*think***logical®**

A **BELDEN** BRAND

TLX80

10G MATRIX SWITCH
PRODUCT MANUAL

Full 4K @ 60Hz Video and KVM Hybrid Switching &
Extension Solutions over the Fewest Cables

Rev. G, May 2021

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Subject: TLX80 10G Matrix Switch Product Manual
Revision: G, May 2021

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MADE IN USA

PREFACE

About Thinklogical A BELDEN BRAND

thinklogical®
A **BELDEN** BRAND
**100 Washington St.
Milford, CT 06460 USA**

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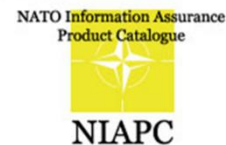
Thinklogical is headquartered in Milford, Connecticut and is owned by Belden, Inc., St. Louis, MO (http://www.belden.com). For more information about Thinklogical products and services, please visit https://www.thinklogical.com.

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 – The 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 – Thinklogical Support: **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.

> ## BEFORE STARTING ANY PROCEDURE, IT IS RECOMMENDED THAT YOU READ THE INSTRUCTIONS THOROUGHLY!

Class 1 Laser Information

The TLX80, 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).

CLASS 1 LASERS do not require any special precautions under conditions of normal use.
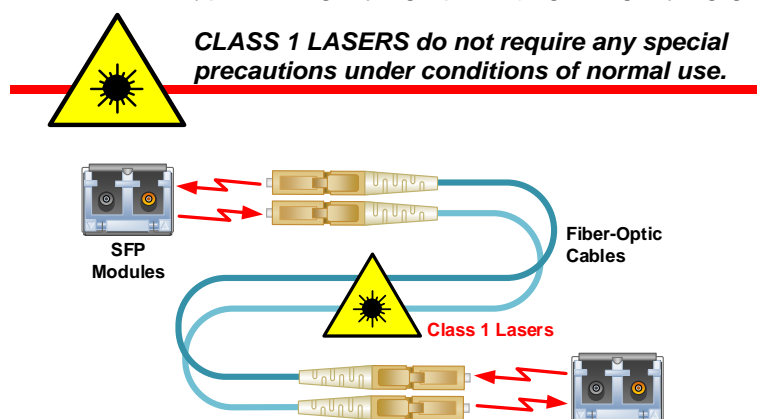
Section 1: TLX System Features

The Logical Solution

The TLX80 is a 10G, high-performance, protocol agnostic, modular, 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 cables in a 6 RU Chassis.
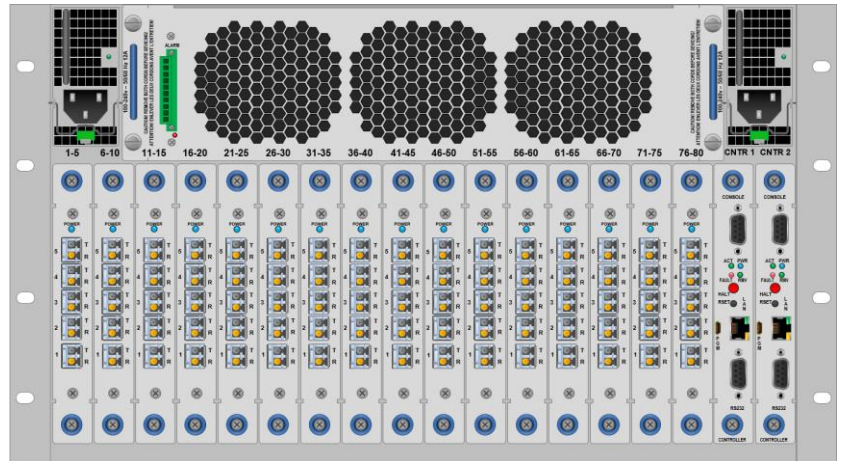
Being protocol agnostic, the switch supports DVI, SDI, HD-SDI, Dual-link DVI, Dual-link SDI, USB HID, USB 2.0 and Audio, adding simplicity and control over sophisticated video and KVM visual computing environments.

The TLX80 is a square crosspoint switch matrix for 80 optical transports to/from Thinklogical Transmitters and Receivers. The TLX80 accepts up to 80 SFP+ Transceivers (Tx & Rx) supporting up to 80 Thinklogical Transmitters and Receivers.

HYBRID SWITCHING SOLUTION

For Uncompressed, High Resolution Video & KVM Systems

Thinklogical 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**.
TLX Matrix Switches are ideal for small or large system applications, with sizes ranging from **12 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 Matrix 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 Matrix Switch's firmware, which means a threat would have to physically access the Matrix Switch to tamper with the settings. *See Appendix E, Secure Applications, beginning on pg. 28.*

THE TLX80 MATRIX SWITCH DESIGN

The rack-mountable design of the TLX80 10G Matrix Switch (sometimes referred to as a Switch or Router) supports up to 80 ports of full, uncompressed 4K video with full color depth at 60Hz frame rate in a 6 RU chassis for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber-optic cable, thus minimizing critical rack space.

Thinklogical's TLX80 10G Matrix Switch includes:

- Housed in a 6 RU Chassis
- Up to 80 fiber ports - In and Out (10Gbps / 6.25 Gbps with re-clocking input)
- Sixteen 5-port, hot swappable I/O Cards
- Redundant, current sharing, hot swappable 1000 W DC Power Supply modules,
- Single-mode, Multi-mode capability
- Supports DVI, SDI, HD-SDI, Dual-link DVI, Dual-link SDI
- Supports multicasting and macros
- SNMP control protocol
- Controllable via LAN or Serial connection
- Single, hot swappable Fan Tray with annunciator port (for alarms)
- Redundant Controller Card
- Fail-over/Power Off button (HALT on Controller)

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**
- **VX80 Matrix Switch 6G I/O cards** (6G to 6G only)

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.
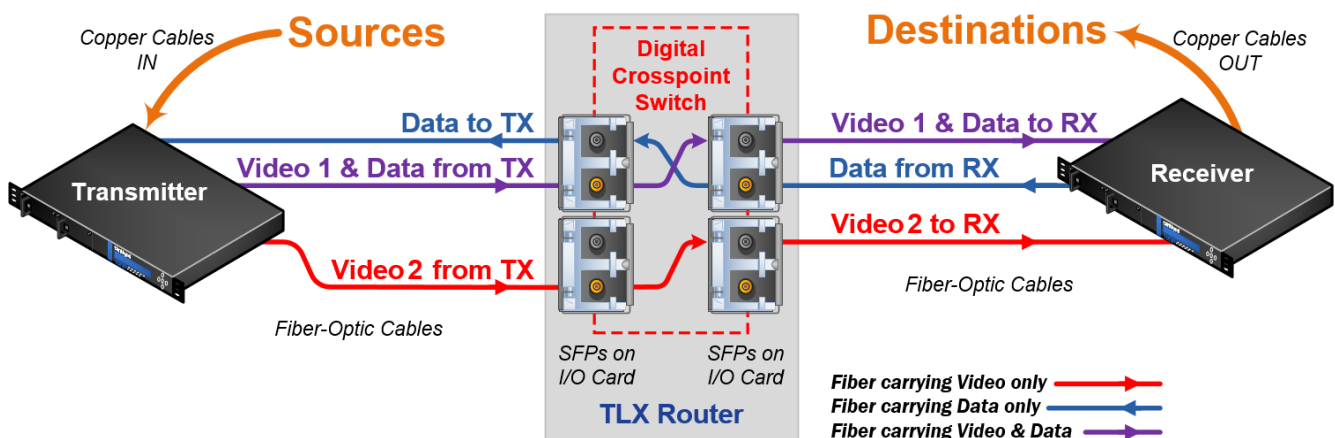
THE CONTROLLER CARDS

The hot-swappable Controller Card connects the Matrix Switch to an External CPU. The **RS-232 Serial Port** may also be used for 3rd party controller integration (such as Crestron, AMX or home-spun interfaces). Also, the System Management Software may be used to control the Switch via the **LAN port**.

Primary and Back-up:

The Primary Controller Card should always be in the left controller slot. *A Back-up Controller Card ensures uninterrupted functionality if the Primary Controller Card should fail or need to be replaced. The Back-up is sometimes referred to as a* Secondary.

The Back-up Controller must have a LAN connection that allows it to communicate with both the Primary Controller and the SMP (required for the Back-up Controller to take control of the switch). Both Controller Cards must have the same CPU Module/Processor.

LED Definitions:

PWR: Blue = Power ON

ACT: Informs which Controller Card (Primary / Back-up) is active. (**ACT**ive)

FAULT: Informs of a Controller Card fault.

RMV: Informs the operator if the CPU (IMX6) is halted. (**ReMoV**e)

Push Button Operation:

HALT (Primary Controller): In a TLX80 with an operational Back-up Controller, holding this button for >5 seconds will halt the CPU (IMX6) and switch active control to the Back-up Controller. If the TLX80 does not have a Back-up Controller, holding this button for >5 seconds will halt the CPU and power down the IO. Note that the RMV (**ReMoV**e) LED will be illuminated and the ACT LED will not.

HALT (Back-up Controller): Holding this button for >5 seconds will halt the CPU (IMX6). If the Back-up Controller was the active controller, the TLX80 will also power down the IO. If the Back-up Controller was not the active controller, the CPU will be halted and is ready to be removed. Note that the RMV (**ReMoV**e) LED will be illuminated and the ACT LED will not.

