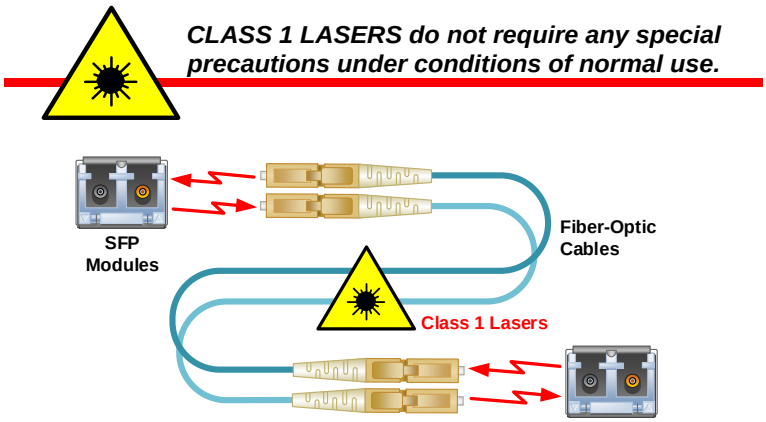
Warning! All Warnings appear in red text, followed by blue text, and preceded by a red stop sign, as shown here.

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 TLX24, 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, eye loupe).



Section 1: TLX System Features

The Logical Solution

The TLX24 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 TLX24 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.

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 their 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 pg. 26)

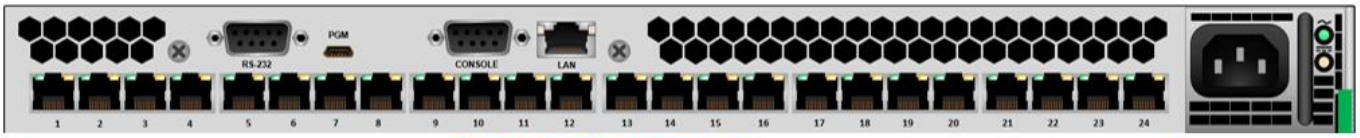
CATx Matrix Switching applications, not available on all Thinklogical Matrix Switch models, do not offer an EAL4 rated level of security.

THE TLX24 MATRIX SWITCH DESIGN

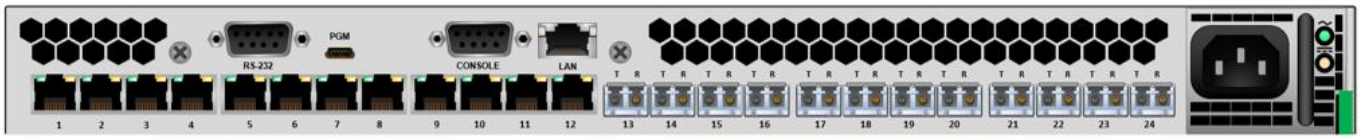
The ultra-compact design of the TLX24 10G Matrix Switch (sometimes referred to as a Switch or Router) supports up to 24 ports of full, uncompressed 4K video with full color depth at 60Hz frame rate in a single 1 RU chassis for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber-optic cable or CATx cable, thus minimizing critical rack space.

REAR PANEL CONFIGURATIONS

24 LC-Type Fiber-Optic Ports



24 RJ45 CATx Ports



12 RJ45 CATx Ports — 12 LC-Type Fiber-Optic Ports

FRONT PANEL CONFIGURATIONS

Source, Destination and Control Buttons — LCD & Navigation Buttons

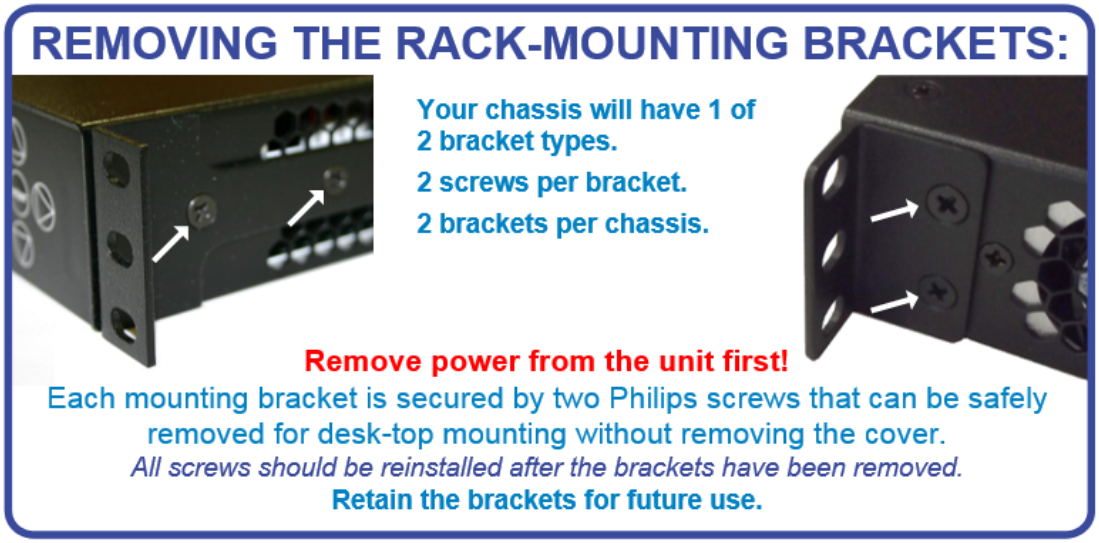
Custom Button-less Version — LCD & Navigation Buttons

Thinklogical's TLX24 10G Matrix Switch includes:

- A 1 RU Chassis with 24 fiber-optic or CATx Transmit/Receive Ports, or 12 of each
- 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
- Controllable via LAN or serial connection
- USB Mini-B Update Port
- Custom Button-less versions operated through a GUI
- 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

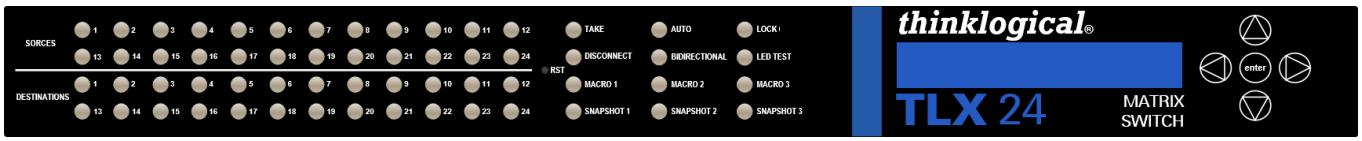
Desktop or Rack Mount

You may choose to place your **TLX24 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 TLX24 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)**.



The Front Panel

TLX24 FRONT PANEL



Button Panel — LCD & Navigation Buttons

LCD & 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 TLX24 front-panel LCD should be visible and accessible for system setup.

