TLX160 10G MATRIX SWITCH
PRODUCT MANUAL

Full 4K @ 60Hz Video and KVM Hybrid Switching & Extension Solutions over the Fewest Cables
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About Thinklogical  A BELDEN BRAND

Thinklogical, a Belden brand, is the leading manufacturer and provider of fiber optic and CATx KVM, video, 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.

Governments, entertainment, scientific and industrial customers worldwide rely on Thinklogical’s products and solutions for secure, high performance, continuous operation and ease of integration. Thinklogical products are designed and manufactured in the USA and are certified to the ISO 9001:2008 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 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**: **Page 1**. Details the features and functions of your equipment.

**Section 2 – Set-Up and Installation**: **Page 14**. Contains all the requirements and procedures necessary to connect and install your equipment, including FPGA upgrades.

**Section 3 – Safety & Regulatory Requirements**: **Page 26**. Thinklogical® strongly recommends that you read this section prior to starting the hardware assembly.

**Section 4 – Thinklogical Support**: **Page 28**. 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 TLX160, 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. telescope or microscope).
Section 1: The TLX System Features

The Logical Solution

The TLX160 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 9 RU Chassis.

The TLX160 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, adding simplicity and control over sophisticated video and KVM visual computing environments.

The TLX160 is a square crosspoint switch matrix for 160 optical and/or CATx transports to/from Thinklogical Transmitters and Receivers. The TLX160 accepts up to 160 SFP+/CATx Transceivers (Tx & Rx) supporting 160 Thinklogical Transmitters and Receivers.

Features of the TLX160 Matrix Switch®

- Housed in a 9 RU Chassis
- Up to 160 fiber ports - In and Out (10Gbps / 6.25 Gbps with re-clocking input)
- Up to 160 CATx ports (10Gbps with re-clocking input)
- 10 ports scalability for hot swappable I/O Cards
- Redundant, current sharing, hot swappable power supply modules,
- Single-mode, multi-mode, coaxial, CATx capability
- Comprehensive system setup and control provided via Thinklogical’s System Management Portfolio software
- 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
- Failover/Power Off button (HALT button on Controller Cards)

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.
Introducing Thinklogical’s newest family of switching and extension solutions, for uncompressed, high resolution video and KVM systems over fewer cables.

Offering a higher bandwidth solution, the TLX product line provides 10Gbps bandwidth per port to preserve signal integrity and provide uncompressed, high resolution video with no artifacts, latency or lost frames.

The TLX product family offers these features to enhance ease of integration:

- **Hybrid switching solutions (fiber and CATx)** start at 12 ports and scale up to 640 ports.
- **A higher bandwidth solution** to address new video resolutions and prepare for future protocols.
- **Reduces system cabling by half** by enabling through higher bandwidth.
- **Extend and switch:**
  - Single display up to 4096x2160 @ 30Hz with full 4:4:4 color depth, over a single fiber or CATx cable. *(CATx not available with the TLX80.)*
  - (or dual displays up to 1920x1200 @ 60Hz with full 4:4:4 color depth)
  - Single display up to 4096x2160 @ 60Hz with full 4:4:4 color depth, over two fibers or CATx cables. *(CATx not available with the TLX80.)*
  - (or dual displays up to 4096x2160 @ 30Hz with full 4:4:4 color depth)
  - Dual displays up to 4096x2160 @ 60Hz with full 4:4:4 color depth, over four fibers or CATx cables. *(CATx not available with the TLX80.)*
- **Dual connectors on TLX Extenders**, offering support for both HDMI and DisplayPort, reduces the number of extenders and converter cables required and enables users to future-proof system designs.
- **Interoperability with Thinklogical’s Velocity family of switch and extension solutions**, to ensure an easy upgrade path and a smooth transition to Thinklogical’s next generation solution.

**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 of 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 640 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, on page 35.*

⚠️ **Note:** CATx Matrix Switching applications do not offer an EAL4 rated level of security. CATx is not available with the TLX80.

**RESILIENCY**

TLX switches are designed to maximize system uptime. The modular approach of the TLX allows user to **hot-swap all critical system components**, including power supplies (in dual supply models), fan trays, control cards, input/output cards and pluggable optics. Furthermore, the system can be easily reconfigured, such as adding additional input/output cards for expansion, without ever turning off the switch or interrupting active signals. **Redundant and current-sharing power supplies** ensure continuous, uninterrupted power to the switch. Matrix switches are also configurable to include **redundant control cards with automatic failover**. Enhanced diagnostics and alarms provide extensive real-time monitoring and diagnostics of critical functions of the switch.

**SYSTEM FUNCTIONALITY**

TLX Extension Systems have a simple transmit and receive design. The TLX Transmitter connects to the source to receive video, audio and peripheral data. Utilizing Thinklogical’s proprietary multiplexing technology, the data is transmitted over fiber through **10Gbps SFP+ technology** for up to 80 kilometers, or over **CATx cable for up to 100m**. At the TLX Receiver, Thinklogical de-multiplexes the data stream to deliver uncompressed, high resolution video, audio and peripheral data at the end-user’s workstation.