RESET (Recessed button, for test purposes only): Resets the CPU (iMX6).
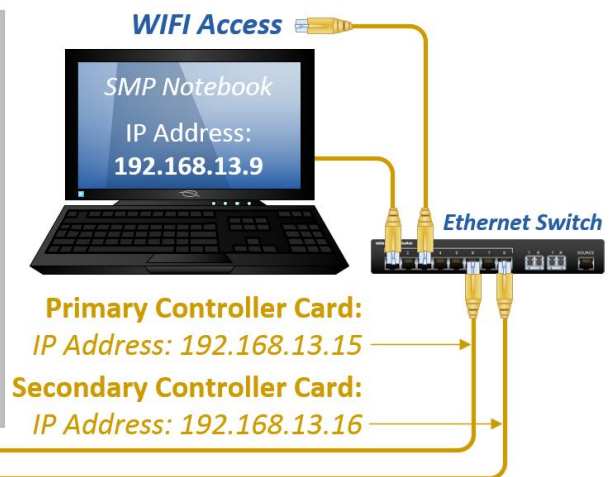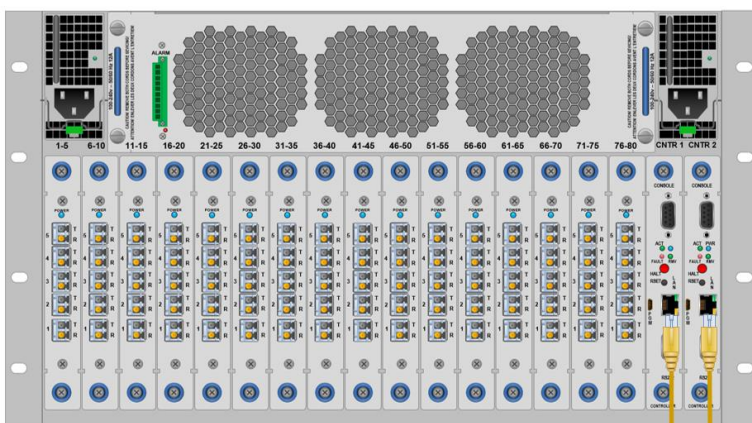
The Controller Cards are connected to the network via the LAN Ports

THE POWER SUPPLY MODULES

The dual, redundant Power Supplies (PWR-000068) ensure continuous, uninterrupted power. The supplies are current sharing, which means the supplies equally share the load. **If a Power Supply fails, the redundant Power Supply can support the entire current load of one fully populated card cage.**

(*Although the TLX Switch functions properly with one Power Module, it is recommended that both modules be used, preferably connected to two independent power sources for redundancy*).

Additionally, the hot-swappable feature allows easy replacement of a module without interrupting the Matrix Switch's system functionality. Both power supplies should be ON during normal use.

(See *How to Remove and Replace a Power Supply Module*, pg. 19)

THE INPUT / OUTPUT CARDS

The TLX80 Matrix Switch supports a maximum of sixteen I/O Cards.
Each TLX80 I/O card contains 5 ports.
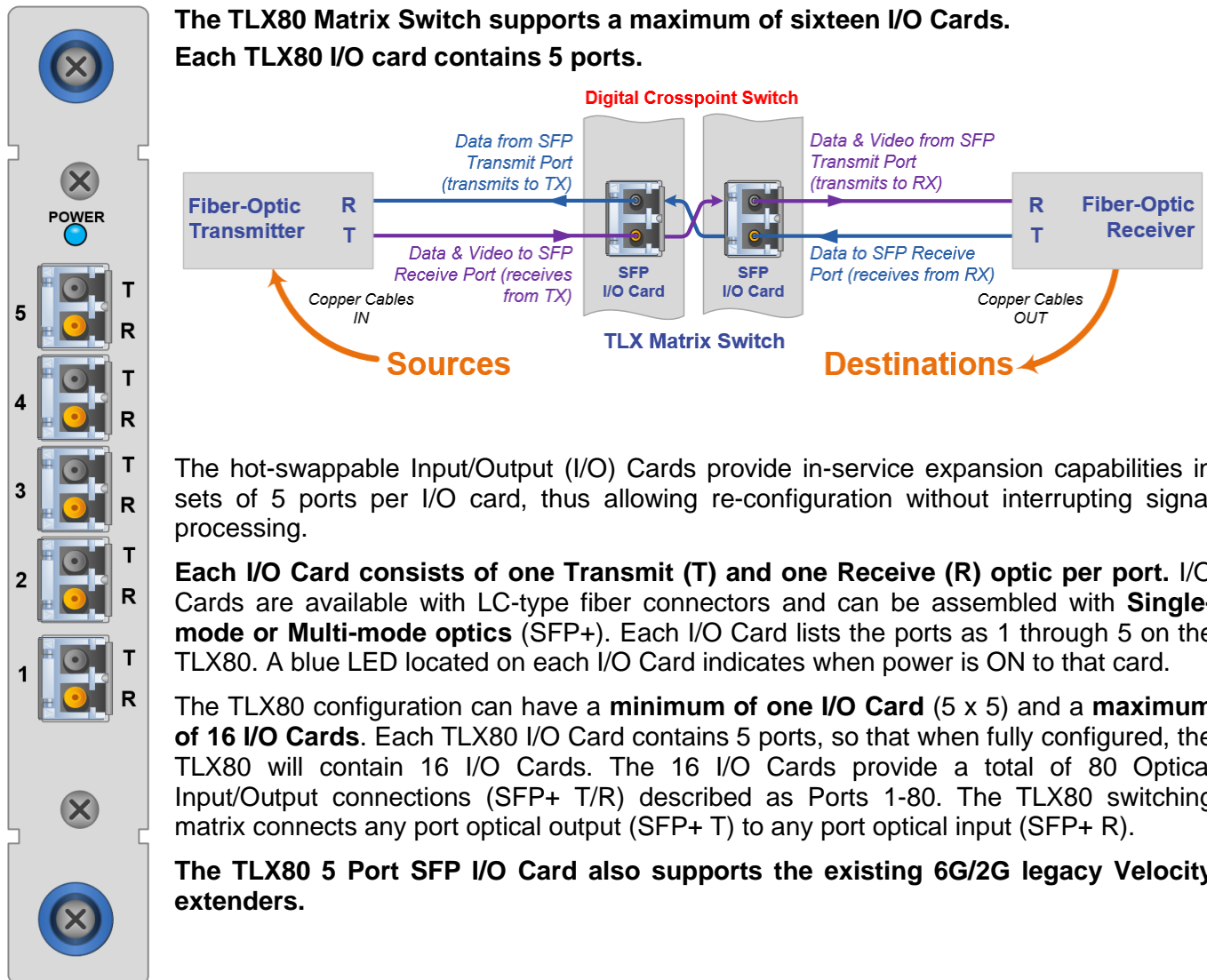
The hot-swappable Input/Output (I/O) Cards provide in-service expansion capabilities in sets of 5 ports per I/O card, thus allowing re-configuration without interrupting signal processing.

Each I/O Card consists of one Transmit (T) and one Receive (R) optic per port. I/O Cards are available with LC-type fiber connectors and can be assembled with **Single-mode or Multi-mode optics** (SFP+). Each I/O Card lists the ports as 1 through 5 on the TLX80. A blue LED located on each I/O Card indicates when power is ON to that card.

The TLX80 configuration can have a **minimum of one I/O Card** (5 x 5) and a **maximum of 16 I/O Cards**. Each TLX80 I/O Card contains 5 ports, so that when fully configured, the TLX80 will contain 16 I/O Cards. The 16 I/O Cards provide a total of 80 Optical Input/Output connections (SFP+ T/R) described as Ports 1-80. The TLX80 switching matrix connects any port optical output (SFP+ T) to any port optical input (SFP+ R).

The TLX80 5 Port SFP I/O Card also supports the existing 6G/2G legacy Velocity extenders.

THE FAN TRAY MODULE

The TLX80 Switch uses 3 DC fans located in one modular, hot-swappable Fan Tray designed for easy replacement without interrupting system functionality. The Fan Tray forces air into the chassis through air baffles in the front door. This cools the vertically mounted I/O Cards, the integrated circuits on the Controller Cards and the Backplane, and removes any heat generated by the Power Supply modules.
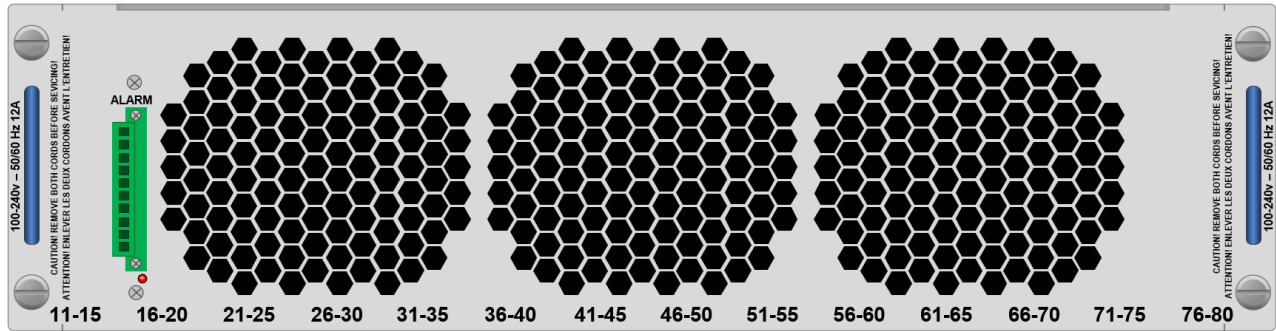
The Fan Tray Module

ALARMS: The Fan Tray is equipped with an annunciator port for system alarms that can be configured to trigger an external control system. The dry alarm contacts are *Normally Closed* when unpowered, *Normally Open* when powered (OK condition) and *Closed* for an alarm condition.
Maximum switching capacity is 2A at 12V.

TLX80 Matrix Switch **Critical Hardware Alarms:**

POWER SUPPLY 1 (LEFT): *Fan failure, temperature spikes, DC voltage/current range, AC power interruption, module removed*
POWER SUPPLY 2 (RIGHT): *Fan failure, temperature spikes, DC voltage/current range, AC power interruption, module removed*
FANS: *Individual fan monitoring*
TEMPERATURE WARNING: *Chassis over temperature, multiple sensors*
TEMPERATURE SHUTDOWN: *Chassis over temperature causing shutdown*
CPU: *Card failure (Only with a redundant card)*
INPUT/OUTPUT CARDS: *SFP+ failure, laser output fault*
ANY OF THE ABOVE
COMMON
GROUND

● **Red LED lit for "ANY OF THE ABOVE" alarm condition**

PORT NUMBERING: SFP numbering starts with Port 1 on the bottom of Card 1 on the left side of the chassis. Each port on each Card has a number designation, 1 through 5, bottom to top, printed to its left for easy reference. There are sixteen 5-Port I/O Cards for a total of 80 Transmit Ports and 80 Receive Ports per Chassis.

