

# router **VX640**

## KVM Matrix Switch **Product Manual**



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**Subject:** VX640 KVM Matrix Switch Product Manual  
**Revision:** F, November 2013



**thinklogical®**



**VX640 Router**

**Information Assurance**

NATO Information Assurance Product Catalogue



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**Thinklogical Innovation Leads the Way.**  
**Performance • Security • Continuous Operation • Ease of Integration**

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## PREFACE

### About this Product Manual

This product manual is divided into four sections, for Hardware, Software, Safety Requirements and Product Support. These are sub-divided to help you easily find the topics and procedures you are looking for. This manual also contains Appendices.

**Part 1 – Hardware:** This section contains all the information and instructions on how to assemble your equipment.

**Part 2 – Set-Up and Installation:** This section contains all the requirements and procedures necessary to connect and install your equipment, including FPGA upgrades.

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

**Part 4 – Thinklogical® Support:** Thinklogical® provides the best customer support available. If you have any questions or need to contact the company, please refer to this section of the manual.

### Conventions Used in this Manual

Throughout this manual you will notice certain conventions 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 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!**

## Introduction

### The Logical Solution

The VX640 is a high performance modular router and non-blocking matrix switch for complete, end-to-end routing of video and peripheral signals over multi-mode or single-mode fiber optic cable.

This highly reliable and resilient router is expandable from 20x20 up to 640x640, which allows for flexible deployment configurations. In addition, the VX640 series 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.

#### Thinklogical's VX640 Router® includes:

- (2) Redundant, Current Sharing Power Supply Modules for the Upper Cage
- (2) Redundant, Current Sharing Power Supply Modules for the Lower Cage
- (1) Fan Tray Module (includes three fans)
- (1) Primary Controller Card
- (8) Switch Cards
- (1) Interconnect Card

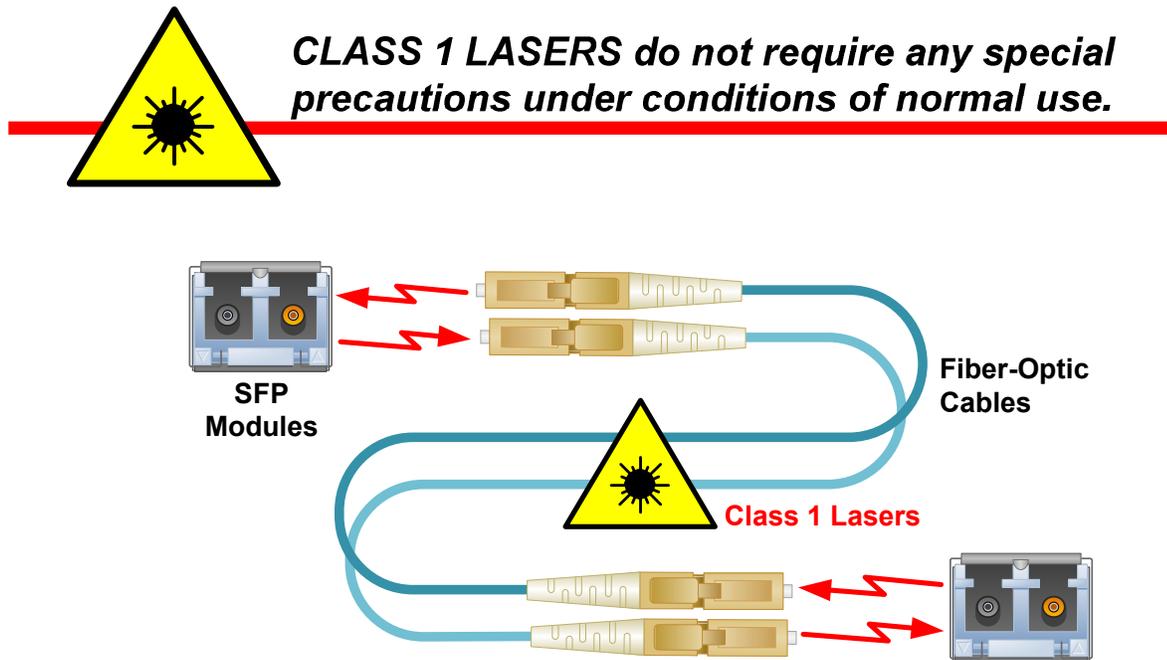
#### Optional Modules (Spares):

VX640 Router Data Input/Output Card, 20 Ports, SFP+  
 VX640 Router Fail-Over Controller Card  
 VX640 Router Switch Card  
 VX640 Router Fan Tray  
 VX640 Router Power Module

The VX640 Router is available with LC-type fiber connectors.

### Laser Information

The VX640, like all Thinklogical® products, is designed and identified as a **Class 1 LASER product**.



# Theory of Operation

## MRTS Technology

Thinklogical's® VX640 KVM Matrix Switch, used together with our Velocity Extenders, incorporates our breakthrough patent-pending technology for transmission and reception of DVI, HID, and high-speed data peripherals across long or short distances.