TLX extension systems are highly configurable to suit the requirements of any application. Extenders are configurable to support **up to 4K video (4096x2160) @ 60Hz, full duplex stereo audio, serial (RS-232), USB HID, USB 2.0 (480Mbps)** and **10/100/1000 Network**. The TLX design offers support for **HDMI 1.4, HDMI 2.0 and DisplayPort 1.2 connector types in a single extender**, with full support for HDCP content.

Additionally, TLX extension systems support embedded audio, with the ability to de-embed audio at the receiver. All extenders are equipped with an additional output for a local display, as well as an Ethernet port for configuration management and updates.

For high-availability applications, redundant fiber path configurations are also available.

The TLX extension systems are **compatible with the full line of scalable, non-blocking TLX matrix switches**, ranging from 12 to 640 ports.
Thinklogical’s proprietary multiplexing technology combines video, audio and peripheral data on a single data stream for up to 80km over a single fiber-optic cable or up to 100m over a single CATx cable.

- **Cable Color Codes:**
  - Video & Data Tx to Rx (fiber)
  - Data Rx to Tx (fiber)
  - Video Tx to Rx (fiber)
  - Bi-directional Video & Data (CATx)

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**Single Display video or KVM extension up to 4096x2160 @ 30Hz over one forward channel and one backchannel**

**Single Display video or KVM extension up to 4096x2160 @ 60Hz over two forward channels and one backchannel**

**Dual Display video or KVM extension up to 4096x2160 @ 30Hz over two forward channels and one backchannel**

**Dual Display video or KVM extension up to 4096x2160 @ 60Hz over four forward channels and one backchannel**

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**TLX Transmitters**

**TLX Receivers**
FORM FACTOR
TLX extension systems are available in a modular form factor. The modular extenders are compact and hot-swappable, so users can field-configure any modular chassis. For fiber extenders, the optical modules, or SFPs, are also hot-swappable. The modular system promotes system flexibility, scalability and reduced maintenance.

The TLX Modular Extender Chassis Line
Several chassis types are compatible with all TLX modular extenders, allowing users to mix-and-match chassis types to reduce the overall footprint of the design. Users can choose from the resilient, rack mount chassis (housing up to four video extenders or up to two KVM extenders in a single rack unit) with redundant and hot-swappable power supplies, or from our more compact, space-saving designs for desktop applications.

Each TLX Chassis accommodates the full line of TLX Extender Products.
- The CHS-000004 is a rack-space-saving, high-reliability rack mount unit for up to 4 modules of HDMI, DVI, RGB or SDI in a compact 1U chassis.
- The CHS-000002 is a desktop solution that accommodates one 7.4” or two 3.7” modules of HDMI, DVI, RGB or SDI in a compact, desktop chassis. Rack-mount attachments are available.

Ready for the challenges of demanding applications, both the CHS-4 and CHS-2 Chassis can combine a variety of HDMI, DVI, RGB or SDI modules in transmit/receive units for a space-saving and cost-effective solution.
- The CHS-000001 stand-alone chassis will accommodate one 3.7” TLX video module.

All TLX Extender Chassis are powered by standard 100-240 VAC, 50-60 Hz.

CHS-000004 Chassis: Supports any combination of up to four TLX video modules. Dual interface and current sharing power supplies. Desktop or 19” rack-mount.

CHS-000002 Chassis: Supports up to two TLX video modules. Desktop only. Rack-mounts available.

CHS-000001 Chassis: Supports one TLX video module. Desktop only.
THE TLX160 MATRIX SWITCH DESIGN

The rack-mountable design of the TLX160 10G Matrix Switch (sometimes referred to as a Switch or Router) supports up to 160 ports of full, uncompressed 4K video with full color depth at 60Hz frame rate in a 9 RU chassis for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber optic cable or CATx cable, thus minimizing critical rack space.

Thinklogical’s TLX160 10G Matrix Switch includes:
- Housed in a 9 RU Chassis
- Up to 160 fiber or CATX ports - In and Out (10Gbps / 6.25 Gbps with re-clocking input)
- 10 port, hot swappable I/O Cards
- Redundant, current sharing, hot swappable 1000 W DC Power Supply modules,
- Single-mode, Multi-mode, Coaxial, CATx capability
- Controllable via LAN or Serial connection
- Single, hot swappable Fan Tray with annunciator port (for alarms)
- Redundant Controller Card
- Failover/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
- Configurator / Hot-Key Manager / System Management Interface
- Standard VX Matrix Switch ASCII Interface (via RS-232 port or via Network port)
- Standard VX Matrix Switch IP Address Configuration Procedure
- Standard VX Matrix Switch SNMP Traps
THE CONTROLLER CARDS

Primary and Back-up:

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.