The port numbers for each I/O Card are shown just above each individual card.
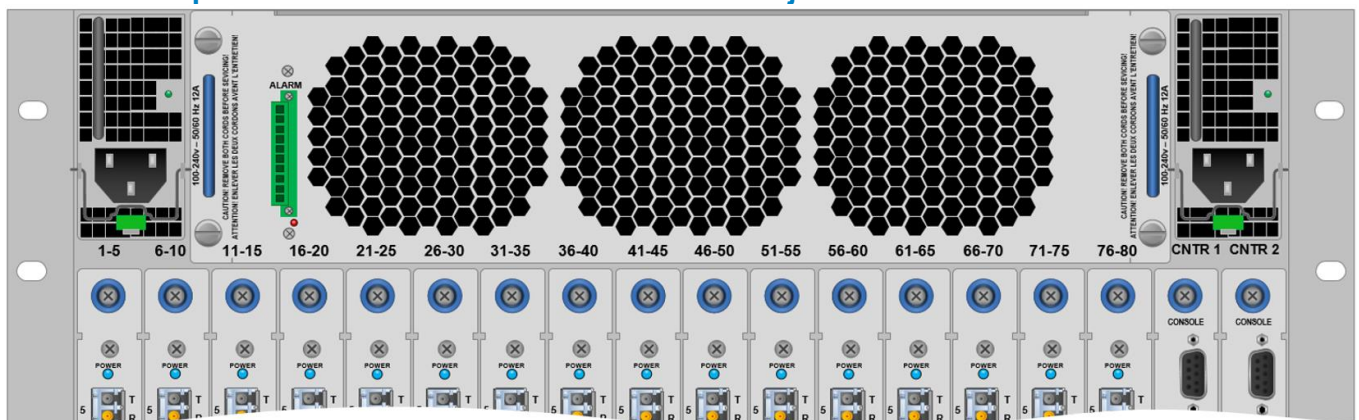
(Card 1, *Ports 1-5*)   (Card 16, *Ports 76-80*)

Input/Output Cards 1-16   **Controller Cards**

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 TLX80 will use up to three IP addresses. The Primary Controller Card will use address X and address X+100. The Back-up Controller Card will use address X+1 and it will take over address X in the event of a failure in the primary Controller Card. These addresses are set by an internal DIP switch (see *TLX80 DIP Switch Settings,* pg. 11). The primary's IP address can be set from 15 to 45. The default subnet used by the switch is 192.168.13.xxx. Users may switch 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 TLX80 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 ports 17601 through 17616, 1 port per I/O card)

Refer to the document: **Manual_TLX_Matrix_Switch_Interfaces**

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

The TLX80 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, 0 for the Upper (or only) switch chassis, 1 for the Lower switch chassis
- 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 *S*imple *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.

Descriptions of the switch's SNMP traps may be found in the document:

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`

By default, NTP is configured to use a time server at `'timeserver1'`. This is defined in `/etc/hosts` as 192.168.13.9.

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 that are in `/etc/rsyslog.d/00-remote.conf`

The default configuration has rsyslog sending (UDP) log messages to a system named `'remotelogger1'`. This name is defined in the file `/etc/hosts` and is defined as 192.168.13.9.

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

SERIAL/RS-232 INTERFACES

The TLX80 Controller Card has two RS-232 serial ports. One is for the Linux command line interface (labeled CONSOLE), and the other is for the Matrix Switch's ASCII command interface (labeled RS-232). If a Back-up Controller Card is installed, then its Linux console port is active. However, only the RS-232 port on the active Controller Card will function.

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 (RS-232)
- 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).

Ordering Information

Part numbers of the various components of the TLX80 Matrix Switch are as follows:

TLX80 Matrix Switch
TLX-MSC-000080   TLX80 Matrix Switch Chassis, 2 Power Supplies, 1 Controller, up to 16 I/O Cards

TLX80 Matrix Switch Data Input/Output Modules
TLX-MSD-M00005   TLX80 Matrix Switch Data Input/Output Card, 5 Multi-Mode Fiber Ports, 10G
TLX-MSD-S00005   TLX80 Matrix Switch Data Input/Output Card, 5 Single-Mode Fiber Ports, 10G
TLX-MSD-MV0005   TLX80 Matrix Switch Data Input/Output Card, 5 Multi-Mode Fiber Ports, 6G
TLX-MSD-SV0005   TLX80 Matrix Switch Data Input/Output Card, 5 Single-Mode Fiber Ports, 6G
TLX-MSD-000005   TLX80 Matrix Switch Data Input/Output Card, unpopulated (for up to 5 Multi- or Single-Mode SFP+)

TLX80 Matrix Switch Spare Modules
TLX-MSM-C00080   TLX80 Matrix Switch Module Controller Card
TLX-MSM-F00080   TLX80 Matrix Switch Module Fan Tray
TLX-MSM-P00080   TLX80 Matrix Switch Module Power Supply

TLX80 TECHNICAL SPECIFICATIONS

PHYSICAL	
TLX80 Chassis	**Dimensions:** Rack Size: **EIA 19"** Height: **6 RU-10.50"** (266.7 mm) Depth: **15.00"** (380.9 mm) Width: **17.16"** (435.9 mm) Weight: **35.5 lbs.** (16.1 kg) Shipping Weight: **55 lbs.** (25 kg)
Ports	**5 x 5 min., 80 x 80 max.**
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, 5A, 50-60Hz**
Maximum Power Consumption	**500 Watts, fully loaded**
Thermal Load	1706 BTU/Hr
WARRANTY	**One Year from date of shipment. Extended warranties available.**

Section 2: Set-Up & Installation

Contents

When you receive your Thinklogical® TLX80 KVM Matrix Switch, you should find the following items in the quantities specified in your order:

- TLX80 Chassis *(includes 2 Power Modules)*
- Controller Card(s) 1 or 2
- Input/Output Card(s) 1 to 16
- Power Cords – PWR-000006-R (International connections may differ) – Qty 2
- Product Manual CD
- Product Quick Start Guide

Unpacking the TLX80

The TLX180 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 TLX80 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 modules are 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 TLX80

Thinklogical's proprietary multiplexing technology combines video, audio and peripheral data on a single data stream for up to 80km over a single fiber.
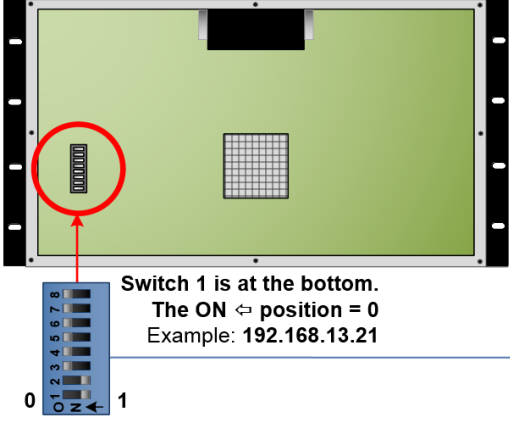
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- Single & Multi-Mode **TLX 10G KVM and Video Extenders** (10G to 10G only)
- Single & Multi-Mode **Velocity 6G KVM and Video Extenders** (6G to 6G only)
- **SDI Xtreme 3G+ Extenders**
- **System Management Portfolio**
- Standard **VX Matrix Switch ASCII Interface** (via RS-232 port or via Network port)
- Standard **VX Matrix Switch IP Address Configuration Procedure**
- Standard **VX Matrix Switch SNMP Traps**
- **VX80 Matrix Switch 6G I/O cards** (6G to 6G only)

Ethernet Control

If the TLX80 Matrix Switch is to be controlled via Ethernet, it will require a **static IP address**. This value can be set via the DIP switch located on the switch's backplane. The front door panel must be removed to access the DIP Switch (8 screws). The factory default setting is: **192.168.13.15** (00000000).

8-Position DIP Switch located on the TLX80 Backplane (shown with front cover removed).

Switch 1 is at the bottom.
The ON ⇦ position = 0
Example: **192.168.13.21**

0   1

8	7	6	5	4	3	2	1	Primary Controller IP Addresses	Back-up Controller IP Address
0	0	0	0	0	0	0	0	192.168.13.15 **&** 192.168.13.115	192.168.13.16
0	0	0	0	0	0	0	1	192.168.13.17 **&** 192.168.13.117	192.168.13.18
0	0	0	0	0	0	1	0	192.168.13.19 **&** 192.168.13.119	192.168.13.20
0	0	0	0	0	0	1	1	192.168.13.21 **&** 192.168.13.121	192.168.13.22
0	0	0	0	0	1	0	0	192.168.13.23 **&** 192.168.13.123	192.168.13.24
0	0	0	0	0	1	0	1	192.168.13.25 **&** 192.168.13.125	192.168.13.26
0	0	0	0	0	1	1	0	192.168.13.27 **&** 192.168.13.127	192.168.13.28
0	0	0	0	0	1	1	1	192.168.13.29 **&** 192.168.13.129	192.168.13.30
0	0	0	0	1	0	0	0	192.168.13.31 **&** 192.168.13.131	192.168.13.32
0	0	0	0	1	0	0	1	192.168.13.33 **&** 192.168.13.133	192.168.13.34
0	0	0	0	1	0	1	0	192.168.13.35 **&** 192.168.13.135	192.168.13.36
0	0	0	0	1	0	1	1	192.168.13.37 **&** 192.168.13.137	192.168.13.38
0	0	0	0	1	1	0	0	192.168.13.39 **&** 192.168.13.139	192.168.13.40
0	0	0	0	1	1	0	1	192.168.13.41 **&** 192.168.13.141	192.168.13.42
0	0	0	0	1	1	1	0	192.168.13.43 **&** 192.168.13.143	192.168.13.44
0	0	0	0	1	1	1	1	192.168.13.45 **&** 192.168.13.145	192.168.13.46

TLX80 DIP Switch Settings

The simplest network connection is an isolated network with only the TLX80, the control server, and any control clients, using static IP addresses. The TLX80 can be set to any of the above settings. The **Control Server** must be at **192.168.13.9**, and the **Control Clients** can then be set to any other addresses in the **192.168.13.X** subnet.

If static IP addresses for the control server and its clients are not possible, then the control server will require two (2) network interfaces, with one interface set to the static address **192.168.13.9** and dedicated to the TLX80 KVM Matrix Switch(s), while the other network interface can be configured as required by the facility's network administrator

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 Input and Output card 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. Individual cards can be removed for easy access to the SFP+ modules.