Navigating the Menus

Main Root Menus: 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* enter, *then* ▲ *or* ▼ *to*:**

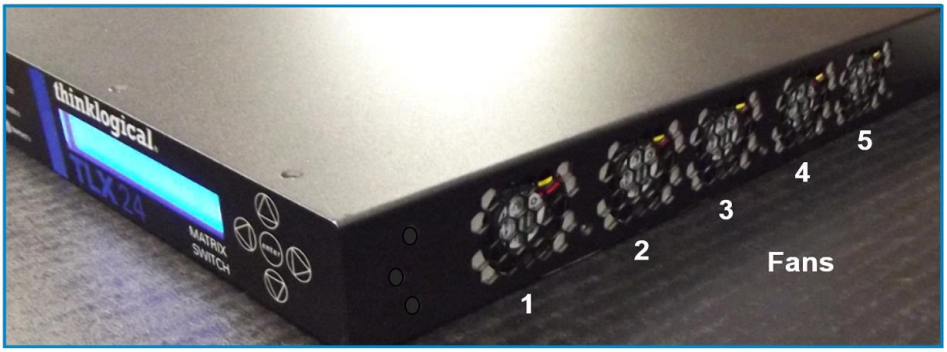
- ***View System Menu:*** FPGA Version, Ambient Temp, Physical Temp, Alarm Status
- ***View Network Menu:*** IP Address. Network Mask, Gateway, MAC Address
- ***Program Network:*** IP Address. Network Mask, Gateway
- ***Reboot/Power Off***

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:

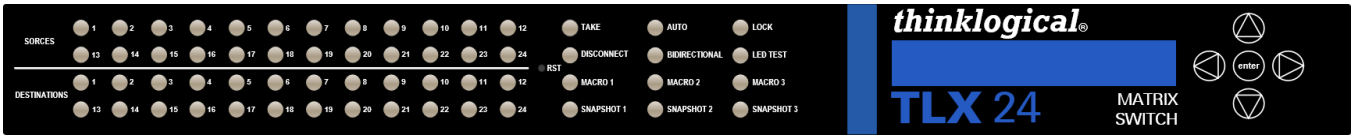
0x000 = All fans OK
0x010 = Fan 1 failure
0x008 = Fan 2 failure
0x004 = Fan 3 failure
0x002 = Fan 4 failure
0x001 = Fan 5 failure



The physical locations of Fans 1-5 inside the TLX24 Chassis

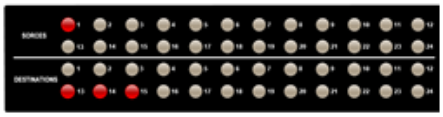
The Button Panel

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



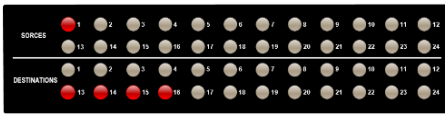
The Button Panel, located on the front of the TLX24, provides Matrix Switch control via the RS232 port's API interface. The following pages provide a functional description of each of the 60 buttons.

SOURCES 1-24 **Used to select any one of the 24 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.

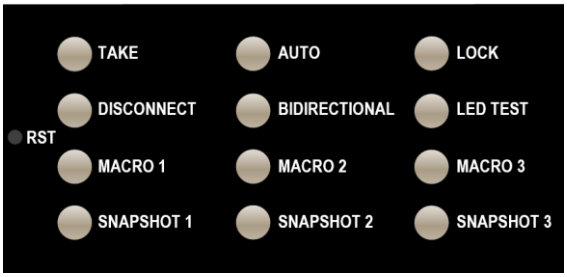


Source 1 is connected to Destinations 13, 14 & 15.

DESTINATIONS 1-24 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 16 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.

THE POWER SUPPLY MODULE

The TLX24 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. 19 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 processor to processor communications

THE NETWORK INTERFACES

The default subnet used by the TLX24 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 TLX24 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 **N**etwork **M**anagement **P**rotocol*** (supports version V2c and V3 USM). Please call our technical support staff at 1-203-647-8700 for downloadable MIB ***M**anagement **I**nformation **B**ase* 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 TLX24 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)

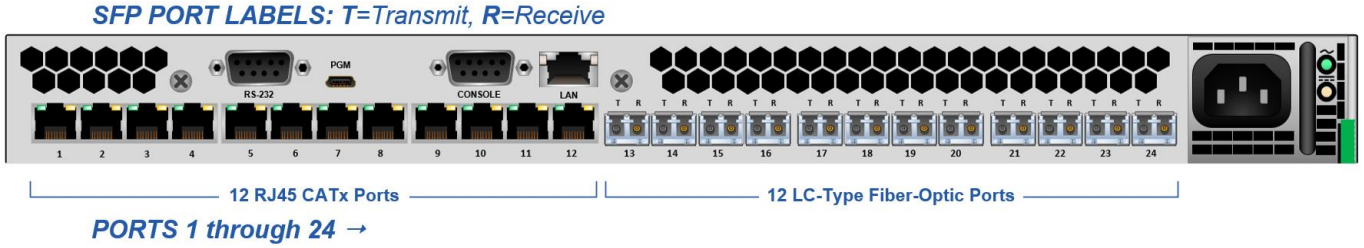
- Baud Rate: 115200
- Data Bits: 8
- Parity: none
- Stop Bits: 1
- Flow Control: none
- DB9 DCE
  - A straight cable is needed to connect to a PC (*not* a null-modem).

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).

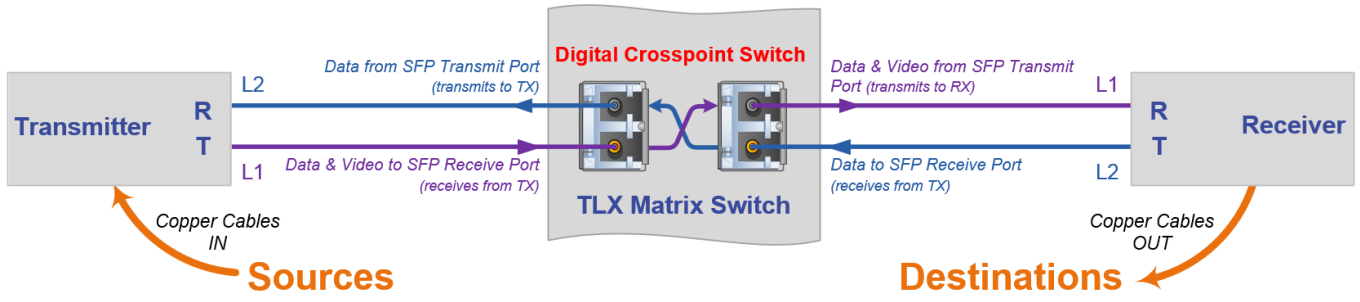
PORT NUMBERING

Port numbering starts with Port 1 on the left. Each port has a number designation, 1 through 24, printed below it for easy reference.



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.



TLX24 Matrix Switch Part Numbering

TLX24 CATx

TLX-MSC-C0024 TLX Matrix Switch Chassis with 24 CATx Ports, 10G

TLX24 Hybrid (10G 0nly)

TLX-MSC-CM0024 TLX MSC with 12 CATx Ports & 12 Multi-Mode Fiber Ports

TLX-MSC-CS0024 TLX MSC with 12 CATx Ports & 12 Single-Mode Fiber Ports

TLX24 Fiber

TLX-MSC-M00024 TLX Matrix Switch Chassis with 24 Multi-Mode Fiber Ports, 10G

TLX-MSC-MV0024 TLX Matrix Switch Chassis with 24 Multi-Mode Fiber Ports, 6G+

TLX-MSC-S00024 TLX Matrix Switch Chassis with 24 Single-Mode Fiber Ports, 10G

TLX-MSC-SV0024 TLX Matrix Switch Chassis with 24 Single-Mode Fiber Ports, 6G+

TLX-MSC-M00A24 TLX Matrix Switch Chassis with 24 Multi-Mode Fiber Ports, 10G+ Custom

TLX-MSC-MV0A24 TLX Matrix Switch Chassis with 24 Multi-Mode Fiber Ports, 6G+ Custom

TLX-MSC-S00A24 TLX Matrix Switch Chassis with 24 Single-Mode Fiber Ports, 10G+ Custom

TLX-MSC-SV0A24 TLX Matrix Switch Chassis with 24 Single-Mode Fiber Ports, 6G+ Custom

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

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 **5**th month of 20**21**, 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.

TLX24 TECHNICAL SPECIFICATIONS

PHYSICAL	
TLX24 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	**24x24 Fiber, 24x24 CATx or 12x12 Fiber/12x12 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, 2A, 50-60Hz**
Maximum Power Consumption	**180W**
Thermal Load	**615 BTU/Hr**
WARRANTY	**One year from date of shipment. Extended warranties available.**

Section 2: Set-Up & Installation

Contents

When you receive your Thinklogical® TLX24 KVM Matrix Switch, you should find the following items in the quantities specified in your order:

- TLX24 Chassis *(includes 1 Power Module)*
- Power Cord – PWR-000006-R (International connections may differ)
- Product Manual CD
- Product Quick Start Guide

Unpacking the TLX24 Matrix Switch

The TLX24 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!