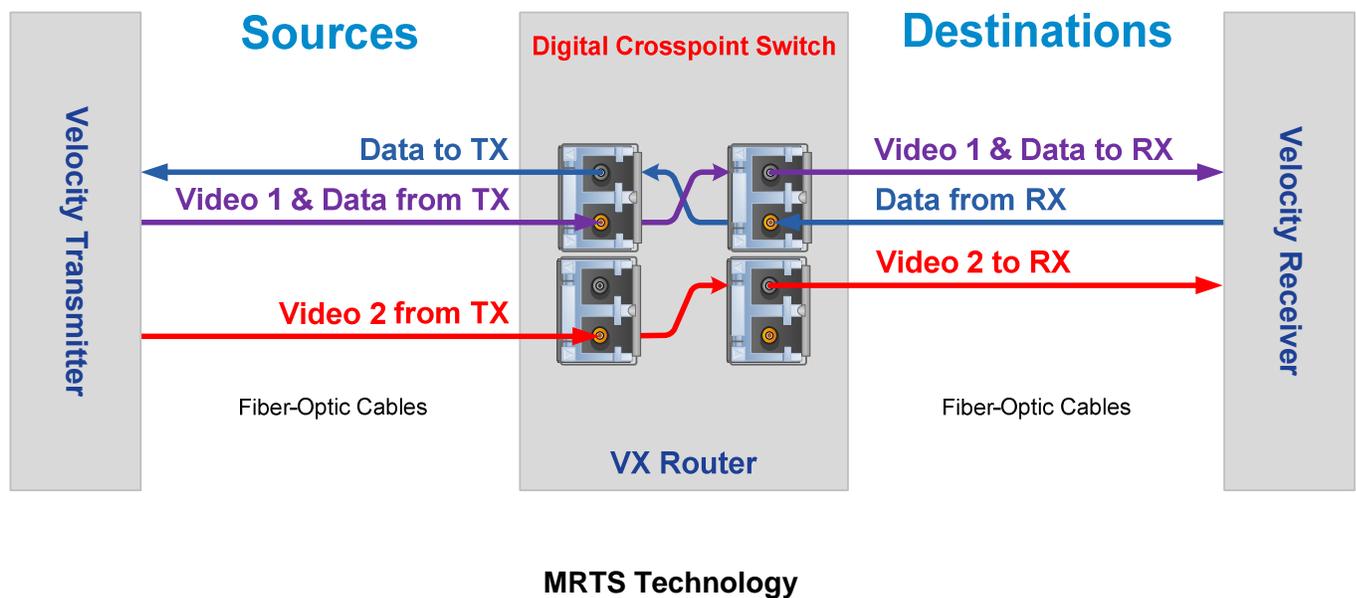
This technology, known as **Multi Rate Transmission System (MRTS)**, provides end-to-end data transmission with unparalleled performance. This unique optic platform enables multiple data streams to be transmitted long distances over single or multiple fibers with complete reconstruction of the data clock at the destination end point. *The result is perfect synchronization with each transmitted stream.*

*All new products are designated with our "Powered by MRTS Technology" logo.*

Powered by  
**MRTS Technology**

MRTS is a highly reliable technology and delivers powerful benefits to our customers when combined with our new SFP+ optics. The new MRTS Technology has the ability to transport every frame of a 1920 x 1200 @ 60Hz (or higher) video stream with no compression, along with all desktop peripherals (keyboard, mouse, etc., including 480Mbps USB 2.0) with no perceptible latency. Moreover, these signals can be transmitted distances from just a few meters up to 40 kilometers over single-mode or multi-mode fibers.

MRTS allows for traditional AV implementations and video routing to be incorporated into the same switch fabric, providing greater value, flexibility, performance and security. Additional unique capabilities include the ability to support 6.25Gbps bandwidth per stream, between 50% and 100% higher than our nearest competitors (typically 1.485Gbps to 3.2Gbps). This is significant because a single DVI stream requires a 5.4Gbps data rate to accommodate the 165MHz of video data. Our competitor's lower bandwidth capability is generally manifested in either dropped frames or lower resolution associated with compressing schemes. Not so with MRTS Technology.



## System Features

### General System Features

Each **VX640** includes the following features:

- 640 Duplex In and Out Fiber Ports for 640 x 640 Non-Blocking Matrix Switching
- Fiber Optic Non-Blocking Matrix Router
- Each Video Connection Supports 6.22 Gbps
- Single-Mode and Multi-Mode Fiber Optic Capability
- Coaxial SFP Modules for SDI/HD and SDI/3G Video
- Redundant, Hot-Swappable and Current Sharing Power Supply Modules
- Hot Swappable, 20 Port Scalability for In and Out Cards
- Hot Swappable SFP+ Optical Port Connections
- Hot Swappable Fan Tray with Annunciator Port (for Alarms)
- Hot Swappable Fail-Over Controller Card (optional)
- SNMP (2c) Control Protocol
- Control/Administration X4 Configurator GUI Included
- Multi-casting and Macros Supported
- Protocol Agnostic
- Compatible with all Thinklogical's® Video and KVM Extension Systems
- Compatible with all Thinklogical's® SDI Xtreme 3G+ Extension Systems



**VX640 Router KVM Matrix Switch**

## Technical Specifications

<b>Chassis</b>	<p><b>Dimensions:</b>            Rack Size/Width: EIA 19" (482.6 mm)            Height: 28 RU- 49" (1244.6 mm)            Depth: 16.07" (408.2)            Depth with cable management: 20.36" (517.3 mm)            (Tolerance: ± .039"; .1000 mm)</p> <p>Weight: 132 lbs (59.87 kg)            Shipping Weight: 160 lbs (72.57 kg)</p> <p>Power Consumption: 1700 watts fully loaded</p>
<b>Ports</b>	20 x 20 minimum / 640 x 640 maximum
<b>Alarm Relay Contacts</b>	<p>Maximum DC: 1A at 30VDC            Maximum AC: 0.3A at 125VAC            Contact resistance maximum: 100 mΩ</p>
<b>Operating Temp and Humidity</b>	0° to 50°C (32° to 122 °F), 5% to 95% RH, non-condensing
<b>Power Requirements</b>	<p>AC Input: 100-240VAC, 47-63 Hz            Universal AC Power Supply</p>
<b>Compliance</b>	Approvals for US, Canada, and European Union
<b>Warranty</b>	1 year from date of shipment. Extended warranties available.