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.

SFP+
ACTUAL SIZE

⚠️ <u>Note:</u> **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 TLX80 I/O Card has either 10 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 TLX80 switching matrix connects any SFP's optical output port (Transmit) to any other SFP's optical input port (Receive) with LC-type connectors.

→ **OPTICAL OUTPUT PORT (Transmit)**

← **OPTICAL INPUT PORT (Receive)**

Requirements: Thinklogical recommends SX+ Laser Enhanced (50µm) fiber with LC-type connectors for your TLX80 KVM Matrix Switch and 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.

STOP **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.

STOP **Warning! Minimum bend diameter must be no less than 3". Be careful not to kink or pinch the fiber when using ties.**
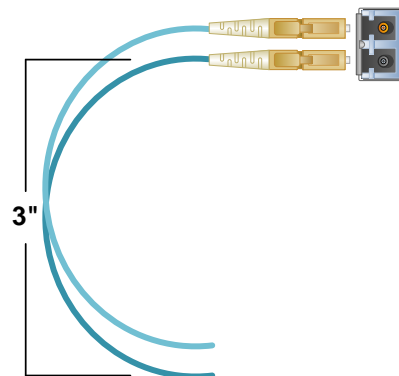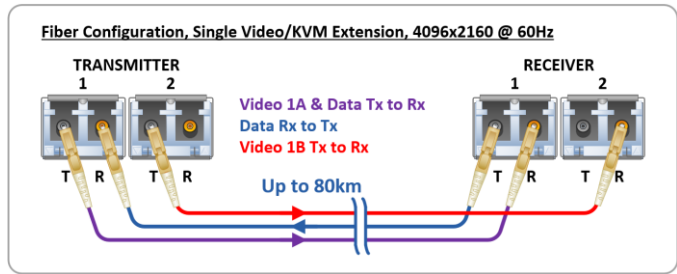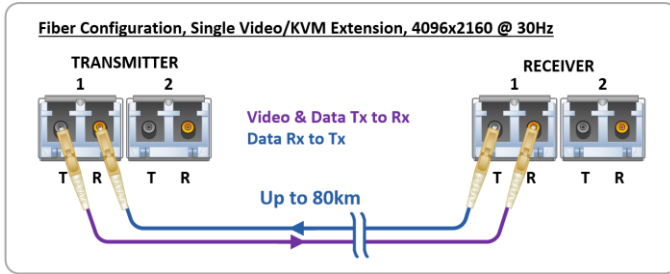

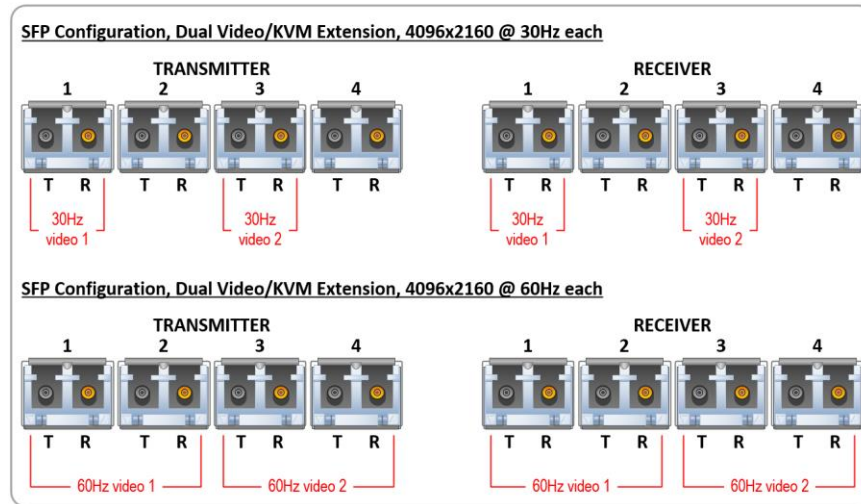*Thinklogical recommends SX+ Laser Enhanced Fiber-optic Cable, 50 or 62.5 microns, terminated with LC type connectors.*

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
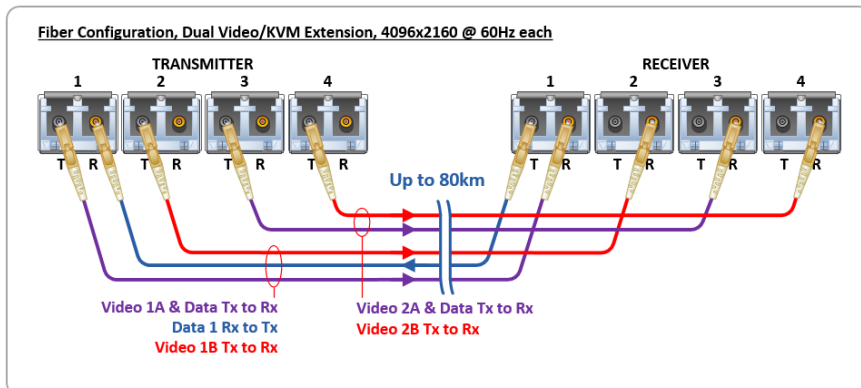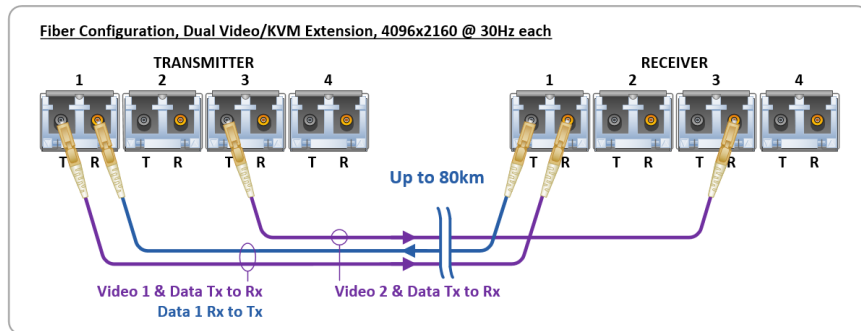
TLX Extender Fiber-Optic Cable Configurations

SINGLE VIDEO MODULES

Fiber Configuration, Single Video/KVM Extension, 4096x2160 @ 30Hz

TRANSMITTER 1 2
RECEIVER 1 2
Video & Data Tx to Rx
Data Rx to Tx
T R T R
Up to 80km
T R T R

Fiber Configuration, Single Video/KVM Extension, 4096x2160 @ 60Hz

TRANSMITTER 1 2
RECEIVER 1 2
Video 1A & Data Tx to Rx
Data Rx to Tx
Video 1B Tx to Rx
T R T R
Up to 80km
T R T R

DUAL VIDEO MODULES

SFP Configuration, Dual Video/KVM Extension, 4096x2160 @ 30Hz each

TRANSMITTER 1 2 3 4
RECEIVER 1 2 3 4
T R T R T R T R
30Hz video 1   30Hz video 2
T R T R T R T R
30Hz video 1   30Hz video 2

SFP Configuration, Dual Video/KVM Extension, 4096x2160 @ 60Hz each

TRANSMITTER 1 2 3 4
RECEIVER 1 2 3 4
T R T R T R T R
60Hz video 1   60Hz video 2
T R T R T R T R
60Hz video 1   60Hz video 2

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

Fiber Configuration, Dual Video/KVM Extension, 4096x2160 @ 30Hz each

TRANSMITTER 1 2 3 4
RECEIVER 1 2 3 4
T R T R T R T R
Up to 80km
T R T R T R T R
Video 1 & Data Tx to Rx
Data 1 Rx to Tx
Video 2 & Data Tx to Rx

Fiber Configuration, Dual Video/KVM Extension, 4096x2160 @ 60Hz each

TRANSMITTER 1 2 3 4
RECEIVER 1 2 3 4
T R T R T R T R
Up to 80km
T R T R T R T R
Video 1A & Data Tx to Rx
Data 1 Rx to Tx
Video 1B Tx to Rx
Video 2A & Data Tx to Rx
Video 2B Tx to Rx

Routing Thinklogical Extenders through the TLX80

Comprised of a fiber-in, fiber-out **Matrix Switch** and fiber-optic **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.
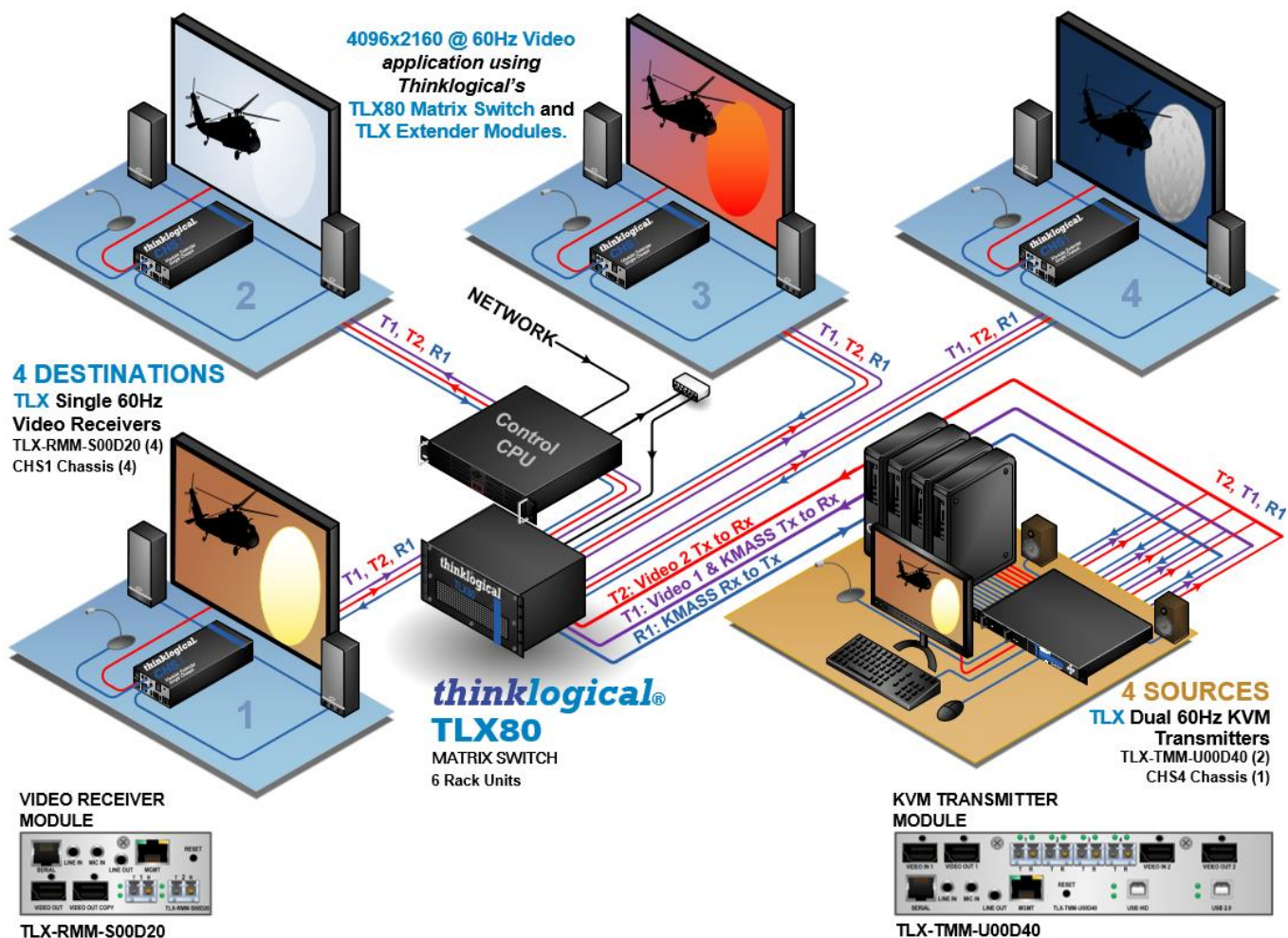