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

LED Definitions:

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

FAULT: Informs of a Controller Card fault.

OK2RMV: Informs the operator if the CPU (IMX6) is halted. (OK to ReMoVe)

Push Button Operation:

HALT (Primary Controller): In a TLX160 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 TLX160 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 OK2RMV (Okay to remove) 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 TLX160 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 OK2RMV (Okay to remove) LED will be illuminated and the ACT LED will not.

RESET (Recessed button, for test purposes only): Resets the CPU (IMX6).
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 per card cage, 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. 24)

THE INPUT / OUTPUT CARDS

TLX160 Matrix Switch supports a maximum of sixteen I/O Cards. Each TLX160 I/O card contains 10 ports.

The TLX160 Matrix Switch features two I/O Card designs, the **10G SFP+ I/O Card** and the **10G CATx I/O Card**.

The TLX160 Chassis supports any mix of SFP or CATx Cards. The 10G SFP I/O Cards and the 10G CATx I/O Cards are compatible with each other. (The TLX160 switching matrix supports connections to/from any 10G Optical Port from/to any CATx Port.)
The hot-swappable Input/Output (I/O) cards provide in-service expansion capabilities in sets of 10 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 individual I/O Card lists the ports as 1 through 10 on the TLX160. A blue LED located on each I/O card indicates when power is ON to that card.

The TLX160 configuration can have a minimum of one I/O Card (10 x 10) and a maximum of 16 I/O Cards. Each TLX160 I/O card contains 10 ports, so that when fully configured, the TLX160 will contain 16 I/O cards. The 16 I/O cards provide a total of 160 Optical Input/Output connections (SFP+ T/R) described as Ports 1-160. The TLX160 switching matrix connects any port optical output (SFP+ T) to any port optical input (SFP+ R).

The TLX160 10 Port SFP I/O card also supports the existing 6G/2G legacy Velocity extenders.

The hot-swappable Input/Output (I/O) cards provide in-service expansion capabilities in sets of 10 RJ45 ports per I/O card, thus allowing re-configuration without interrupting signal processing.

Each individual CATx I/O Card lists the RJ45 ports as 1 through 10 on the TLX160.

A blue LED located on each I/O card indicates when power is ON to that card.

Two LEDs located on each RJ45 connector indicate activity and link status.

THE FAN TRAY MODULE

The TLX160 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 removing any heat generated by the Power Supply modules.
The Fan Tray is also equipped with an annunciator port for system alarms which can be configured to trigger an external control system. The Alarm contacts are NC, *Normally Closed*).

**The TLX160 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**
- **COMMOM GROUND**

A red LED indicates an 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 10, bottom to top, printed to it’s left for easy reference. There are sixteen 10-Port I/O Cards for a total of 160 Transmit Ports and 160 Receive Ports per Chassis.

The port numbers for each I/O Card are shown on the Fan Tray, just above each individual card.
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 TLX160 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 TLX160 DIP Switch Settings, page 15). 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 TLX160 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_SwitchInterfaces

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 17320, 1 port per I/O card)

Refer to the document: Manual_TLX_Matrix_SwitchInterfaces
6. Service Request (LOS) Signaling (UDP port 17560)
The TLX160 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 Simple Network Management Protocol (supports version V2c and V3 USM). Please call our technical support staff at 1-203-647-8700 for downloadable MIB Management Information Base definition files.

There are certain entries in the SNMP configuration file (/etc/snmp/snmpd.conf) that users may wish to modify:
- syslocation Text to aid in locating the unit
- syscontact Name/ Phone/ Email address of a contact
- trap2sink IP address/ Name of a system to receive SNMP traps

The default name used by trap2sink is ‘snmp.trap’ and is defined in the file /etc/hosts as pointing to 127.0.0.1. The easiest method to change the trap address is to modify the /etc/hosts entry and not change the trap2sink setting in the configuration file. Users may have multiple trap2sink entries in the configuration file to specify multiple trap destinations.

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. In order 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 located in /etc/rsyslog.d/00-remote.conf

The default configuration has rsyslod 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 TLX160 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).

---

**TLX160 TECHNICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Chassis</th>
<th>Dimensions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLX160 Chassis</td>
<td>Rack Size: EIA 19.00&quot; (482.6 mm)</td>
</tr>
<tr>
<td></td>
<td>Height: 9 RU-15.75&quot; (400.0 mm)</td>
</tr>
<tr>
<td></td>
<td>Depth: 14.00&quot; (355.6 mm) including PS handles: 15.75&quot; (400.0 mm)</td>
</tr>
<tr>
<td></td>
<td>Width: 17.49&quot; (444.2 mm)</td>
</tr>
<tr>
<td></td>
<td>Tolerance: ± .039&quot; (.991 mm)</td>
</tr>
<tr>
<td></td>
<td>Weight (Matrix Switch - all fiber): 49.0 lbs. (22.23 kg)</td>
</tr>
<tr>
<td></td>
<td>Shipping Weight: 155 lbs. (70.31 kg)</td>
</tr>
<tr>
<td></td>
<td>Weight (each Fiber I/O Card): 1.45 lbs. (0.659 kg)</td>
</tr>
<tr>
<td></td>
<td>Weight (each CATx I/O Card): 2.40 lbs. (1.089 kg)</td>
</tr>
</tbody>
</table>