- Carefully remove the TLX24 from its shipping package and inspect it to make certain that it is in good condition.
- Ensure that all the SFP modules are sealed with a removable dust plug.
- Verify that the power supply is fully seated in the chassis and that the locking latch is secure.
- When the device has been inspected and found to be in suitable condition, the installation process can begin.

Connecting to the TLX24 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 TLX24 has either 12 or 24 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 TLX24 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 (50µm) fiber with LC-type connectors for your TLX24 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.

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.

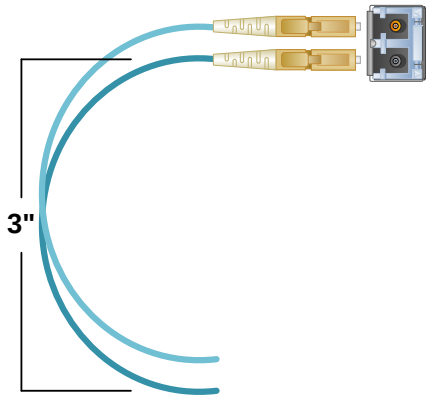
Warning! The ends of the connectors (the ferrule) should never come in contact with any foreign object, including fingertips. Always install a dust cap immediately on the ferrule of any unused fiber to protect the tip.

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.

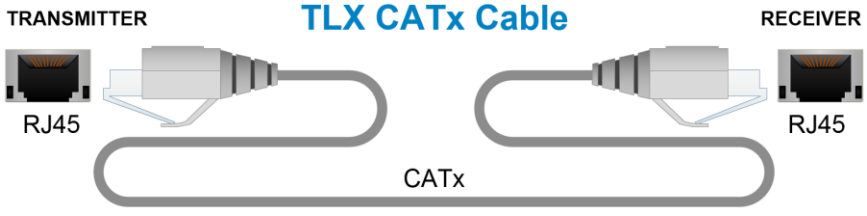
Thinklogical recommends SX+ Laser Enhanced Fiber-optic Cable, 50 or 62.5 microns, terminated with LC type connectors.

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**



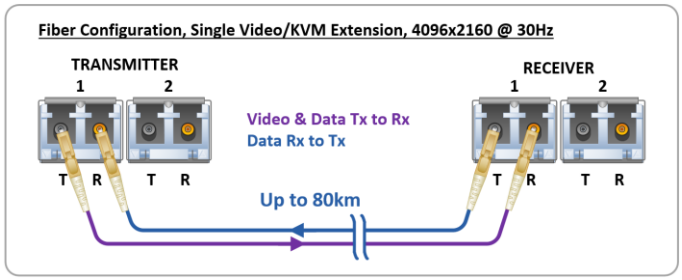
CATx Cable

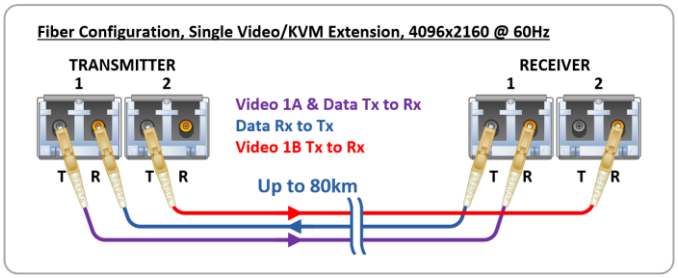
There are currently several versions of CATx (category 5/5a/6/6a/etc.) cables with RJ-45 connectors on the market. **Thinklogical recommends 23 AWG Category 6a Cabling for TLX applications, which operates over channel lengths of up to 100 meters.** Assume a 30% derating for 26 AWG CAT6a cabling.



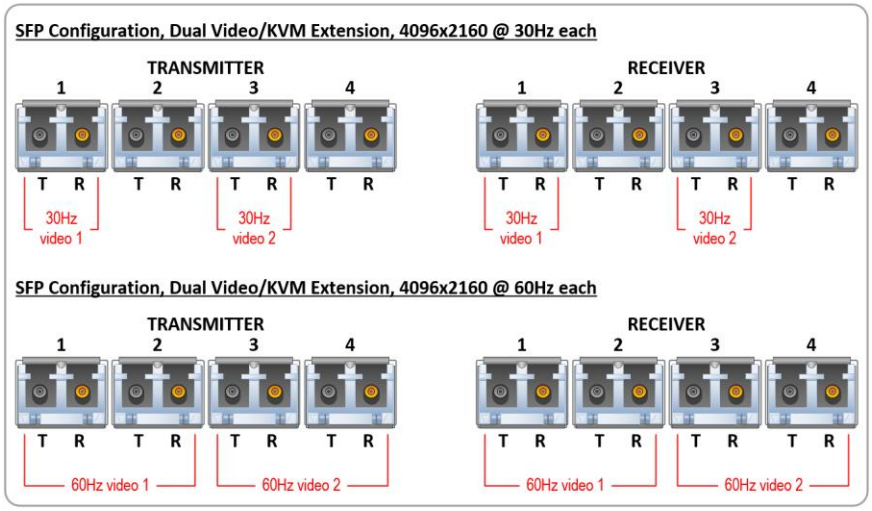
TLX Extender Fiber-Optic Cable Configurations