## PART 1: HARDWARE

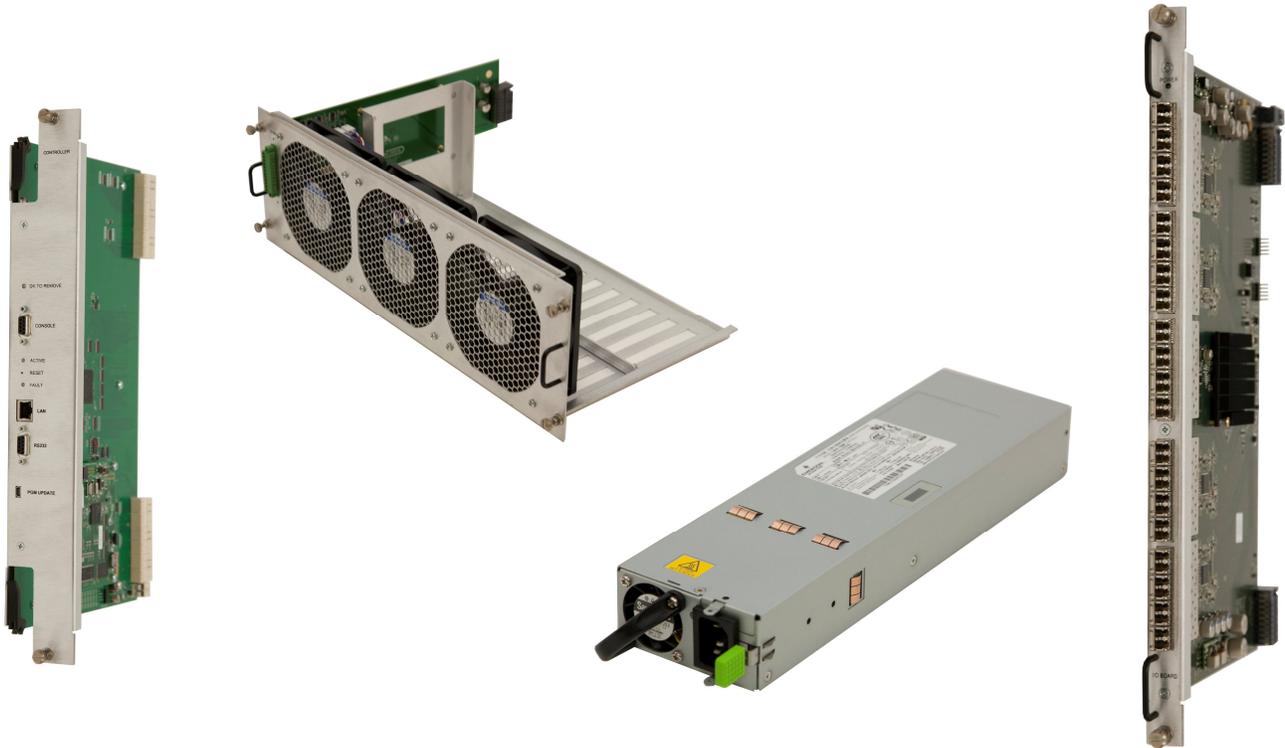
### Contents

When you receive your Thinklogical® VX640 KVM Matrix Switch, you should find the following items:

- VX640 Chassis (includes 4 Power Modules, Fan Tray, Up to 8 Switch Cards, Upper and Lower Interconnect Cards and one or two Controller Cards)
- Power Cord – Qty 4 – PWR-000056-R (International connections may differ)
- CAT5 Cable Assembly, 15 Feet – CBL000001-015FR
- Product Manual CD
- Product Quick Start Guide
- Chassis **Options (Spares):**
  - Fail-Over Controller Card – VXM-000025
  - Spare Switch Card – VXM-000026
  - Spare Fan Tray – VXM-000027
  - Spare Power Module – VXM-000028
  - Data Input/Output Card, 20 Ports – VXM-DI0R20

If you ordered an EAL4 certified unit, please verify that you have received the proper materials. The router should be labeled as (VXR-000640 Rev B). This information is located on a sticker just inside the front door of your router along with the serial number information. Please also check that you have the correct version of the Velocity Matrix Router 640 Data Input/Output Cards (MXM-DI0R20 Rev A). This information is located on a sticker on the card with serial number information

The VX640 KVM Matrix Switch ships configured to customer specifications. All physical connections to the product use industry-standard connectors.



**VX640 Modules**

*Left to right: Controller Card, Fan Tray, AC Power Module, Data Input/Output Card*