TLX80 Matrix Switch Transmit / Receive Concept
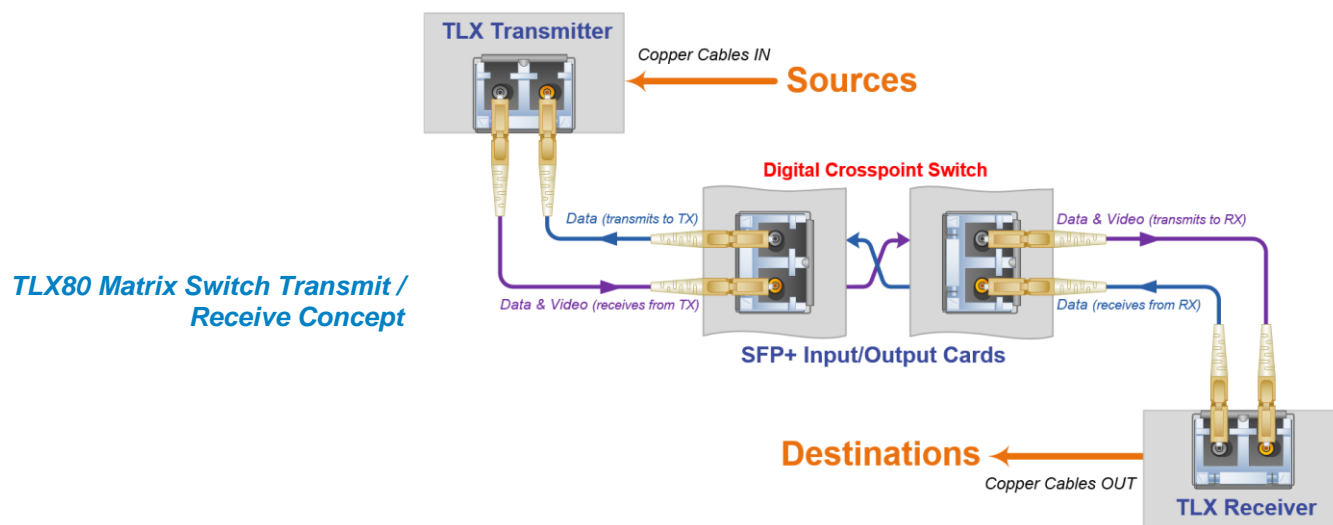
Connecting to a Receiver

The 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 TLX80 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 TLX80 Transmitter ports using fiber-optic cables (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).

4096x2160 @ 60Hz Video *application using Thinklogical's* **TLX80 Matrix Switch** and **TLX Extender Modules.**

4 DESTINATIONS
TLX Single 60Hz
Video Receivers
TLX-RMM-S00D20 (4)
CHS1 Chassis (4)

NETWORK

Control CPU

thinklogical®
TLX80
MATRIX SWITCH
6 Rack Units

T2: Video 2 Tx to Rx
T1: Video 1 & KMASS Tx to Rx
R1: KMASS Rx to Tx

4 SOURCES
TLX Dual 60Hz KVM
Transmitters
TLX-TMM-U00D40 (2)
CHS4 Chassis (1)

VIDEO RECEIVER
MODULE

TLX-RMM-S00D20

KVM TRANSMITTER
MODULE

TLX-TMM-U00D40

Routing *Thinklogical*® TLX Extenders through the TLX80

Connecting to a Control CPU

The TLX80 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 **TLX80 Quick Start Guide** is also available in **Appendix A** on 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 **1-203-647-8700**.

⚠ **Note: If mounting the chassis in a rack, ensure 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.**

How to Remove and Replace Modules

<div style="border:2px solid blue;">

READ THE INSTRUCTIONS THOROUGHLY BEFORE STARTING ANY PROCEDURE!

</div>

How to Remove and Replace an Input / Output Card

⚠️ **Note: No shutdown is required prior to installing/replacing Input/Output Cards.**

1 Turn the card's **two thumbscrews** counterclockwise until they disengage from the chassis. Pull the card straight out using both handles. *Do not pull on the thumbscrews when removing the module – damage may occur! Use the handles!*

2 Hold the replacement module by the handles and place it into the slot vertically with the POWER LED on top. The card should slide freely until it reaches the backplane connector. Use just enough force to **firmly engage** the card with the mating connector. **If the module does not slide into the connector, do not force it!** Damage may occur. Remove the card and start over.

3 Hand-tighten the thumbscrews. **Do not tighten the thumbscrews with a screwdriver.**

How to Remove and Replace a Fan Tray

The TLX80 uses three DC fans to move air vertically through the enclosure. Be sure to not block the air vents on the front of the unit. Leave at least 2" of space on both sides

⚠️ **Note: Leave adequate ventilation space on both sides of the units (2" minimum), especially if devices are being stacked above or below the TLX80 KVM Matrix Switch.**

⚠️ **Note: Remove both Power Cords before servicing. (*Also noted on the Fan Tray, below.*)**

1 Turn the **four thumbscrews** counter-clockwise until they disengage from the chassis.

2 Pull the Fan Tray module straight out using the **two handles** on either side.

3 Place the new tray so that the alarm is toward the left. Hold the Fan Tray by the handles and slide the aluminum housing into the card guides until it reaches the backplane connector. At this point, use just enough force to **firmly engage** the tray with the mating connector. **If the tray does not slide into the connector, do not force it!** Damage may occur. Remove the tray and start over.

🛑 **Warning! Do not operate the unit without a Fan Tray installed.**

4 Hand-tighten the thumbscrews. **Do not tighten the thumbscrews with a screwdriver.**

How to Remove and Replace a Power Supply Module

Each Power Module (PWR-000068) is universal input 100-240VAC, 50-60Hz. Use the proper power cords for your region. (Two PWR-000006-R power cords are supplied with the unit).

🛑 **Warning! Disconnect the power cord before proceeding!**

⚠️ **Note: If only ONE power supply is installed, shutdown IS required. If TWO power supplies are installed and only one is being replaced, shutdown IS NOT required.**

The Power Modules are universal input 100-240VAC 50-60Hz. Use the proper power cords for your region (PWR-000006-R, supplied with the unit). **Although the TLX80 functions properly with one Power Module, it is recommended that the Primary and Back-up be connected to two independent power sources for redundancy.**

1 Lift the **green latch** tab.

2 While holding the tab up, pull the Power Module **straight out** of the chassis by the handle.

3 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 rear mating connector. **If the module does not slide easily into the connector, do not force it! Damage may occur.** Remove the module, reseat it, and start over.

How to Safely Remove an Active Controller Card or Shut Down the System

During normal, non-maintenance operation, the **Primary Control Card should always be the Active controller for the system.** However, there may be times when other conditions temporarily exist, such as during maintenance, updates, repairs, etc.

Although the system will run normally on the Back-up Control Card, not having a second card eliminates the fail-over protection afforded by a redundant, two-card system.

The following methods allow the safe removal of one or both Control Cards.

⚠️ **Note: During normal operation, the Primary Control Card should always be the active controller for the system.**

During normal operation the Primary or Back-up Controller can be managed via the console port or over an SSH connection.

The PWROFF Command

- Typing **pwroff** at the command line prompt, from either the Primary or the Back-up Control Card, will halt BOTH Control Cards and turn off the power to all the I/O card slots in the system.

- The Controller Cards' 3.3V stand-by voltage remains on, even after issuing a **pwroff**.

- For a complete system shut-down, remove the AC power cord(s) from the Matrix Switch or from the AC source.

In addition to the **pwroff** command, the system can be safely shut down by pressing the HALT buttons.

The HALT Button

- Each Controller Card has a HALT button for controlled shut-down. (*See pg. 3 for specific operation of one or both HALT buttons.*)

⚠️ **Note: Re-inserting the Primary Control Card restores the system back to running on the Primary Control Card. Ensure that the LAN connection to the card is restored promptly.**

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 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**-**21**00**28** 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.