SINGLE VIDEO MODULES

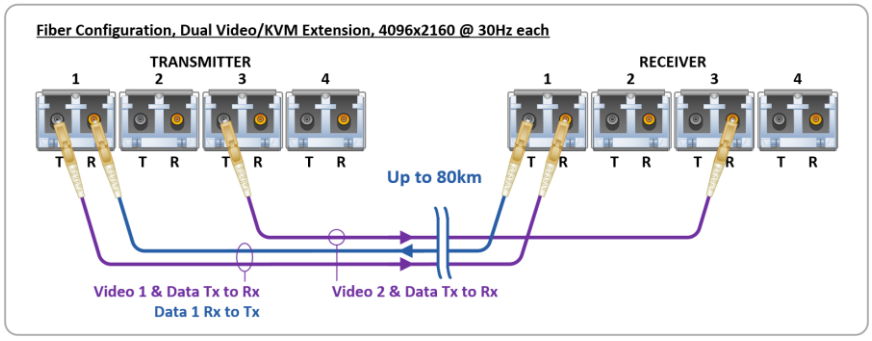


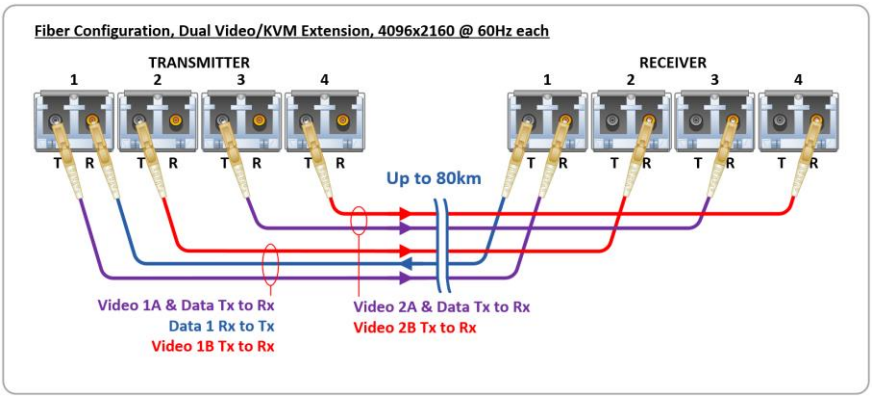


DUAL VIDEO MODULES



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

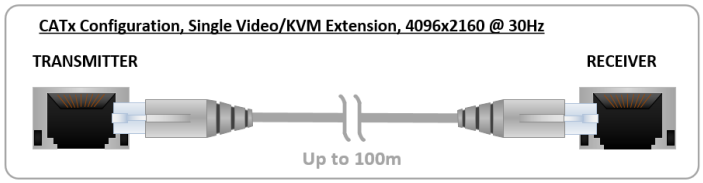


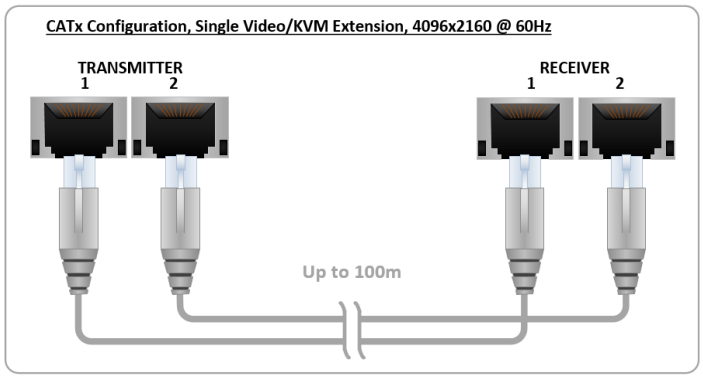


TLX CATx Extender Cable Configurations

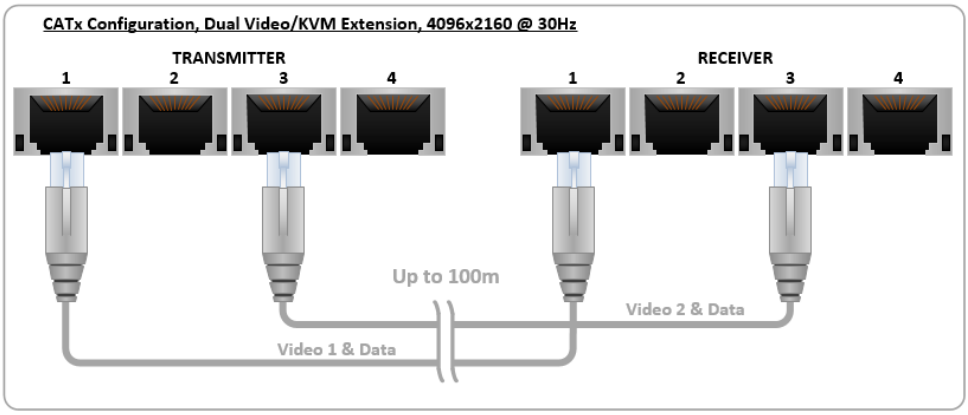
There are currently several versions of CATx (category 5/5a/6/6a/etc.) cables on the market. **Thinklogical recommends using a minimum of CAT6 for your TLX KVM Matrix Switch and Extension System (CAT6a 23 AWG recommended)**. All cables CAT6 or higher can extend up to a maximum of 100m.