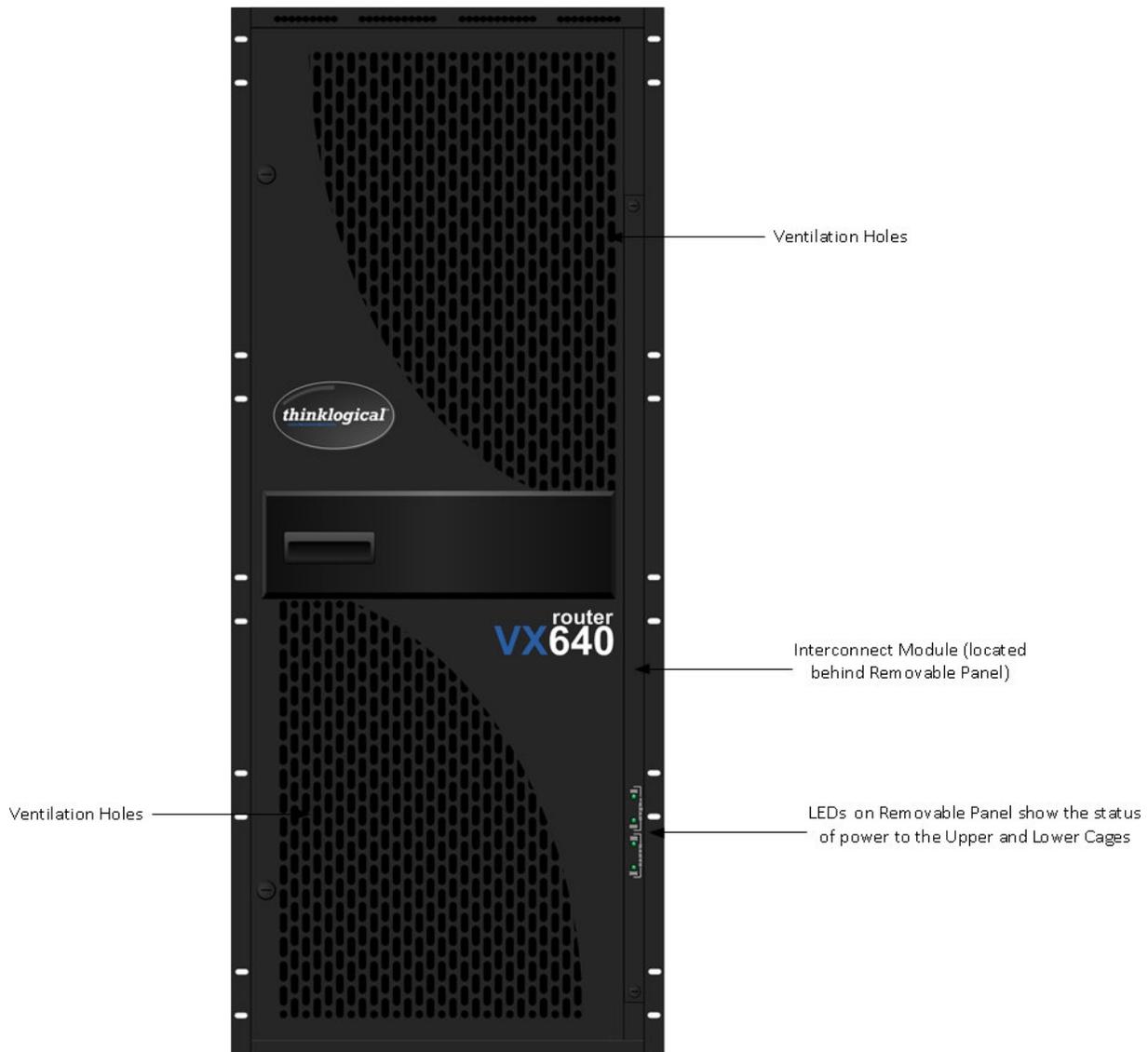
## Ordering Information

<b>Thinklogical's VX640 Router</b>	
<b>Part Number</b>	<b>Description</b>
	<b>VX640 Chassis</b>
<b>VXR-000640</b>	Velocity Matrix Router 640 Chassis (includes Upper and Lower Cage Backplanes, Upper and Lower Interconnect Boards, 8 Switch Cards, 1 Fan Tray, 1 Controller Card, and 4 Power Modules)
	<b>VX640 Data Card</b>
<b>VXM-DIOR20</b>	Velocity Matrix Router 640 Data Input/Output Card, 20 Ports, SFP+, Multi-Mode
	<b>VX640 Spares</b>
<b>VXM-000025</b>	Velocity Matrix Router 640 Controller Card
<b>VXM-000026</b>	Velocity Matrix Router 640 Switch Card
<b>VXM-000027</b>	Velocity Matrix Router 640 Fan Tray Module
<b>VXM-000028</b>	Velocity Matrix Router 640 Power Module

## VX640 Modules

### Hot-Swappable Modules

The inspired, modular approach of the VX640 means all critical system components, including switch cards, power supplies, cooling fans and pluggable optics (SFP+), are hot-swappable, thus minimizing system down-time. (The Interconnect Card is modular, but not hot-swappable. It can be easily replaced in the field, but the VX640 will need to be shut down.)



Detailed Front View of VX640



**Warning!** KEEP THE DOOR CLOSED WHEN IN USE! The VX640 Front Door contains air-flow baffles that are integral to the router's cooling system. Do not leave the front door open or off the chassis for more than a few minutes if the unit is running. Keeping the front door open for an extended period may lead to a malfunction or damage to the VX640.

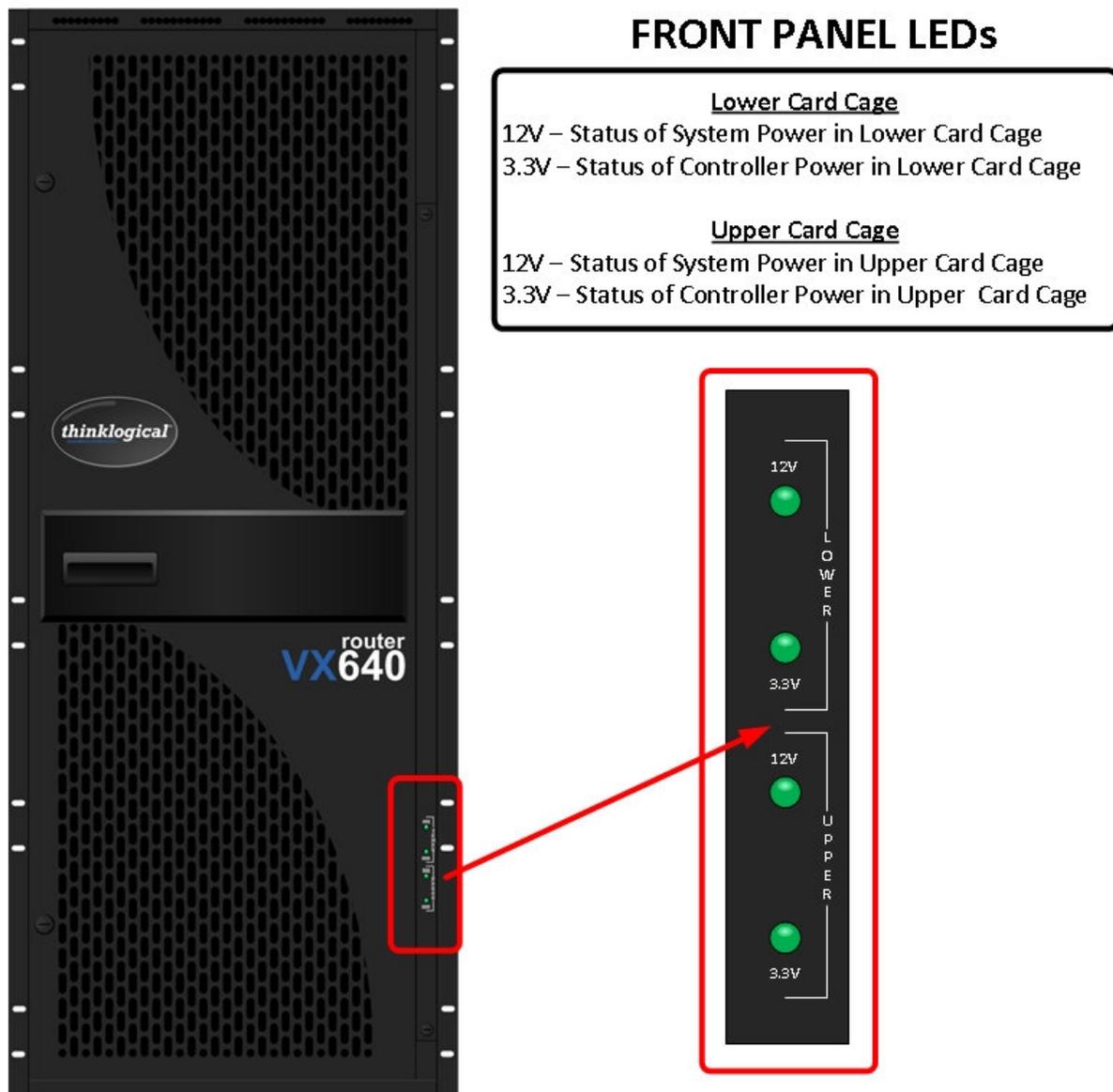
## Interconnect Module

The Interconnect Module connects the Upper Card Cage to the Lower Card Cage. It is located within the chassis of the VX640. The Interconnect Card contains no active components, but it does have LED indicators and a DIP Switch for setting the static IP address when connecting to the Ethernet. This module can be accessed through the front of the router. See the DIP Switch Instructional Guide in **Appendix B, Setting the DIP Switch Instruction Guide** (page 30) for detailed instructions on how to access the Interconnect Module and set the DIP Switch.