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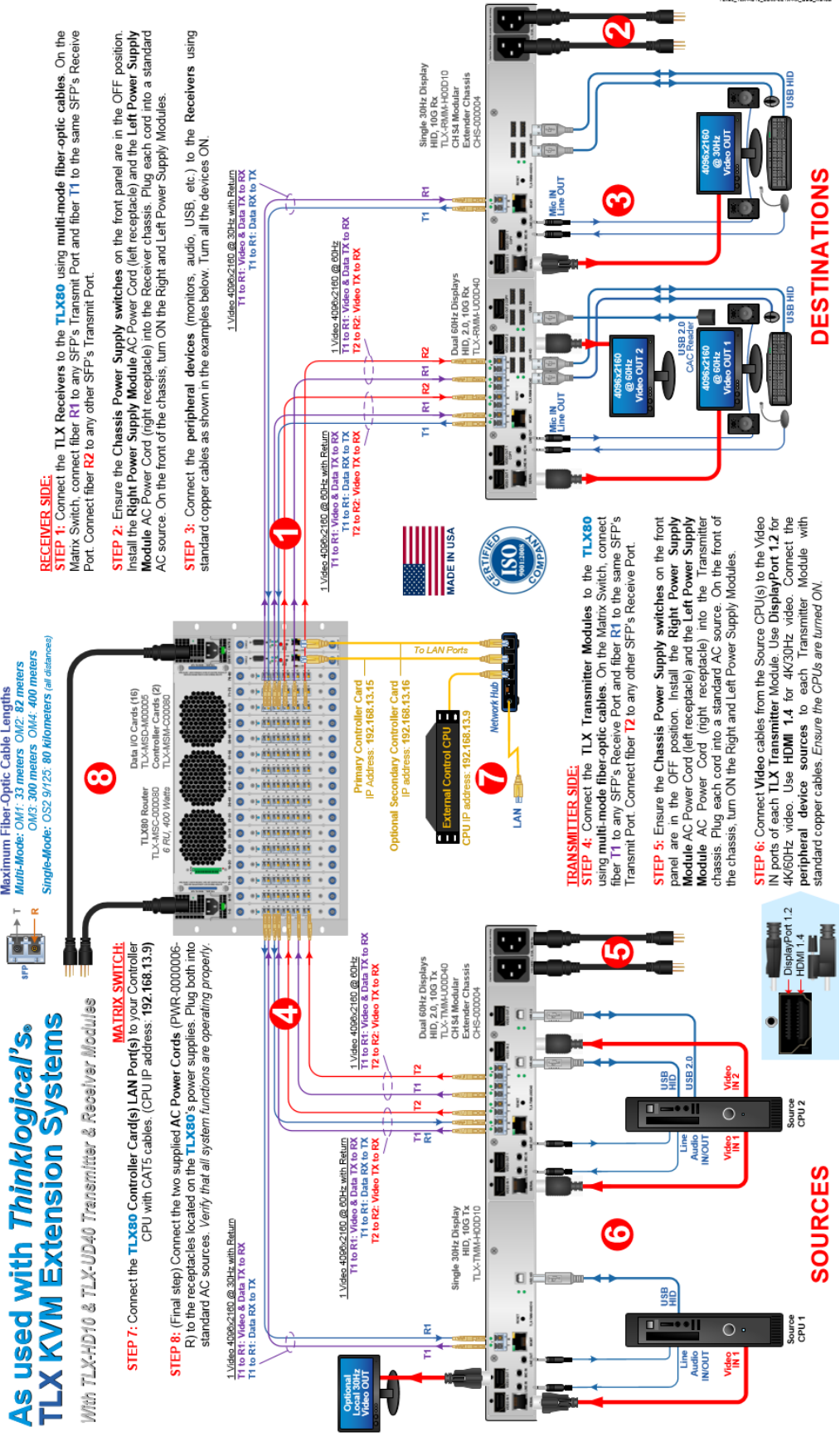
Please include the Return Merchandise Authorization number: **Thinklogical,** A **BELDEN** BRAND
100 Washington Street
Milford, CT 06460 USA
Attn: *RMA#*

Appendix A: TLX80 QUICK START GUIDE

# Appendix B: FPGA Program Code Update Procedure

thinklogical® TLX80 KVM Matrix Switch
FPGA Program Code Update Procedure

The following procedure documents the steps necessary to update the FPGA program code on a TLX80 10G KVM Matrix Switch using a Windows-based computer.

Perform steps 1-8 as described:

1 **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.

2 **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.
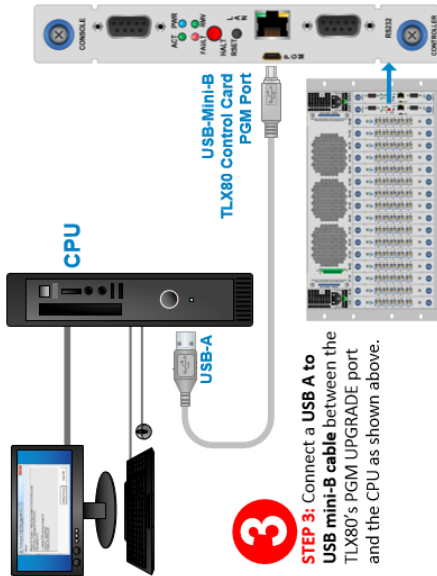
3 **STEP 3:** Connect a **USB A to USB mini-B cable** between the TLX80's PGM UPGRADE port and the CPU as shown above.

4 **STEP 4:** Run the Thinklogical **FPGA Upgrade** application. You will see the following window. Click on *Identify Product*.
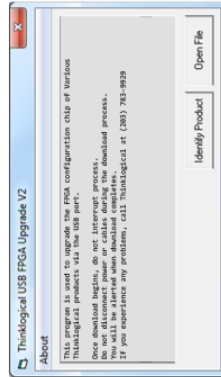
5 **STEP 5:** You may see a window similar to this, identifying the desired file name. Click *Open File.*

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

Browse to and select the file: **TLX80_ctrl_fpga.lbf** (This is the file saved in Step 2.) and press OPEN to begin.
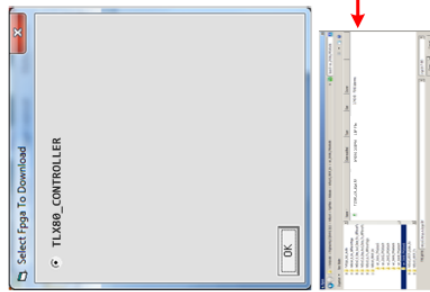
7 **STEP 7:** Verify the response below during the process. The spinning bar to the left of the progress bar will stop when the download is complete.
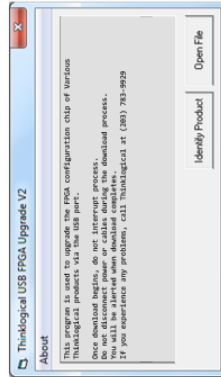
8 **STEP 8:** When **FPGA download is complete,** you will see the window below. The Upgrade Procedure is now complete. Remove the USB cable from the PGM Update Port and exit the application.

CPU

USB-A

USB-Mini-B
TLX80 Control Card
PGM Port

TLX80 Chassis

MADE IN USA

Appendix C: FPGA Download Installation Procedure

thinklogical® FPGA Download Installation Procedure

This procedure documents the steps to run the FPGA Download Installation program on a Windows-based computer:

FPGA Update Preparation:
- The *FPGA Download.exe* application is stored in:
- **http://ftp.thinklogical.com/ftp/visualization/updates/Fpga_Upgrade.zip**
- Open the **FPGA_upgrade.zip** file and run the Setup.exe file. Accept all the default installation options.
- A Start menu program group named "**FPGA_Download**" will be created.

Perform steps 1-5 as described:

①

STEP 1: To install the application, double click on **setup.exe (Contained in FPGA_upgradeVxxx.zip).** If asked for permission to make changes, select *Yes*. At the *Welcome* screen shown here, select *OK*.
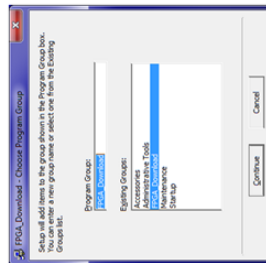
②

STEP 2: Begin the installation by clicking the **Exit Setup** button.

③

STEP 3: Choose program group: Select *Continue* when the default selections are displayed.

④

STEP 4: The files will now attempt to download. If a **Version Conflict** is displayed, select *Yes (keep this file)*.

⑤

STEP 5: The **Thinklogical FPGA Download Setup** is now complete. Press *OK*. **You are now ready to download to a Thinklogical device.**

NOTE: When upgrading for the first time, the user may encounter a **Found New Hardware Wizard** box if the current drivers are not installed **(A)** or if not connected to the internet **(B)**. Follow the instructions below, then proceed to steps **(C)** and **(D)**.

A

STEP A: The **Found New Hardware Wizard** may open if the Thinklogical product is being connected to the PC for the first time.

B

STEP B: If not connected to the Internet, select *No, not this time* and navigate to where the FPGA Update application is installed. The driver is in the Install Directory. Proceed to **Step 3**. **If using an internet connection**, select: *Yes, this time only*. Click on *Next*. Proceed to **Step C.**

C
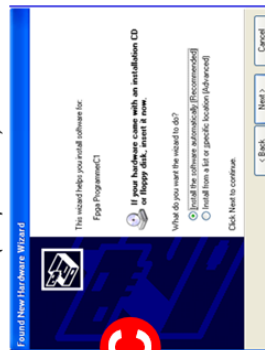
STEP C: Select *Install the software automatically (Recommended)*. Click on *Next*

D
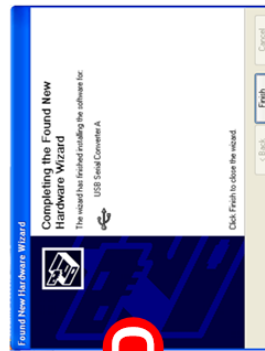
STEP D: Follow the instructions for the **Completing the Found New Hardware Wizard** Box. Click on *Finish*.

Appendix D: SD Card Replacement Procedure for the TLX80 Controller Card

This procedure assumes a normally operating TLX system that is using both a Primary and a Back-up Controller Card.

⚠️ **Note: If Partitioning, Restricted Switching or P2P is being used, copy the** `upstream.csv` **file from the appropriate** `/var/local/router` **subdirectory. This file will be copied onto the new SD card.**

1. Connect a Linux Command Line Interface serial cable to the Controller Card via the serial CONSOLE port. Datacomm parameters are: 115200, 8, N, 1, None.

2. Connect a Linux Command Line Interface serial cable to the Back-up Controller Card via the serial CONSOLE port and issue a `poweroff` command. Wait until the RMV (*OK to remove*) message appears.

3. Remove the Back-up Controller and replace the SD card.

4. Install the Back-up Controller Card into the chassis with a CONSOLE serial connection. Do not connect the network cable.