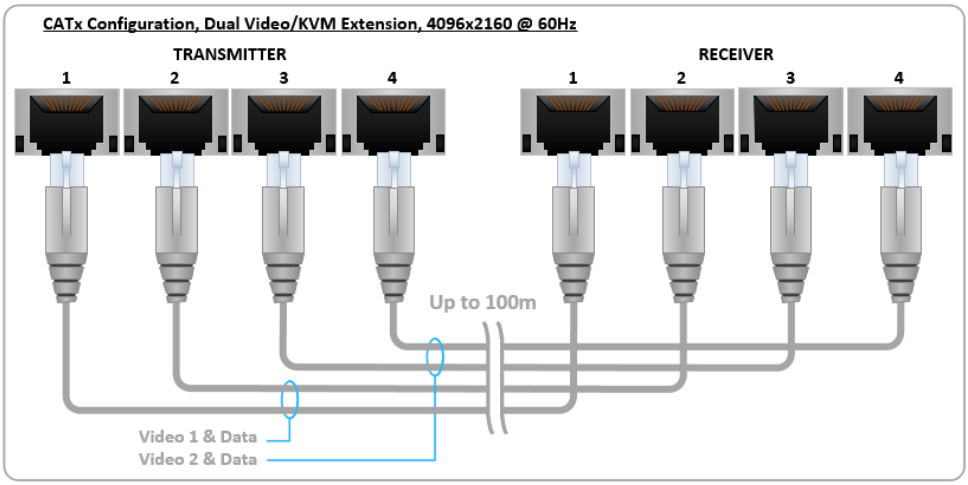
SINGLE VIDEO





DUAL VIDEO

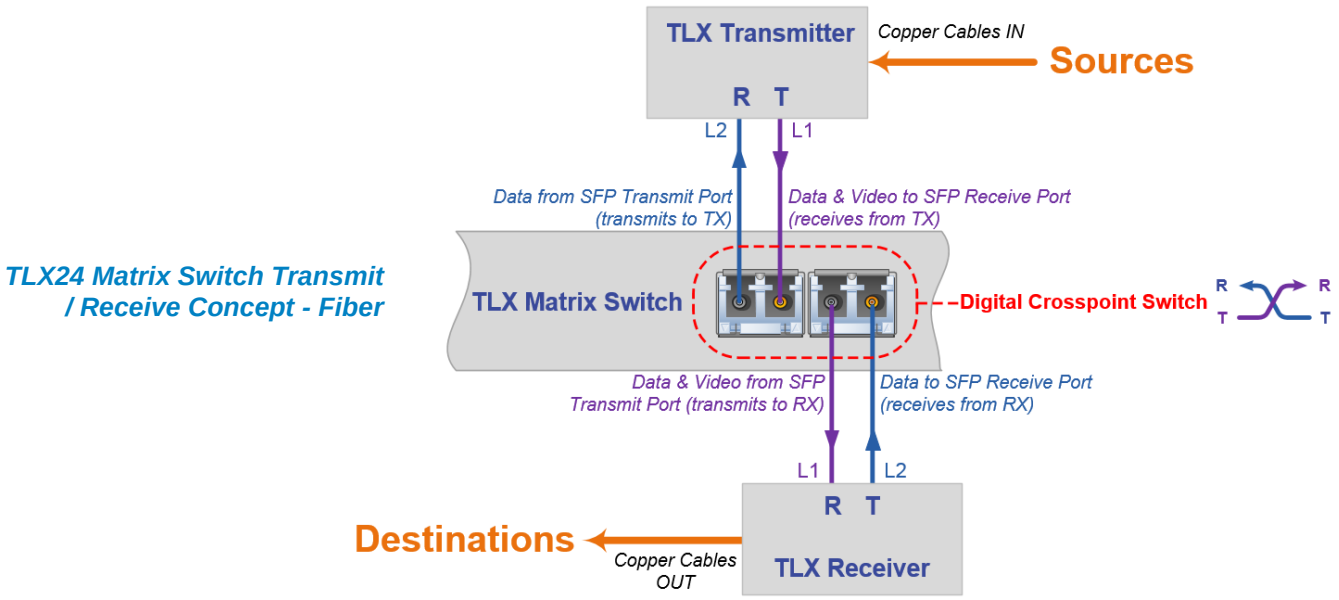


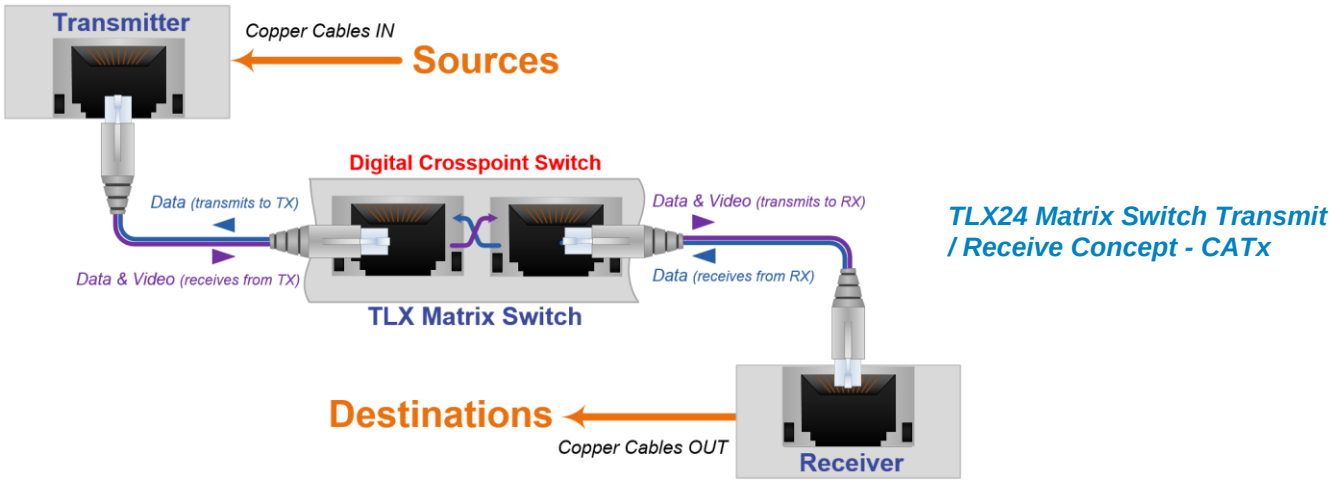


Note: On Dual Video models, Ports 1 & 2 are Video 1 and Ports 3 & 4 are Video 2.

Routing Thinklogical Extenders through the TLX24

Comprised of a fiber-in, fiber-out 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.



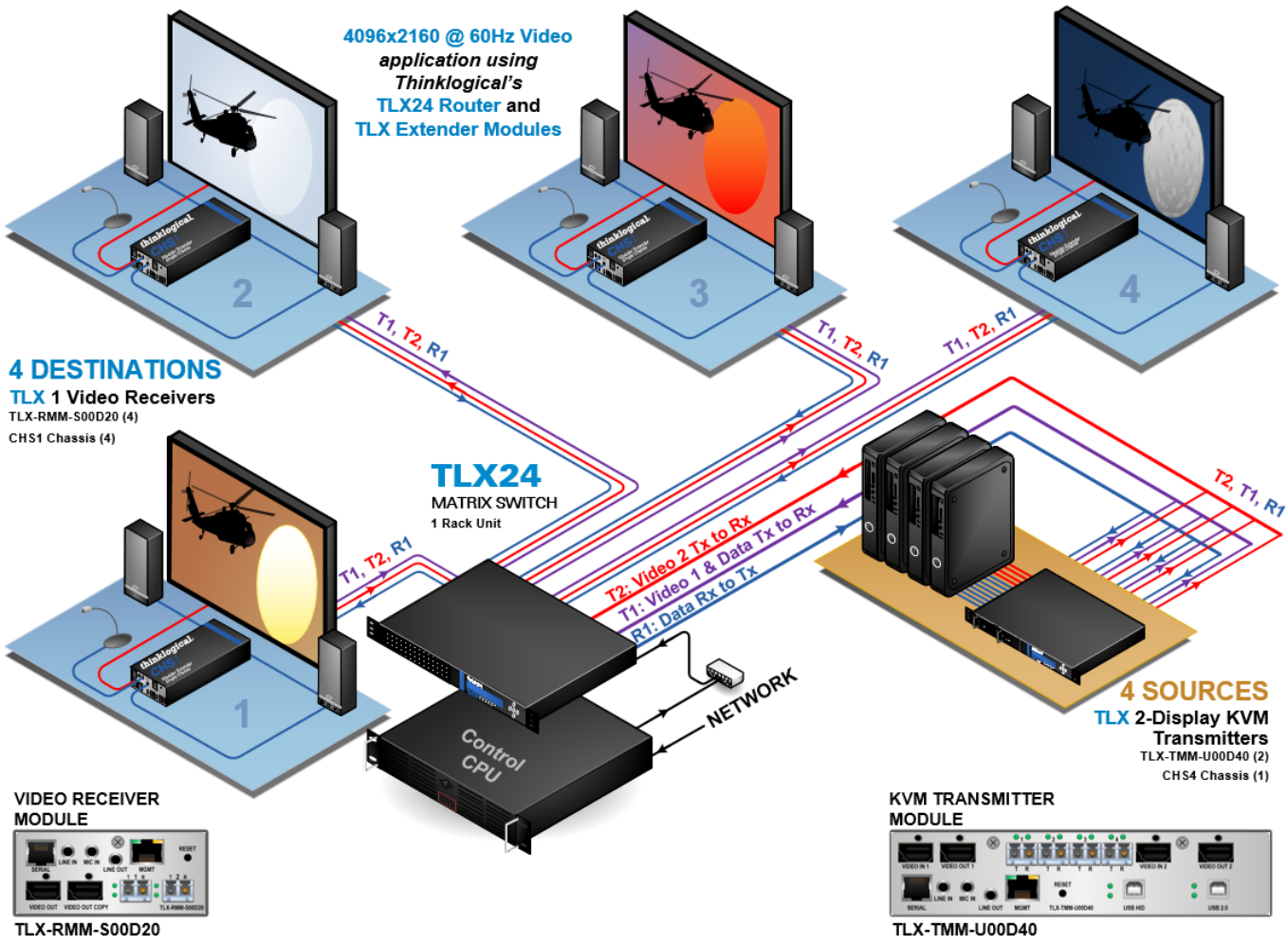


Connecting to the Receiver

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 TLX24 using fiber-optic cable (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).

Connecting to the 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 TLX24 Transmitter ports using fiber-optic cables (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).



Routing *Thinklogical*® TLX Extenders through the TLX24

Connecting to a Control CPU

The TLX24 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 (**T**ransmission **C**ontrol **P**rotocol) 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 **TLX24 Quick Start Guide** is also available in **Appendix A** (pg. 24).

Firmware Updates

See **APPENDIX B: FPGA Program Code Update Procedure**, pg. 25.

Firmware updates are available through Thinklogical®. For technical assistance, please call us at **1-203-647-8700**.

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 the ***Reboot/Power Off*** *menu.*

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 TLX24 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 processor can be managed via the Console Port or an SSH connection.

The PWROFF Command

- Typing **`pwroff`** at the command line prompt will halt the processor *but will NOT turn off the power to the entire base board, including the SFPs.*
- Once the processor 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 TLX24 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 Install 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).

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 power cord has been removed.

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.

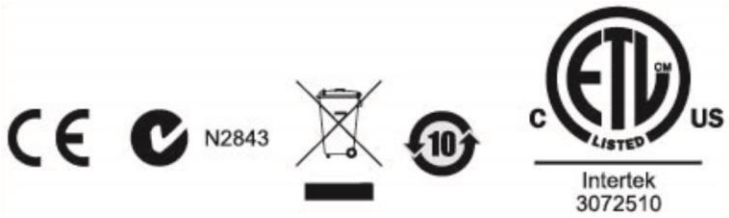
4 **Insert the new Power Module into the chassis** and slide it in until it reaches the backplane connector. At this point, use just enough force to firmly engage the module with the mating connector and lock the latch. Install the AC cord.

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 exigencies du Règlement sur le matérial 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.