| Max. No. Ports | 160 fiber or 160 CATx |
| Operating Temp and Humidity | 0° to 50°C (32° to 122 °F), 5% to 95% RH, non-condensing |
| Power Requirements | AC Input: 100-240VAC, 50-60 Hz |
| | Universal AC Power Supply |
| Power Consumption | ~500 Watts, fully loaded (Fiber) |
| | ~1050 Watts, fully loaded (CATx) |
| Compliance | Approvals for US, Canada, and European Union |
| Warranty | 1 Year from date of shipment. Extended warranties available. |
Section 2: Set-Up & Installation

Contents

When you receive your Thinklogical® TLX160 KVM Matrix Switch, you should find the following items in the quantities specified in your order:

- TLX160 Chassis *(includes 2 Power Modules)*
- Controller Card(s) 1 or 2
- Input/Output Card(s) 1 to 16
- Power Cords – PWR-000056-R (International connections may differ) – Qty 2
- Product Manual CD
- Product Quick Start Guide

Unpacking the TLX160

The TLX160 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.

BEFORE STARTING ANY PROCEDURE, IT IS RECOMMENDED THAT YOU READ THE INSTRUCTIONS THOROUGHLY!
Step 1 Carefully remove the TLX160 from its shipping package and inspect it to make certain that it is in good condition.

Step 2 Ensure that all the SFP modules are sealed with a removable dust plug.

Step 3 Verify that the power supply modules are fully seated in the chassis and that the locking latch is secure.

Step 4 When the device has been inspected and found to be in suitable condition, the installation process can begin.

Connecting to the TLX160

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
- Configurator / Hot-Key Manager / System Management Interface
- 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

Ethernet Control

If the TLX160 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. The factory default setting is: 192.168.13.15 (00000000).

TLX160 DIP Switch Settings

The simplest network connection is an isolated network with only the TLX160, the control server, and any control clients, using static IP addresses. The TLX160 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 TLX160 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):

- **System Management Interface** package requires Debian 32 or 64 bit.
- **Configurator** and Hot Key Manager run on Linux (RedHat 32 & 64 bit, Debian 32 & 64 bit or Windows XP, 7, and 8).
- **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.

**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 TLX160 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 TLX160 switching matrix connects any SFP’s optical output port (Transmit) to any other SFP’s optical input port (Receive).

**Requirements:** Thinklogical recommends SX+ Laser Enhanced (50µm) fiber with LC-type connectors for your TLX160 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.

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

**CATx Cables**

There are currently several versions of CATx (category 5/5e/6/6a/etc.) cables with RJ-45 connectors on the market. **Thinklogical recommends CAT6a 23 AWG Solid, Shielded and foiled (S/FTP- Shielded/ Foiled Twisted Pair) Cabling for TLX applications, which can operate 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.

Note: On Dual Video models, Ports 1 & 2 are Video 1 and Ports 3 & 4 are Video 2.
Routing Thinklogical Extenders through the TLX160

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 TLX160 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 TLX160 Transmitter ports using fiber-optic cables (Multi-mode fiber for distances up to 400m; Single-mode fiber for distances beyond 400m).
Connecting to a Control CPU

The TLX160 is controlled via a dedicated external Control CPU. This allows for customization as well as ease of control and administration. Access is provided via a network connection or serial RS-232 port.

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

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

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

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

Thinklogical offers a web-based control program called 'Configurator'. This program is described in greater detail in the document: `Manual_System_Management_Portal`, available on the Thinklogical web site.
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

Firmware

On Screen Display (OSD) - Firmware Option
The optional Configurator can be accessed and controlled via an OSD (On-Screen Display) technology. The Configurator software can be installed on a designated out-of-band (OOB) PC which users can access from a workstation. A preconfigured hot-key sequence will deliver the Configurator GUI straight to the user's desktop monitor. The user can then select the defined sources and destinations that they wish to connect. While a user is making the connections, they have exclusive use of the OOB PC. Once they have completed their connections, the OOB PC becomes available for the next user. The OOB PC that has the Configurator loaded on it has a built in timeout function, therefore the PC should not be taken out of service for an extended period of time. The timeouts can be set in increments of one second. Typical timeouts are in the order of 10 seconds.

Upgrades
See APPENDIX C: FPGA Program Code Update Procedure, page 33 and APPENDIX D: FPGA Download Installation Procedure on page 34.

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

Order of Installation Events
Please refer to the Quick Start Guide included with your products for detailed instructions. The TLX160 Quick Start Guides are also available in Appendix A (Fiber) on page 31 & Appendix B (CATx) on page 32.