5. When the Controller Card boots up, wait for the `crng init done` message, then verify the IP settings with the `ipconfig` utility.

6. Check the 'date/time/time zone' with a `date` command.*

7. Perform other site-specific operations as necessary (*password, hostname, gateway, NTP, etc.*)

8. On the Back-up Controller, issue a `poweroff` command and wait for the `system halted` message to appear.

9. Disconnect the Back-up Controller from the chassis backplane, wait 5 seconds, then reconnect it.

10. Wait for the `crng init done` message, then connect the network cable to the Back-up Controller Card and wait 10 seconds.

11. Unplug the network cable from the Primary Controller Card.

12. After 20 seconds the system will fail-over to the Back-up Controller and the ACTIVE LED on the Back-up will come on. On the Primary, the ACTIVE LED will be off and the FAULT LED on.

13. Test the Back-up Controller's function by performing a switching operation.

14. On the Primary Controller, issue a `poweroff` command and wait for the RMV (*OK to remove*) message to appear.

15. Remove the Primary Controller Card and replace the SD card.

16. Install the Primary Controller with a CONSOLE serial cable. Do not connect the network cable.

17. When the Controller Card boots up, wait for the `crng init done` message, then verify the IP settings with the `ipconfig` utility.

18. Check the 'date/time/time zone' with a `date` command.*

19. Perform other site-specific operations as necessary (*password, hostname, gateway, NTP, etc.*)

20. On the Primary Controller, issue a `poweroff` command and wait for the RMV (*OK to remove*) message to appear.

21. Disconnect the Primary Controller from the chassis backplane, wait 5 seconds, then reconnect it.

22. Wait for the `crng init done` message, then connect the network cable to the Primary Controller.

23. Fail-over from the Back-up Card occurs automatically; The ACTIVE LED will come on.

24. Test the Primary Controller's function by performing a switching operation.

To check and change the 'date, time & time zone,' see **Tech Support Bulletin 19-009B, next page.*

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Technical Support Bulletin
May 21, 2019
Page 1 of 1

SUBJECT:	TSB #: TSB-19-009, Rev. B

Setting the Date, Time & Time Zone – Linux Devices

PRODUCT(S) AFFECTED:

Matrix Switches, SMP2 Module, SMP2 Appliance and SMP Client

PROBLEM:

Having an incorrect date/time setting may cause system problems. These range from; incorrect log file data to Linux not booting properly.

Note: This is not a bug in Debian Linux; it's an intentional security feature.

For example: In the case of a TLX matrix switch, it may boot into a "maintenance" mode which precludes the use of the ipconfig utility. This mode is indicated by: "login incorrect, type root password for maintenance, or type control-D to continue." If this should occur, login as root and set the date & time as below.

SOLUTION:

1. Log into the device as root.
2. Check the date, time and time zone by issuing a "date" command.
3. To change the time zone, issue a "dpkg-reconfigure tzdata" command. A menu will appear allowing you to easily update the time zone.
4. To set the date and time, issue the command in the format "date mmddhhmmyy" for month, day, hour, minute, year. For example: "date 0128162019" will set the module for January 28, 2019, 4:20PM. This sets the Linux clock. However, this will be lost after repowering the unit.
5. Check the date, time and time zone again to make sure it is correct.
6. Set the permanent hardware clock with the following command: "hwclock –systohc". Note there is a space and double hyphen between the parameters. Now when Linux boots it will read the H/W clock correctly.

Warning:

Make sure you double check your date & time setting after configuring it. Accidentally changing the date too far in the past will prevent Linux from booting at all. If this should ever happen, remove and replace the RTC battery to reset the date/time to a known state and then correct it.

Additional benefit:

Having the clocks set on system devices ensures that the log entries will have accurate timestamps if the system needs troubleshooting and the logs need to be examined.

INITIATOR(S):	DATE:	APPROVALS:	DATE:
	5/21/2019	Project Engineer:	5/21/2019

Appendix E: Secure Applications

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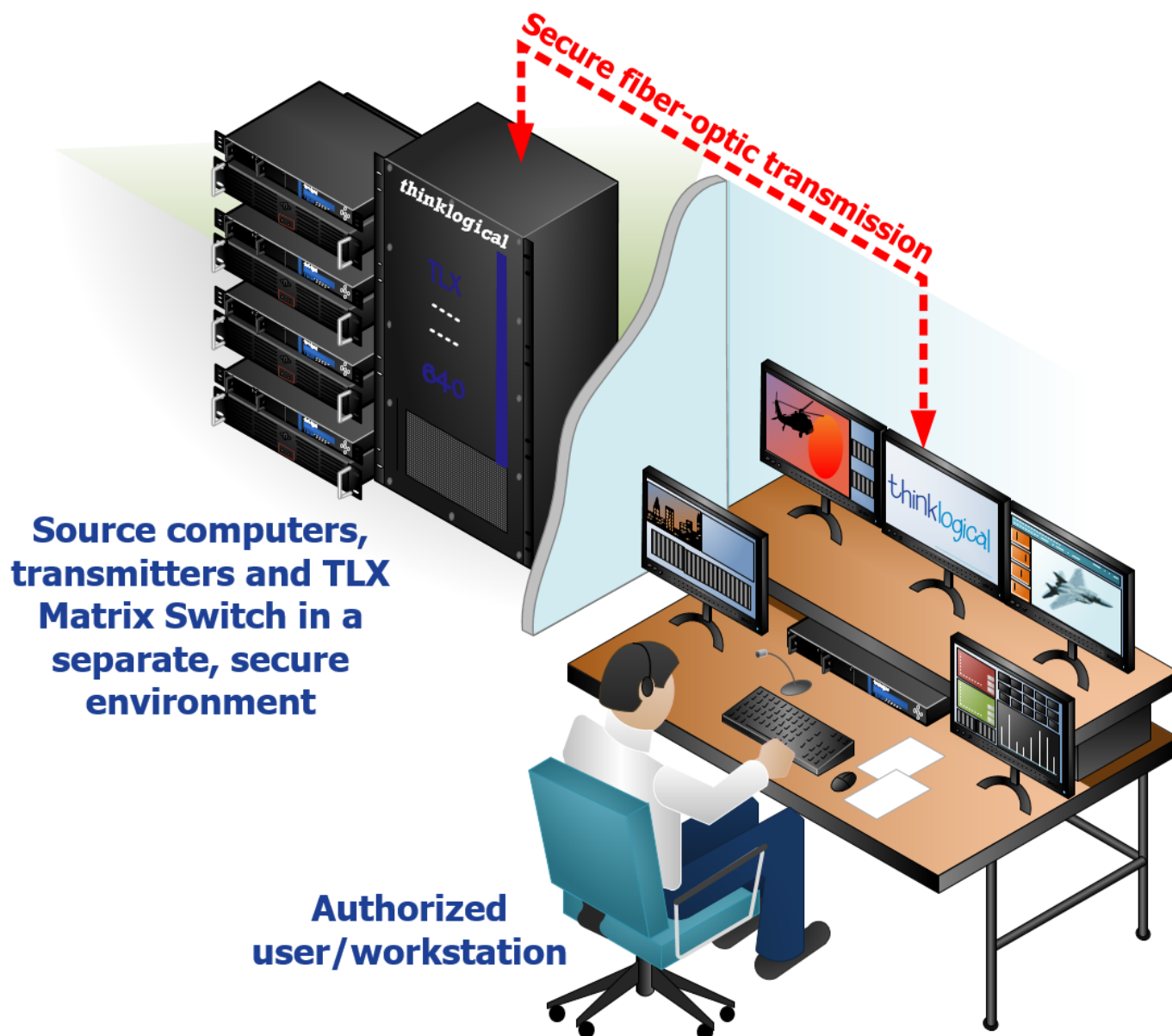
Thinklogical's TLX, VX and MX Matrix Switches use two methods for secure routing. One is known as **Restricted Switching** and the other is known as **Partitioning**. These methods can be deployed singularly or jointly, depending on security requirements.

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 controller card at:
/var/local/router/restrict/upstream.csv

At system power up, after initial boot-up, the **Primary Controller Card** will only evaluate its Restricted Switching Table (upstream.csv file) once upon becoming active. The **Back-Up Controller Card** will NOT evaluate its Restricted Switching Table (upstream.csv file) at initial boot-up but rather when a switchover occurs from Primary Active to Back-Up 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.

The inactive Back-Up Controller Card will not verify its Restricted Switching Table (csv file), so it will not log error messages with current time stamp entries until it becomes active. Also, 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 on the controller card: **/var/log/daemon.log**.

For access to the *daemon.log* file via SSH, refer to THE NETWORK INTERFACES section of this document (pg. 6) for correct IP addresses of Controller Cards when in Primary Active or Back-Up Active mode.

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

1) Review the **daemon.log** file on the active Controller Card 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** on the active Primary Controller Card before implementing multiple levels of security classification domains on the same Matrix Switch.

3) In a redundant system, make the Back-Up Controller Card active by disconnecting the LAN cable from the Primary Controller Card's LAN port. The Back-Up Controller Card, upon becoming active, will evaluate its Restricted Switching Table. Check the **daemon.log** file on the Back-Up Controller Card for any errors in the Restricted Switching Table and correct them before implementing multiple levels of security classification domains on the same Matrix Switch using the Back-Up Controller Card.

4) Fully test the Back-Up Controller Card's **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 Controller will not evaluate the updated table until the following procedures are followed:

When updates are made to the Restricted Switching Table in a **non-redundant system**, Thinklogical recommends the following (This procedure will be disruptive to system connections):

1) Update the Restricted Switching Table of the Primary Controller Card.

2) Take the Primary Controller Card out of service by following guidelines in the "Safely Remove an Active Controller Card" section of this document (pg. 19).

When updates are made to the Restricted Switching Table in a **redundant system**, Thinklogical recommends the following (This procedure will NOT be disruptive to system connections):

1) Update the Restricted Switching Table of the active Primary Controller Card. The table will not take affect at this time.

2) Update the Restricted Switching Table of the inactive Back-Up Controller Card with the same table used for the Primary Controller Card.

3) Take the Primary Controller Card out of service by typing 'halt' at the command line. This will make the Back-Up Controller Card active and evaluate its Restricted Switching Table. Thinklogical recommends verifying the changes to the Back-Up Controller Card.