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

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

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 **R**eturn **M**erchandise **A**uthorization **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*.**

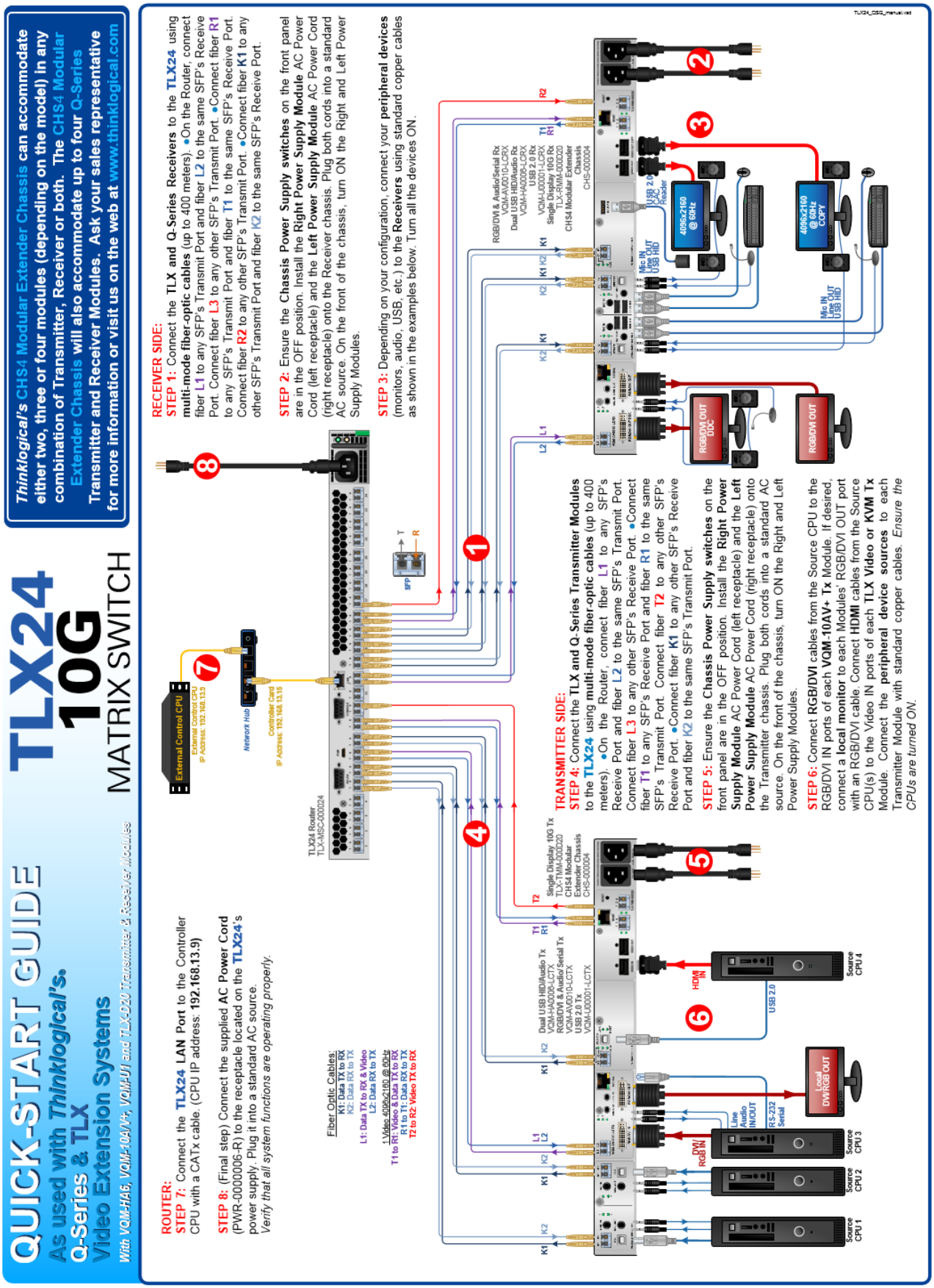
Our Address

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:

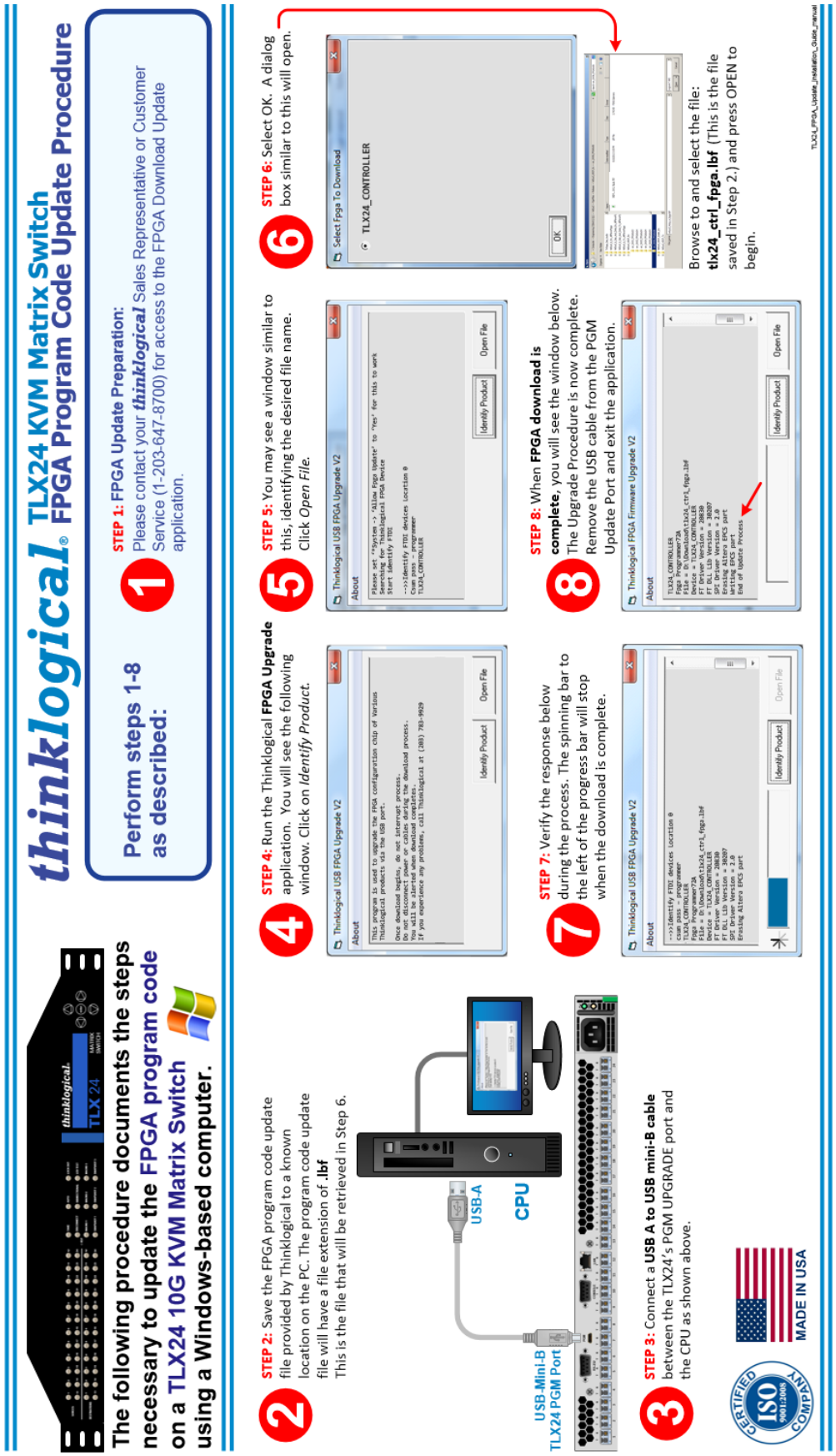
Please include the Return Merchandise Authorization number:

Thinklogical, A **BELDEN** BRAND
100 Washington Street
Milford, CT 06460 USA
Attn: *RMA#*