*The Interconnect Module is NOT hot-swappable.*

## Status LEDs

The VX640 router was designed with status LEDs located on the front of the unit. These LEDs give a visual indication (LED on) that the System Power (12V) and the Controller Power (3.3V) in both the Upper and Lower Card Cages is applied.



VX640 Front Panel Status LEDs

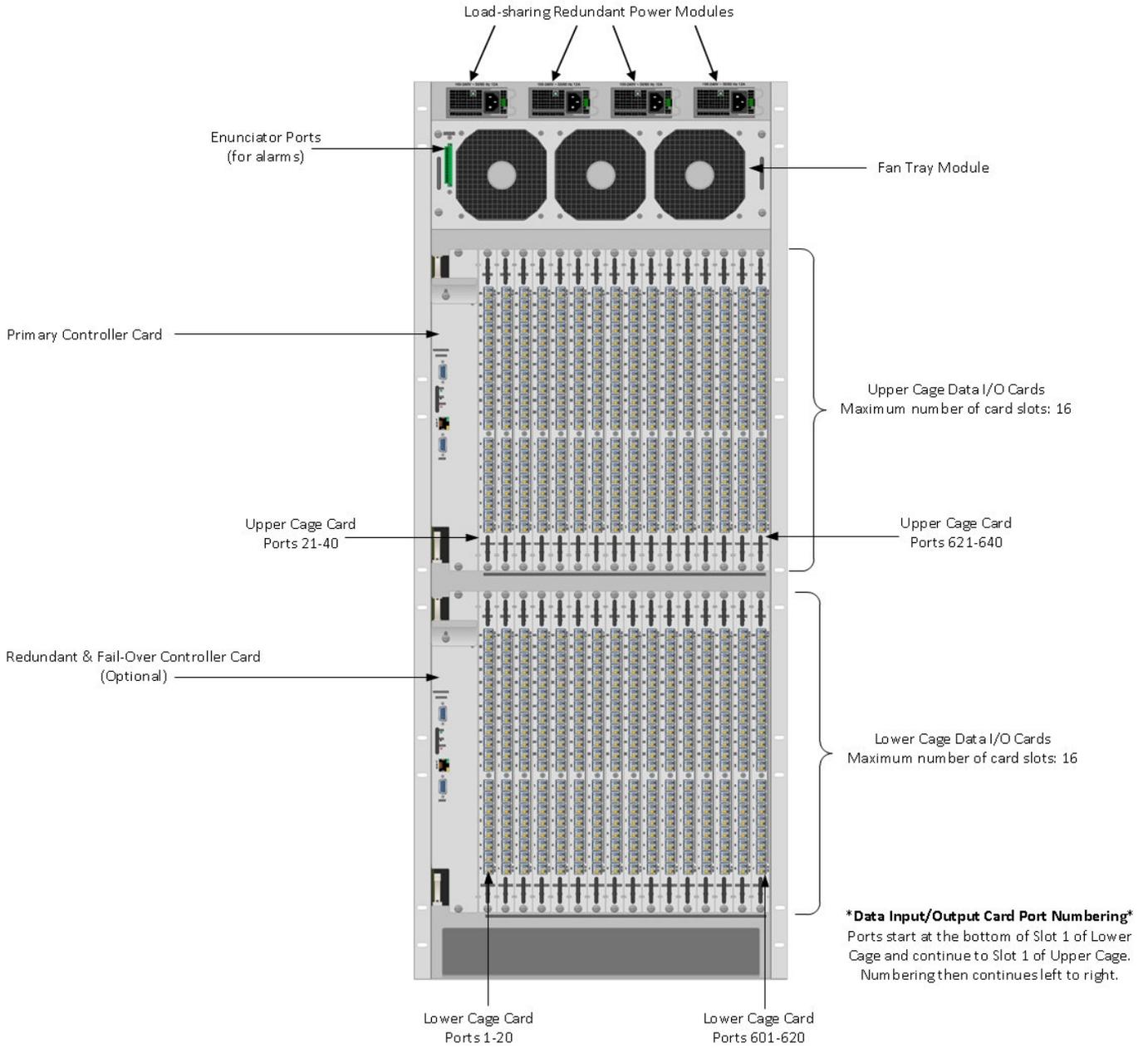
## Switch Card Modules

The VX640 contains 8 Switch Cards which are located behind the Front Door. The Switch cards are labeled from **right (Card 1) to left (Card 8)**. These cards contain the cross-point fabric of the router, allowing for 8 possible paths to make connections. In the event that a Switch Card fails, some connections may not be allowed.

*The hot-swappable feature allows for easy replacement of a Switch Card without the need to shut down the VX Router.*



**Note: All modules may be replaced without interruption to other module functions.**



**Detailed Rear Panel View of VX640**

## Power Supplies

The dual, redundant power supplies for each card cage 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 VX Router 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 for easy replacement of a module without interrupting the VX Router's system functionality. **All four power supplies should be turned on during normal use, even if one of the card cages is not populated with modules.**

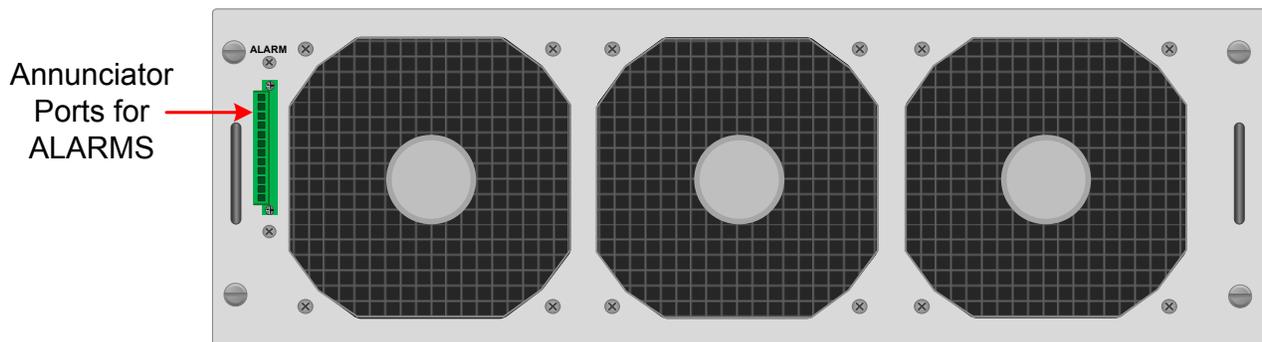
## Fan Tray

The VX640 Router 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 Switch Cards, and the backplane, as well as removing any heat generated by the power supply modules. (Each power supply module also has its own, internal cooling fan.)