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.
How to Remove and Replace Modules

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

How to Remove and Replace an Input / Output Card

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

Step 1 Turn the card’s two thumbscrews counterclockwise until they disengage from the chassis. Pull the card straight out using both handles.

Warning! Do not pull on the thumbscrews when removing the module – damage may occur! Use the handles!

Step 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.

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

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

How to Remove and Replace a Fan Tray

The TLX160 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 and below the card cage on the rear panel. 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 TLX160 KVM Matrix Switch.

Note: No shutdown is required prior to replacing the Fan Tray.

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

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

Step 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.

Warning! 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.

Step 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 is universal input 120-240VAC, 50-60Hz. Use the proper power cords for your region. (Two PWR-000056-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 120-240VAC 50-60Hz. Use the proper power cords for your region (PWR-000056-R, supplied with the unit). Although the TLX160 functions properly with one Power Module, it is recommended that the Primary and Back-up be connected to two independent power sources for redundancy.

Step 1 Lift the green latch tab.
Step 2 While holding the tab up, pull the Power Module straight out of the chassis by the handle.
Step 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.

Warning! 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 commands allow the safe removal of a Control Card and the switch of activity from one Control Card to the other without interruption of connections

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 HALT Command

- Each Controller Card has a HALT button for controlled shut-down. (See page 7 for specific operation of one or both HALT buttons.) Also, typing halt at the command line will perform an orderly shut-down of the active Control Card.
- Once the Control Card is inactive, it will stop signaling the other Control Card. This prompts the other card to become active. This will take only a few seconds.
- Remove any cables (LAN, RS-232, Console, etc.) from the inactive card. It can now be safely removed from the chassis.
- At this point, the system is now running on the Back-up Control Card.
Note: Re-inserting the Primary Control Card restores the system back to running on the Primary Control Card. Insure that the LAN connection to the card is restored promptly.

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, but not all the voltages to the Controller Cards.

Note: HALT does not turn off the 3.3V slot power to the Controller Cards.

- The Controller Cards’ 3.3V stand-by voltage remains on, even after issuing a HALT.
- For a complete system shut-down, remove the AC power cord(s) from the Matrix Switch or from the AC source.

Ordering Information

Part numbers or the various components of the TLX160 Matrix Switch are as follows:

**TLX160 Matrix Switch**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLX-000160</td>
<td>TLX160 Matrix Switch Chassis, 2 Power Supplies, 1 Controller, up to 16 I/O Cards</td>
</tr>
</tbody>
</table>

**TLX160 Matrix Switch Data Input/Output Modules**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLX-MSM-M00010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, 10 Multi-Mode Fiber Ports, 10G</td>
</tr>
<tr>
<td>TLX-MSM-S00010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, 10 Single-Mode Fiber Ports, 10G</td>
</tr>
<tr>
<td>TLX-MSM-MV0010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, 10 Multi-Mode Fiber Ports, 6G</td>
</tr>
<tr>
<td>TLX-MSM-SV0010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, 10 Single-Mode Fiber Ports, 6G</td>
</tr>
<tr>
<td>TLX-MSM-000010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, <strong>unpopulated</strong> (for up to 10 Multi- or Single-Mode SFP+)</td>
</tr>
<tr>
<td>TLX-MSM-C00010</td>
<td>TLX160 Matrix Switch Data Input/Output Card, 10 CATx Ports</td>
</tr>
</tbody>
</table>

**TLX160 Matrix Switch Spare Modules**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLX-MSM-C00160</td>
<td>TLX160 Matrix Switch Moduel, Controller Card</td>
</tr>
<tr>
<td>TLX-MSM-F00160</td>
<td>TLX160 Matrix Switch Moduel, Fan Tray</td>
</tr>
<tr>
<td>TLX-MSM-P00160</td>
<td>TLX160 Matrix Switch Moduel, Power Supply</td>
</tr>
</tbody>
</table>
Symbols found on the product
Markings and labels on the product follow industry-standard conventions. Regulatory markings found on the products comply with 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 to be compliant with the following standards (both domestic USA and many international locations):

**North America**

**Safety**
- ANSI/UL 60950-1:2007/03/27 Ed:2 Rev:2011/12/19
- CSA C22.2#60950-1: 2007/03/27 Ed: 2 (R2012)

**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: 2016 Class A
- Industry Canada ICES-003: 2016

**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 adequate measures.

**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**

**Electromagnetic Emissions**
- CENELEC EN 55022:2010 +AC:2011

**Electromagnetic Immunity**
- CENELEC EN 55032:2015
- EN61000-3-2/: 2000 Harmonics
- EN61000-3-3: 2008 Flicker
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.

**Warning!** 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 measures.

**Note:** This equipment has been tested and found to comply 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 take adequate corrective measures at their own expense.

**Note:** This Class A digital apparatus complies with Canadian ICES-003 and has been verified as being 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.