Appendix A: TLX24 ALL FIBER QUICK START GUIDE



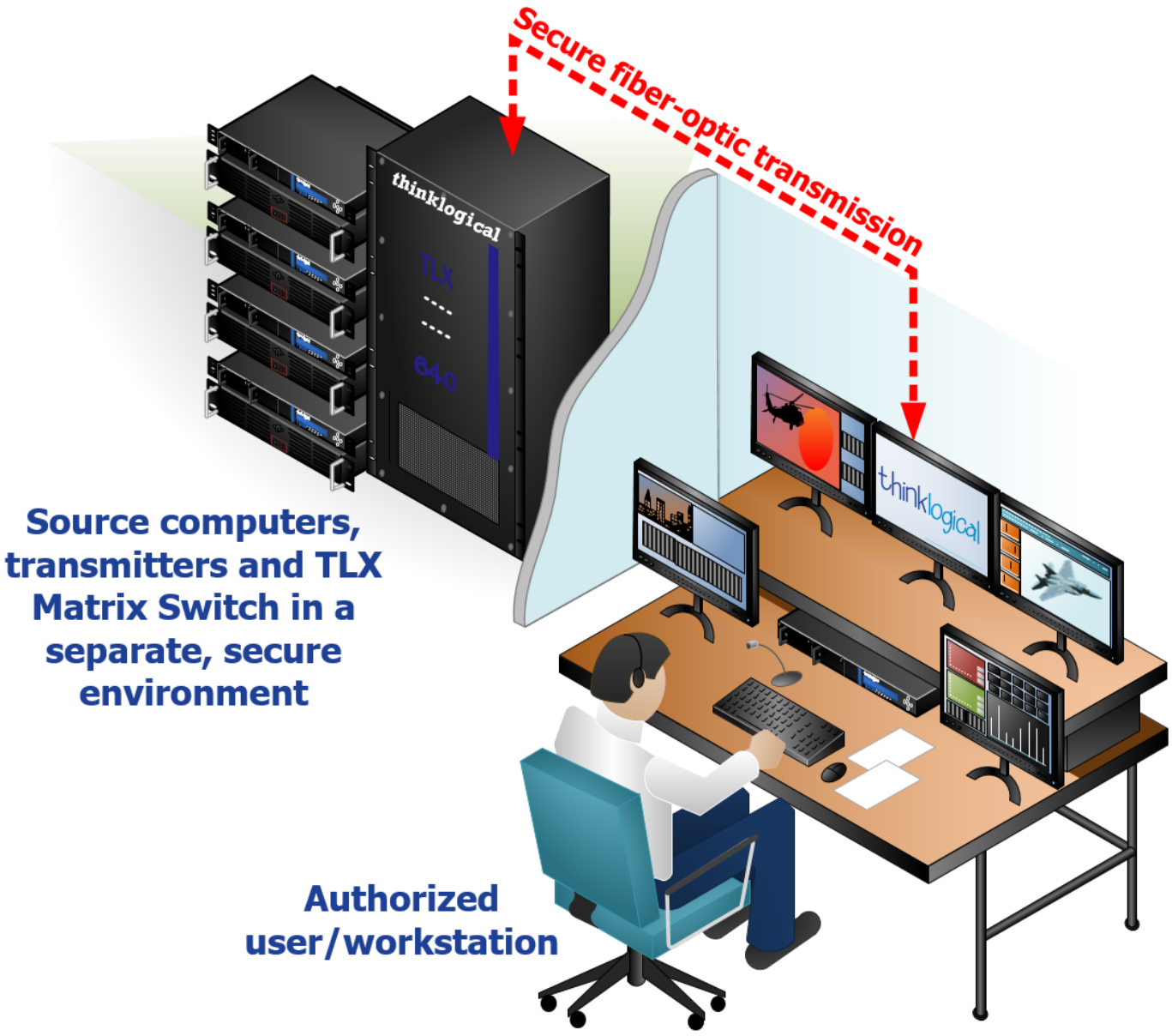
Appendix B: FPGA Program Code Update Procedure



Appendix C: Secure Applications

TLX24 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 **deamon.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. 6).

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.

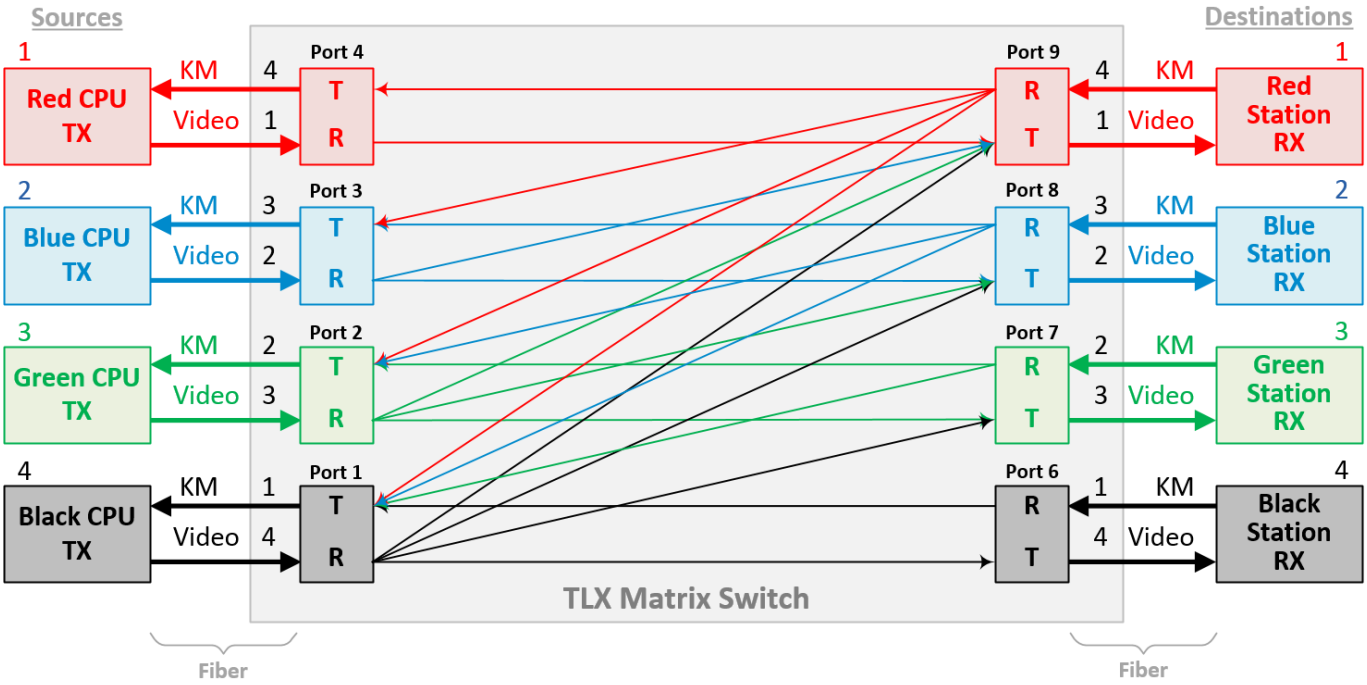
There are cases where updates to the Restricted Switching Table must be made in an active system. When an update is made to the table, the processor will not evaluate the updated table until the LAN connection is restored.