**Warning! KEEP THE DOOR CLOSED WHEN IN USE! The VX640 Front Door contains air-flow baffles that are integral to the router's cooling system. Do not leave the front door open or off the chassis for more than a few minutes if the unit is running. Keeping the front door open for an extended period may lead to a malfunction of the VX640.**

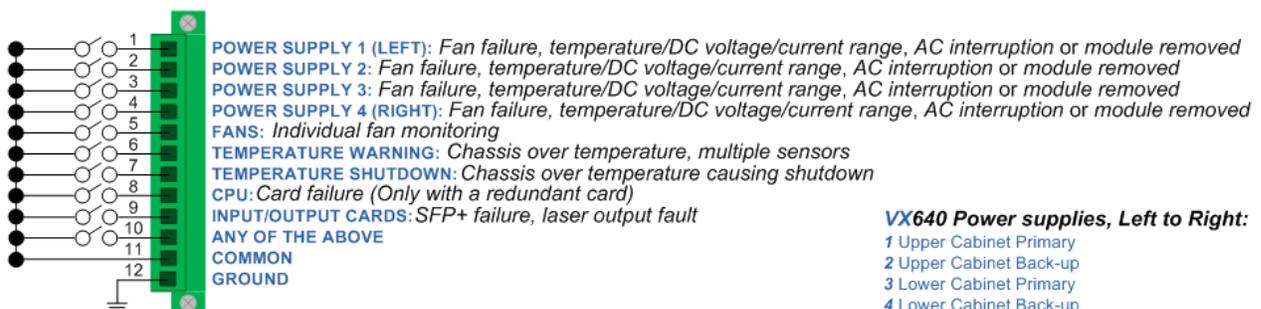
The Fan Tray is also equipped with an Annunciator Port for the use of alarms. The system alarms can be configured to trigger an external control system or generate e-mail notifications.



**VX640 Fan Tray with Alarm Annunciator**

The VX640 Critical Hardware Alarms are as follows (*Contacts are NC, Normally Closed*):

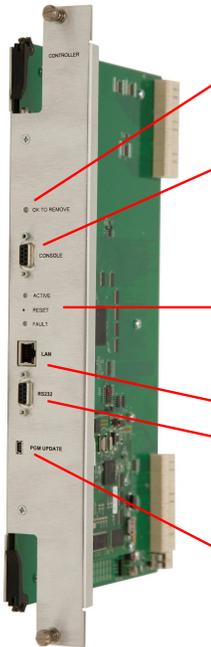
### The VX640 Router Critical Hardware Alarms:



**Alarm Descriptions for the VX640**

## Controller Card

The hot-swappable Controller Card connects the Router to an External CPU. The serial port can also be used for 3rd party controller integration (such as Crestron, AMX or home-spun interfaces). Also, the X4 Configurator Software can be used to control the VX Router via the LAN port.



**OK TO REMOVE**

LED ON: Safe to remove the Controller card from the VX640

**CONSOLE**

Console Port Settings: 115200 Baud, 8 Bits, No Parity, 1 Stop Bit, No Flow Control

**ACTIVE:** LED ON indicates card is Primary

**RESET:** Reset power button

**FAULT:** Red LED indicates card malfunction

**LAN  
RS-232**

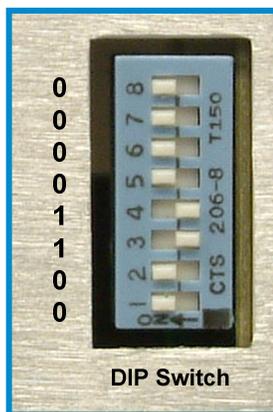
ASCII Control Port (RS-232) Settings: 9600 Baud, 8 Data Bits, 1 Stop Bit, XON/XOFF

**FIRMWARE UPDATE PORT**

VX640 Controller Card

## Ethernet Control

If the VX640 KVM 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 Interconnect module. See **Appendix B, Setting the DIP Switch Instruction Guide** (page 30) for detailed instructions on how to access and set the DIP Switch. Factory default setting will be **192.168.13.15**.



								Primary Controller IP Addresses	Back-up Controller IP Address
8	7	6	5	4	3	2	1		
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

VX640 DIP Switch Settings

The simplest network connection is an isolated network with only the VX640, the control server, and any control clients using static IP addresses. The VX640 can be set to any of the above settings. The control server must be at **192.168.13.9**, and the control clients could then be set to any other addresses in the **192.168.13.X** family.

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 VX640 KVM Matrix Switch(s) while the other network interface can be configured as required by the facility's network administrator.

**The External Control CPU must meet the following minimum requirements:**



- RedHat EL5.3 installed (or CentOS 5.3) (32-bit, not 64-bit, version)
- Windows XP, Windows 7
- Mac OS X
- 1 Gig RAM
- 1 DVD drive
- VGA and/or DVI video port
- USB or PS2 Keyboard / Mouse
- 2 network ports (Port 1 - system maintenance, Port 2 – VX640 dedicated)
- 80 Gig (minimum) hard drive
- 1 optional RS-232 serial port (Crestron/AMX serial access)

A **Back-Up Controller Card is optional** to ensure uninterrupted functionality if the Primary Controller Card fails or needs to be replaced. The **Primary Controller Card should always be in the upper controller slot**. The back-up card must have a LAN connection that allows it to communicate with both the Primary Controller and a server with the IP address **192.168.13.9**. Without this interface, the back-up controller cannot take control of the router.