**Note:** 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: **05-170129** indicates the unit was built in the **5**th month of **2017**, and is unit number **129**.

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: Thinklogical Support

How to Contact Us

Customer Support

Thinklogical® is an engineering company and we will always do our best to ensure that you receive any assistance you need directly from our most knowledgeable engineers.

We believe that the first line of support comes from the design engineers that developed each particular product.

Therefore, your questions or issues will be handled promptly by our in-house engineers who are most familiar with your products. We won’t be satisfied until you are satisfied.

Thank you for choosing Thinklogical® products for your application.

We appreciate your business and are dedicated to helping you successfully use our products.

Thinklogical® is always here to help you.

To contact us, please use the following telephone numbers and internet-based methods:

Website

Check out our website for current product offerings, support information and general information about all of the products we offer.

Our internet website offers product information on all current systems, including technical specification sheets and installation guides (for viewing online or for download), product diagrams showing physical connections and other information you might need.

Internet: www.thinklogical.com

Note: Most online documents are stored as Adobe Acrobat “PDF” files. If you do not have the Adobe Acrobat reader needed to view PDF files, visit www.adobe.com for a download.

Email

Thinklogical® is staffed Monday through Friday from 8:30am to 5:00pm, Eastern Time Zone. We will do our best to respond to your email inquiries promptly. Please use the following email addresses:

info@thinklogical.com – Information on Thinklogical® and our products.

sales@thinklogical.com – Sales Department - orders, questions or issues.

support@thinklogical.com – Product support, technical issues or questions, product repairs and request for Return Authorization.
Telephone

Thinklogical Operator  
Product & Customer Support:  
US Commercial & Canada Sales:  
US Federal Government Sales:  
Toll Free in the Continental US:  
International Sales (Europe, Middle East, Africa):  
International Sales (Asia Pacific, Central & Latin America):

1-203-647-8700  
1-203-647-8798  
1-203-647-8715  
1-203-647-8716  
1-800-291-3211  
1-203-647-8704  
1-203-647-8734

Please contact our expert sales staff in Milford, CT. We are here Monday through Friday from 8:30am to 5:00pm, Eastern Time Zone. We’ll provide a representative’s direct dial phone number when you call.

If leaving a voice message, please provide a preferred time to call back so we may reach you at your convenience.

Our switchboard attendant will direct your call during regular business hours. We have an automated attendant answering our main telephone switchboard after regular business hours and holidays. Please leave voice messages for individuals at any time.

Fax

Our company facsimile number is 1-203-783-9949. Please indicate the nature of the fax on your cover sheet and provide return contact information.

Product Support

Thinklogical’s® support personnel are available Monday through Friday from 8:30am to 5:00pm, Eastern Time Zone. If your application requires assistance at some time outside of our normal business hours, please contact us beforehand and we will do our best to make arrangements to help you with your Thinklogical® products.

Warranty

Thinklogical® warrants this product against defects in materials and workmanship for a period of one year from the date of delivery. Thinklogical® and its suppliers disclaim any and all other warranties.

Note: Thinklogical® products carry a one year warranty, with longer term available at time of purchase on most products. Please refer to your product invoice for your products 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 1-800-291-3211 (USA).
Return Authorization

If you need to return your Thinklogical® product to us for any reason, please get a Return Merchandise Authorization Number (RMA#) from Thinklogical’s Product Support Department (1-203-647-8700) before sending the unit in.

In the event you must return a product to Thinklogical® directly, please contact Customer Support at 1-800-291-3211 or 1-203-647-8700. Customer Support will ask you to describe the problem and will issue you a Return Merchandise Authorization number (RMA#). Pack the device in its original box, if possible, and return it with the RMA# printed on the outside of the box.

⚠️ Note: DO NOT return a product to Thinklogical® without a Return Merchandise Authorization.

Our Addresses

If you have any product issues or questions or need technical assistance with your Thinklogical® system, please call us at 1-800-291-3211 (USA only) or 1-203-647-8700 and let us help. If you need to write us or return a product, please use the following address: Return address for products with Return Merchandise Authorization: Thinklogical, A BELDEN BRAND
Attn: RMA#
100 Washington Street
Milford, CT 06460 USA

Website: www.thinklogical.com
Facebook: www.facebook.com/ThinklogicalUSA
LinkedIn: www.linkedin.com/company/thinklogical
Google+: http://plus.google.com/u/0/109273605590791763795/about
YouTube: www.youtube.com/user/thinklogicalNA
Twitter: @thinklogical
Appendix A: TLX160 FIBER QUICK START GUIDE

QUICK-START GUIDE TLX160 10G Fiber-Optic MATRIX SWITCH

As used with Thinklogical’s TLX KVM Extension System

with TLX-HD10 or TLX-E10 Transmitter & Receiver Modules
**Appendix B: TLX160 CATx QUICK START GUIDE**

**MATRX SWITCH with TLX20 Transmitters & Receivers**

**STEP 1:** Connect the TLX CATx Receivers to the TLX160 using CATx6a 23 AWG Solid, Shielded and foiled (S/FTP- Shielded/ Foiled Twisted Pair) cables. On the Matrix Switch, connect CATx Cable 1 to any I/O Card Port and CATx Cable 2 to any other I/O Card Port. (It is advisable to use adjacent ports.)