4) Ensure that the LAN connection to the Primary Controller Card is connected. Extract the Primary Controller Card, wait 10 seconds, then re-insert the Primary Controller Card back into the chassis, allowing the system to make the Primary Controller Card the active controller and begin using the updated Restricted Switching Table.

⚠️ **Note: When using a Back-Up Controller configuration, both controllers must have the same Restricted Switching Table file(s) to maintain the security of the system.**

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 Controller Card 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:
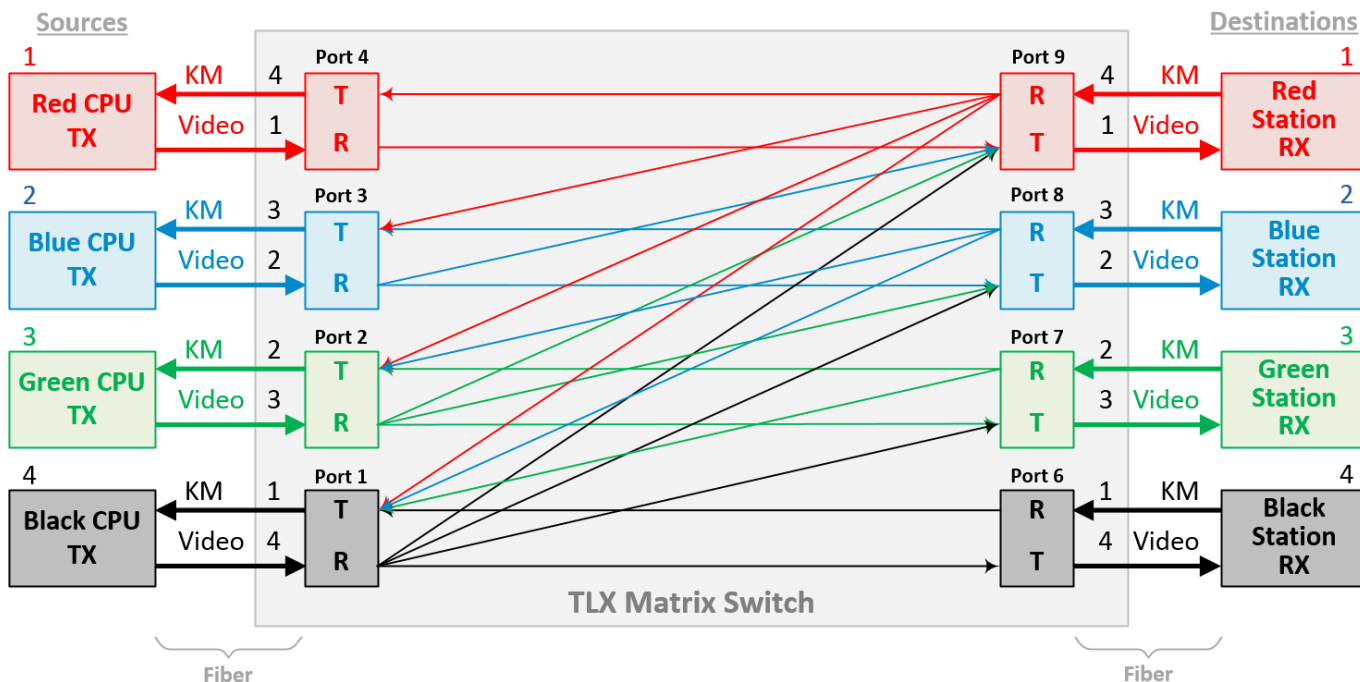
VIDEO:

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.

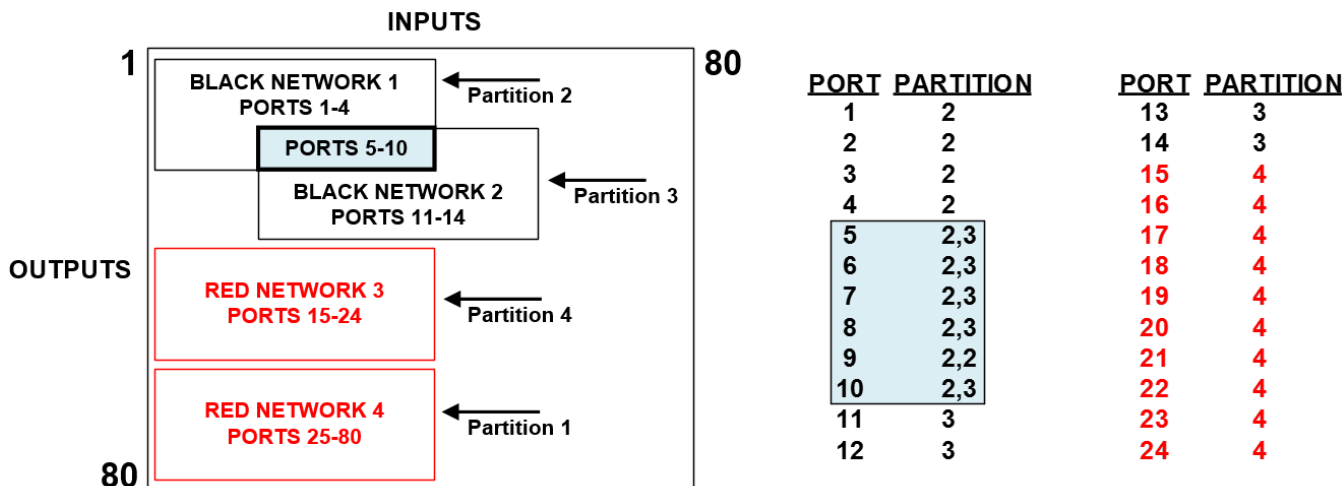***Example:* TLX80 Matrix Switch with four distinct partitions:**
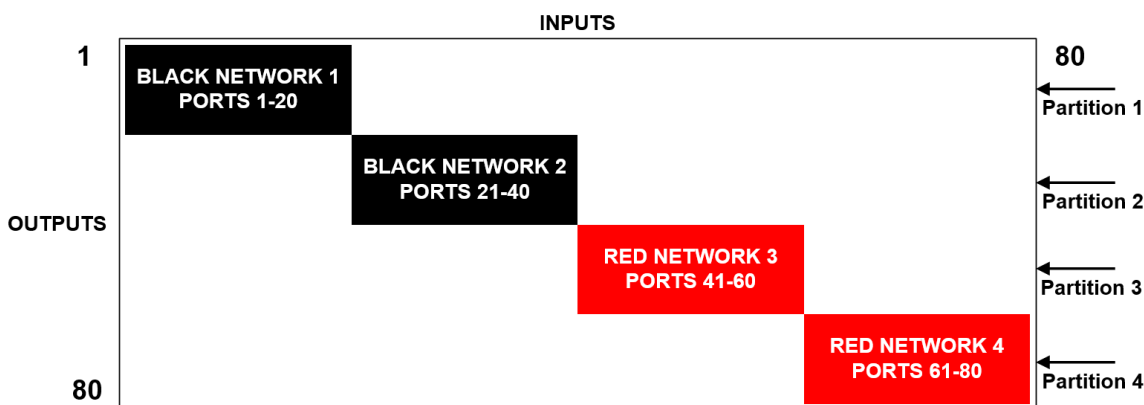
Four partitions set up for secure routing and extension applications. Signals are only capable of transmitting and receiving within a single partition and not across partitions

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		PORT	PARTITION
1	2		13	3
2	2		14	3
3	2		15	4
4	2		16	4
5	2,3		17	4
6	2,3		18	4
7	2,3		19	4
8	2,3		20	4
9	2,2		21	4
10	2,3		22	4
11	3		23	4
12	3		24	4

The Partition Table files are stored on the controller card at:
/var/local/router/partition/upstream.csv

At system power up, after initial boot-up, the **Primary Controller Card** will only evaluate its Partition Table (upstream.csv file) once upon becoming active. The **Back-Up Controller Card** will NOT evaluate its Partition Table (upstream.csv file) at initial boot-up, but rather when a switchover occurs from Primary Active to Back-Up 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.

The inactive Back-Up Controller Card will not verify its Partition Table (csv file), so it will not log error messages with current time stamp entries until it becomes active. Also, 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 controller card: **/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 of controller cards when in Primary Active or Back-Up Active mode.

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

1) Review the **daemon.log** file on the active controller card 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** on the active Primary Controller Card before implementing multiple levels of security classification domains on the same Matrix Switch.

3) In a redundant system, make the Back-Up Controller Card active by disconnecting the LAN cable from the Primary Controller Card's LAN port. Check the **daemon.log** file on the Back-Up Controller Card for any errors in the Partition Table and correct them before implementing multiple levels of security classification domains on the same Matrix Switch using the Back-Up Controller Card.

4) Fully test the Back-Up Controller Card's **Partitioning Domains** 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 Controller will not evaluate the updated table until the procedures outlined below are followed.

When updates are made to the Partition Table in a **non-redundant system**, Thinklogical recommends the following (This procedure will be disruptive to system connections):

1) Update the Partition Table of the Primary Controller Card.

2) Take the Primary Controller Card out of service by following guidelines in the "Safely Remove an Active Controller Card" section of this document (pg. 19).

When updates are made to the Partition Table in a **redundant system**, Thinklogical recommends the following (This procedure will NOT be disruptive to system connections):

1) Update the Partition Table of the active Primary Controller Card. The table will not take affect at this time.

2) Update the Partition Table of the inactive Back-Up Controller Card with the same table used for the Primary Controller Card.

3) Take the Primary Controller Card out of service by typing 'halt' at the command line. This will make the Back-Up Controller Card active and evaluate its Partition Table. Thinklogical recommends verifying the changes to the Back-Up Controller Card.

4) Ensure that the LAN connection to the Primary Controller Card is connected. Extract the Primary Controller Card, wait 10 seconds, then re-insert the Primary Controller Card back into the chassis, allowing the system to make the Primary Controller Card the active controller and begin using the updated Partition Table.

Note: When using a Back-Up Controller configuration, both controllers must have the same Partition Table file(s) to maintain the security of the system.

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 Controller Card and therefore do not restrict any connection.

Administration Access

There are two methods by which the administrator can access the Switch Controller 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. 36 shows the TLX80 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

TLX80 Matrix Switch Secure Application