## Pluggable SFP+ Modules

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

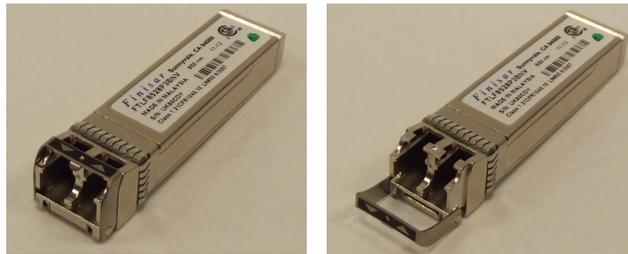
Each Input and Output card contains rows of SFP+ modules that serve as the fiber-optic couplers for the fiber cables to and from the Thinklogical transmitter and receiver extenders. Individual cards can be removed for easy access to the SFP+ modules.

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 Routers 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 VX640 I/O card has 20 SFP+s, each mounted within a grounded metal enclosure. Each SFP+ module is locked into its enclosure with a built-in latch handle that can be opened for removal or locked for installation.



**SFP+ Latch Closed**

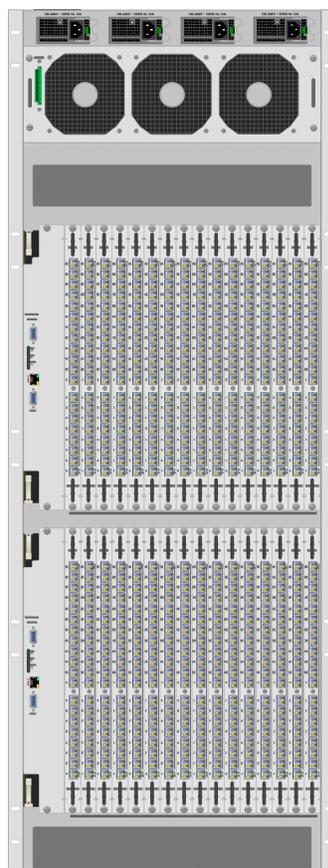
**SFP+ Latch Open**

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

## Input/Output Cards

The hot-swappable Input/Output (I/O) cards provide excellent in-service expansion capabilities in convenient sets of 20 ports per card, allowing re-configuration without interrupting signal processing. The VX640 Router will support up to 32 Input/Output Cards.

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 VX640 I/O Card numbers the ports 1 through 20. An LED located on each card indicates when power is applied to that card.



**Upper Card Cage:**

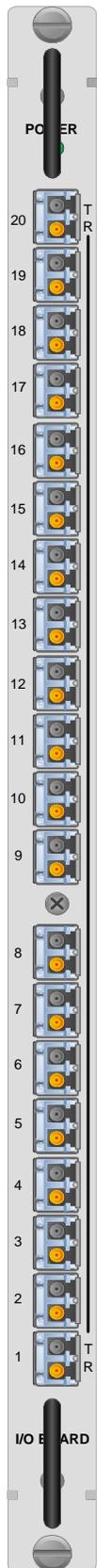
I/O Cards (VXM-DI0R20): **16**  
Controller Card (VXM-000025): **1**

**Lower Card Cage:**

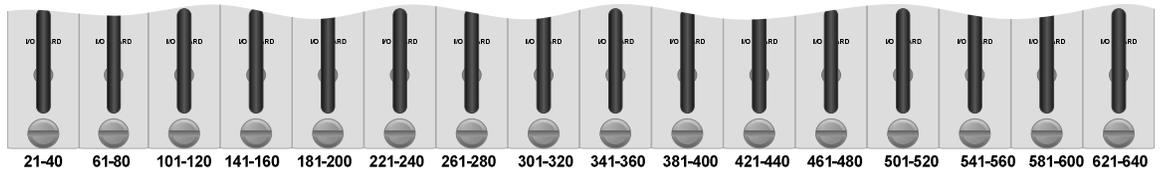
I/O Cards (VXM-DI0R20): **16**  
Controller Card (VXM-000025): **1**

## Input/Output Port Numbering on the VX640

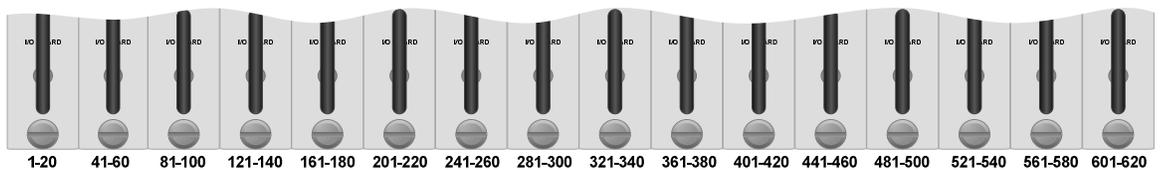
At the bottom of the Lower Cage and at the bottom of the Upper Cage, the port numbers for each slot are listed (all numbering is bottom to top, left to right).