**STEP 2:** Install the 5VDC Power Adapter PWR-000084 into the Receiver’s Power Port. Plug it into a standard AC source.

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

**RECEIVER SIDE:**

**STEP 4:** Connect the TLX CATx Transmitter to the TLX160 using CATx6a 23 AWG Solid, Shielded and foiled (S/FTP- Shielded/ Foiled Twisted Pair) cables. On the Matrix Switch, connect CATx Cable 1 to any I/O Card Port and CATx Cable 2 to any other I/O Card Port. (It is advisable to use adjacent ports.)

**STEP 5:** Install the 5VDC Power Adapter PWR-000084 into the Transmitter’s Power Port. Plug it into a standard AC source.

**STEP 6:** Connect the Video Cable CBL000104-002MR (DisplayPort 1.2) for video up to 4K (60Hz) from the Source CPU to the Video IN port of the TLX CATx Transmitter. Connect the peripheral device sources to the Transmitter with standard copper cables. Ensure the Source CPU is turned ON.

---

**Source CPU**

**Destination CPU**

---

**Thinklogical’s TLX160 10G Matrix Switch**

features redundant Power Supplies and Controller Modules for uninterrupted performance, even during system reconfiguration, updates or delays. The TLX160 remains fully functional with only one Power Supply installed or with one Controller activated.

**NOTE:** When using a single Controller, the Left module (Primary) must be used.

**TLX160 CATx 10G MATRIX SWITCH**

**STEP 7:** Connect the TLX160 Controller Cards’ LAN Ports to your Controller CPU with standard CATx5 cables. (CPU IP address: 192.168.1.19)

**STEP 8:** (Final step) Connect the two supplied AC Power Cords (PWR-000056-R) to the receptacles located on the TLX160’s power supplies. Plug both into standard AC sources. Verify that all system functions are operating properly.
The following procedure documents the steps necessary to update the FPGA program code on a TLX160 10G KVM Matrix Switch using a Windows-based computer.

**Appendix C: FPGA Program Code Upgrade Procedure**

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 .ibf. 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 TLX160’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.**

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.**

Browse to and select the file: `tls160ctrl_fpga.ibf` (This is the file saved in Step 2.) and press OPEN to begin.
Appendix D: FPGA Download Installation Procedure

FPGA Update Preparation:
- The FPGA_Download.exe application is stored in:
- 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 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 E: Secure Applications

Note: CATx Matrix Switching applications do not offer an EAL4 rated level of security. CATx is not available with the TLX80.

TLX Matrix Switch Control

When used in a secure application, the fiber-optic Matrix Switch and External Computer (server) used to manage the system must be located 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:

<table>
<thead>
<tr>
<th>I/O</th>
<th>Number</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;i&quot;,</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;i&quot;,</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>&quot;i&quot;,</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>&quot;i&quot;,</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>&quot;i&quot;,</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>&quot;o&quot;,</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;o&quot;,</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&quot;o&quot;,</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>&quot;o&quot;,</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>&quot;o&quot;,</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

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 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 for the TLX160 Switch are stored in the on-board Controller at: 

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

At system power up, after initial boot-up, the Primary Control Card will only evaluate its Restricted Switching Table (upstream.csv file) once upon becoming active. The Secondary Control Card will NOT evaluate its Restricted Switching Table (upstream.csv file) at initial boot-up but rather when a switchover occurs from Primary to Secondary Active. If an upstream.csv file is found, a log entry to the daemon.log file will be made indicating “Restricted Switching ENABLED”. If no file is found, then a log entry of “Restricted Switching DISABLED” is made.

**Note:** The inactive Secondary Control Card will not verify its Restricted Switching Table (csv file) and, as a result, 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 control card: /var/log/daemon.log.

**Note:** For access to the daemon.log file via SSH, refer to “THE NETWORK INTERFACES” section of this manual (page 8) for correct IP addresses of control cards when in Primary Active or Secondary Active mode.
To verify the **system restrict policy**, Thinklogical recommends the following:

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

3) In a redundant system, make the Secondary Control Card active by disconnecting the LAN cable from the Primary Control Card’s LAN port. The Secondary Control Card, upon becoming active, will evaluate its Restricted Switching Table. Check the `daemon.log` file on the Secondary Control 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 Secondary Control Card.

4) Fully test the Secondary Control 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 Control Card.

2) Take the Primary Control Card out of service by following guidelines in the “Safely Remove an Active Control Card” section of this document (page 24).

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 inactive Secondary Control Card.