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	Source Computer Network Transmissions That Can Be Seen
RED	BLACK, GREEN, BLUE, RED
BLUE	BLACK, GREEN, BLUE
GREEN	BLACK, GREEN
BLACK	BLACK

KEYBOARD/MOUSE:

Destination Workstation Network	Source Computer Networks That Can Be Controlled
RED	BLACK, GREEN, BLUE, RED
BLUE	BLACK, GREEN, BLUE
GREEN	BLACK, GREEN
BLACK	BLACK

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

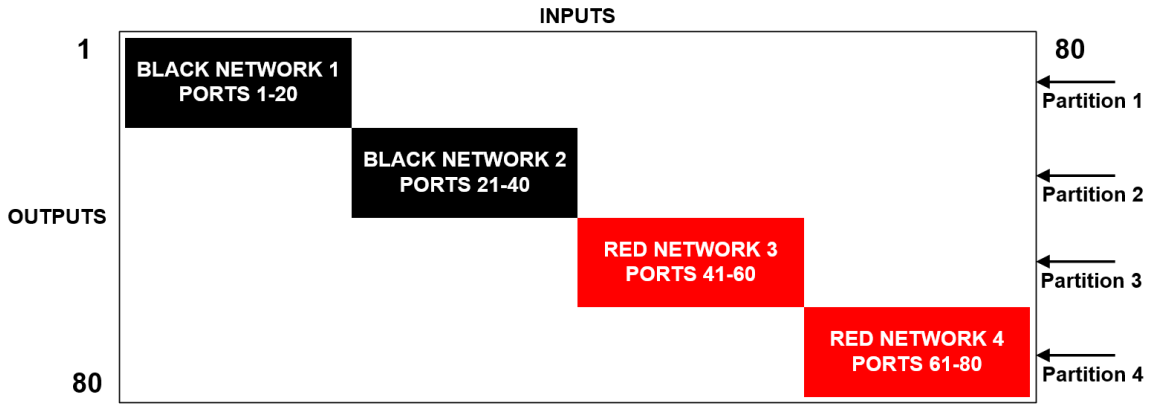
I/O	Number	Priority
"i"	1	4
"i"	2	3
"i"	3	2
"i"	4	1
"i"	6	1
"i"	7	2
"i"	8	3
"i"	9	4
"o"	1	1
"o"	2	2
"o"	3	3
"o"	4	4
"o"	6	4
"o"	7	3
"o"	8	2
"o"	9	1

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 **C**omma **S**eparated **V**alue (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: **TLX80 Matrix Switch with four distinct partitions:**

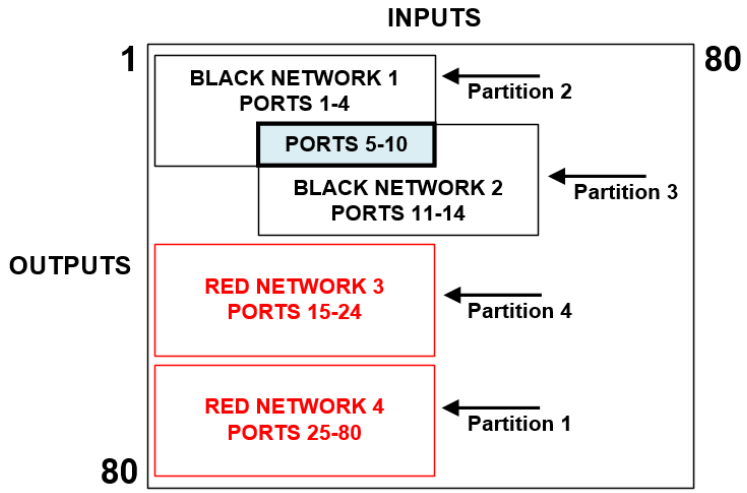


Four partitions set up for secure routing and extension applications. Signals are only capable of transmitting and receiving within a single partition and not across partitions

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:



PORT	PARTITION
1	2
2	2
3	2
4	2
5	2,3
6	2,3
7	2,3
8	2,3
9	2,2
10	2,3
11	3
12	3

PORT	PARTITION
13	3
14	3
15	4
16	4
17	4
18	4
19	4
20	4
21	4
22	4
23	4
24	4

The TLX24 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 **deamon.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. 6) 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-ALPHANUMER!C CH@RACTER$. Special characters (& $ % >) and punctuation marks (? “ - !) increase the strength of a password.

Secure Application Examples

The Diagram on pg. 32 shows the TLX24 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:

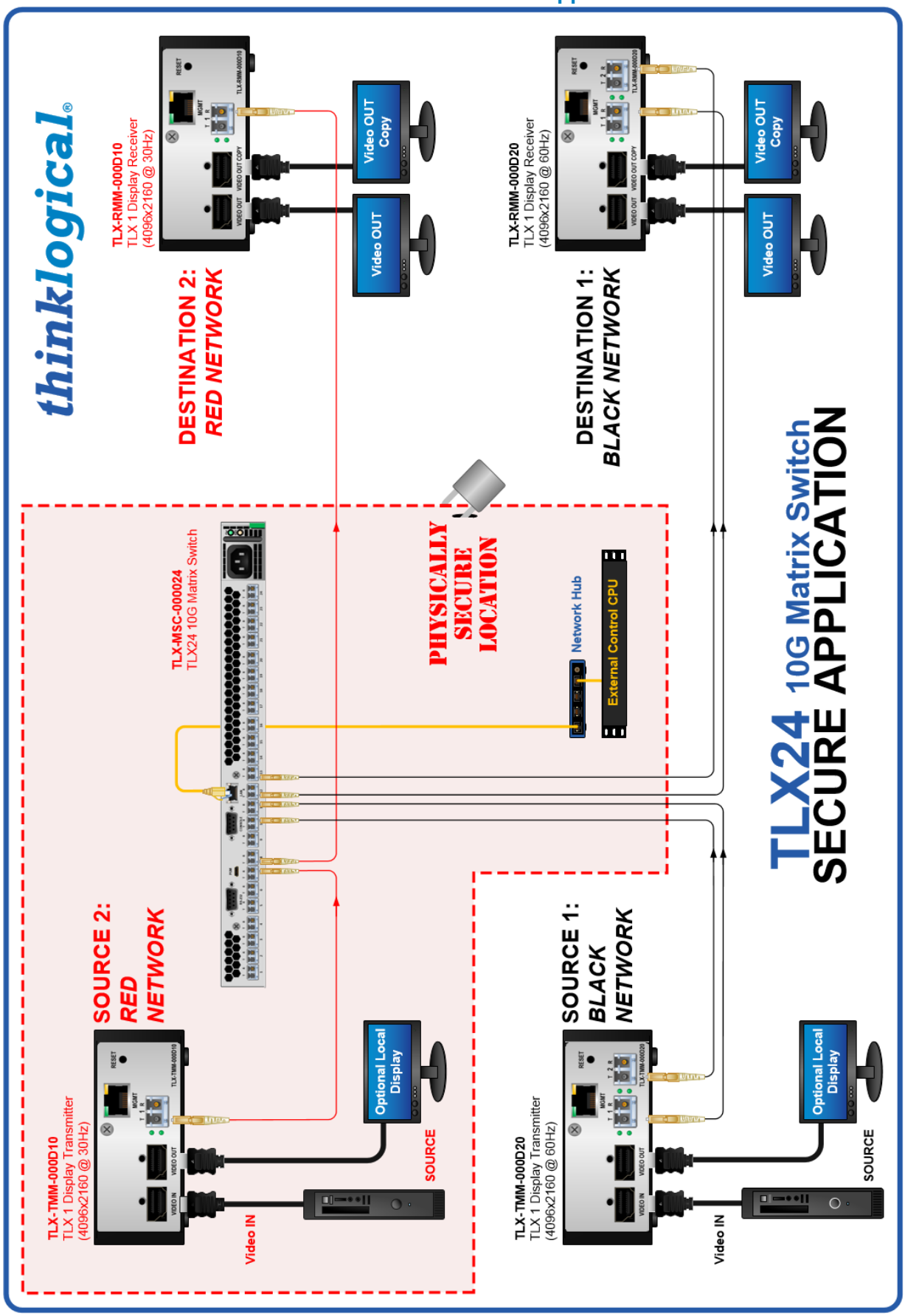
Direction	Number	Priority
I	1	2
I	2	2
O	2	2
I	42	2
O	41	2
O	42	2
I	5	1
O	5	1
I	45	1
O	45	1

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

TLX24 Matrix Switch Secure Application