2) Take the Primary Control Card out of service by following guidelines in the “Safely Remove an Active Control Card” section of this document (page 24). This will cause the Secondary Control Card to become active and evaluate its Restricted Switching Table.

3) Update the Restricted Switching Table of the inactive Primary Control Card with the same table used for the Secondary Control Card.

4) Extract and re-insert the Primary Control Card back into the chassis to cause the system to make the Primary Control Card the active controller and begin using the updated Restricted Switching Table. Insure that the LAN connection to the Primary Control Card is restored promptly.

**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 Control 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
RED, BLACK, GREEN, BLUE, RED
BLUE, BLACK, GREEN, BLUE
GREEN, BLACK, GREEN
BLACK, BLACK

KEYBOARD/MOUSE:
Destination Workstation Network
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.

<table>
<thead>
<tr>
<th>I/O</th>
<th>Number</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;i&quot;</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>&quot;i&quot;</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>&quot;o&quot;</td>
<td>9</td>
<td>1</td>
</tr>
</tbody>
</table>
Partitioning

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

The user must provide a table defining the partitions. This table is in the form of a comma separated value (CSV) file located in /var/local/router/partition. This file contains the port number and the partitions to which it belongs.

**Example: VX80 Switch with four distinct partitions:**

![Diagram of VX80 Switch with four partitions](image)

*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, 24, 80, 160, 320, 640). A VX80 Switch can be configured with up to 80 partitions, a VX160 up to 160, and so forth. There are also overlapping partition configurations.

**EXAMPLE: A VX80 with four partitions**

The following example shows a VX80 Switch with an overlapping partition (Ports 5-10 are accessible to both partitions 2 and 3):

![Diagram of VX80 Switch with overlapping partition](image)

The Partition Table files for the TLX160 are stored in the on-board Controller at: var/local/router/partition/upstream.csv

At system power up, upon becoming active after the initial boot-up, the Primary Control Card will only evaluate its Partition Table (upstream.csv file) once. The Secondary Control Card will NOT evaluate its Partition Table (upstream.csv file) at initial boot-up, but rather when a switchover occurs from Primary to
Secondary Active. If an **upstream.csv** file is found, a log entry to the **daemon.log** file is made indicating “Partition ENABLED”. If no file is found, then a log entry of “Partition DISABLED” is made.

**Note:** The inactive Secondary Control Card will not verify its Partition Table (csv file), and as a result, 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 control card: `/var/log/daemon.log`

**Note:** For access to the **daemon.log** file via SSH, refer to “THE NETWORK INTERFACES” section of this manual (page 8) for correct IP addresses of control cards when in Primary Active or Secondary Active mode.

To verify the **system partition policy**, Thinklogical recommends the following:

1. Review the **daemon.log** file on the active control 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 Control Card before implementing multiple levels of security classification domains on the same Matrix Switch.
3. In a redundant system, make the Secondary Control Card active by disconnecting the LAN cable from the Primary Control Card’s LAN port. Check the **daemon.log** file on the Secondary Control 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 Secondary Control Card.
4. Fully test the Secondary Control 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 Control Card.
2. Take the Primary Control Card out of service by following guidelines in the “Safely Remove an Active Control Card” section of this document (page 24).

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 inactive Secondary Control Card.
2. Take the Primary Control Card out of service by following guidelines in the “Safely Remove an Active Control Card” section of this document (page 24). This will cause the Secondary Control Card to become active and evaluate its Partition Table.
3. Update the Partition Table of the inactive Primary Control Card with the same table used for the Secondary Control Card.
4. Extract and re-inserted the Primary Control Card back into the chassis to cause the system to make the Primary Control Card the active controller and begin using the updated Partition Table. Insure that the LAN connection to the Primary Control Card is restored promptly.

**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.

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 Control Card and therefore do not restrict any connection.
Administration Access
There are only two methods by which the administrator can access the Switch Controller Configurations:

1. **Using 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. **Using 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 NUM8ERS within the password to enhance its strength.

INCLUDE NON-ALPHANUMERIC CH@RACTER$. Special characters (& $ % >) and punctuation marks (? " !) increase the strength of a password.
Secure Application Examples

The Diagram on pg. 40 shows the TLX160 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:

<table>
<thead>
<tr>
<th>Direction</th>
<th>Number</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>O</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>I</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>O</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>O</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>I</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>45</td>
<td>1</td>
</tr>
</tbody>
</table>

The following connection rules apply: SOURCE 2 can be connected only to DESTINATION 2 and SOURCE 1 can be connected to both DESTINATION 1 and DESTINATION 2.

![Warning Icon]

**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.

![Warning Icon]

**Note:** The optical connections and DESTINATION receiver designated as Red Network must be physically secure.

![Warning Icon]

**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.

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
TLX160 Matrix Switch Secure Application

SOURCE 1: BLACK NETWORK

SOURCE 2: RED NETWORK

DESTINATION 1: BLACK NETWORK

DESTINATION 2: RED NETWORK