Upper Card Cage I/O Card Numbering



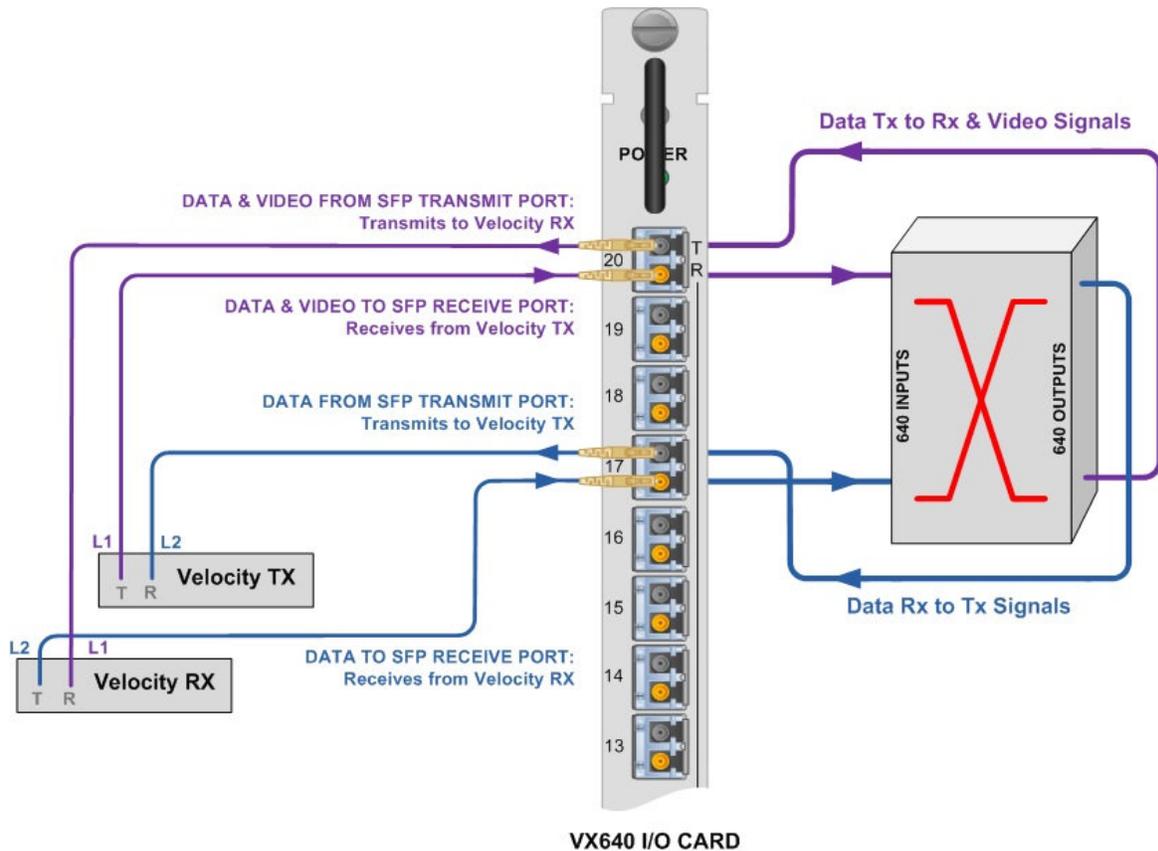
Lower Card Cage I/O Card Numbering



The VX640 Router configuration can have a minimum of one I/O Card (20 x 20) and a maximum of 32 I/O Cards. Each VX640 I/O card contains 20 ports. When fully configured, the VX640 will contain 16 I/O cards in the Upper Card Cage and 16 I/O cards in the Lower Card Cage. The 32 I/O cards provide a total of 640 Optical Input/Output connections described as Ports 1-640.

**The VX640 switching matrix connects any optical output port (SFP+ T) to any optical input port (SFP+ R).**





VX640 Transmit/Receive Concept

## PART 2: SET-UP AND INSTALLATION

### Set-Up

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.



**Note:** Insure that all thumb screws are finger tight so that all the modules are properly held in the chassis.

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

#### Step 1

Carefully remove the VX640 KVM Matrix Switch from its shipping container. Inspect the router to make certain that no damage occurred during shipment.

#### Step 2

All of the I/O cards are installed at the factory to meet your specific configuration. Insure that the I/O cards are properly seated in the unit and that all the SFP modules are sealed with a removable dust plug. All of the I/O cards are held in place by thumb screw retainers.

**Step 3**

Verify that the four power supplies, located above the fan tray, are secure in the chassis.

**Step 4**

Verify that the fan tray is fully seated in the chassis and that the thumb screws are secure.



**Note:** If mounting the chassis in a rack, insure that air flow to the fans and the front door is not restricted.

**Step 5**

The temperature in the chassis is monitored by internal temperature sensors in several locations. Sensors located in the Power Supplies, Fan Trays, on the Controller Card(s), on the I/O Card(s), and on the Switch Cards monitor continuously for any anomalous conditions.



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

**Step 6**

All fan speeds are monitored. Any fan speed that does not meet specification will cause an alarm condition.



**Warning!** Do not open or remove the front door for more than a few minutes when the unit is powered. (The door includes air-flow baffles that are part of the cooling system.) The Switch Card integrated circuits may overheat when operating without the front door closed.



**Note:** All failure conditions send out notifications prior to shut down. For a detailed list of the alarm functions, see [page 10: Alarm Descriptions for the VX640](#).

**Step 7**

When the VX Router has been inspected and found to be in suitable condition, the installation process can begin.

## Connecting to the VX640

### Fiber Optic Cable

#### Requirements

Thinklogical® recommends SX+ Laser Enhanced (50µm) fiber for your VX640 KVM Matrix Switch and Velocity Extension System. Multi-mode fiber can extend up to a maximum of 1000m and Single-mode fiber can extend distances beyond 1000m.



#### Handling Fiber Optic Cable

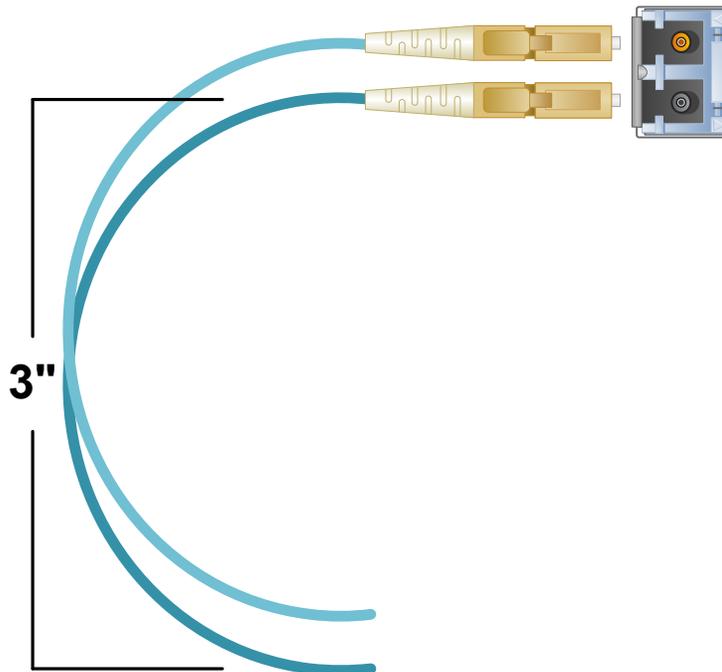
Unlike copper cabling, fiber optic cable requires special handling. A small speck of dust or a scratch to the ferrule tip (the end of the connector) can attenuate the optical signal, rendering the cable inoperable.



**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 radius must be no less than 3". Be careful not to kink or pinch the fiber when using ties.



## Connecting to Thinklogical® VelocityKVM Extenders

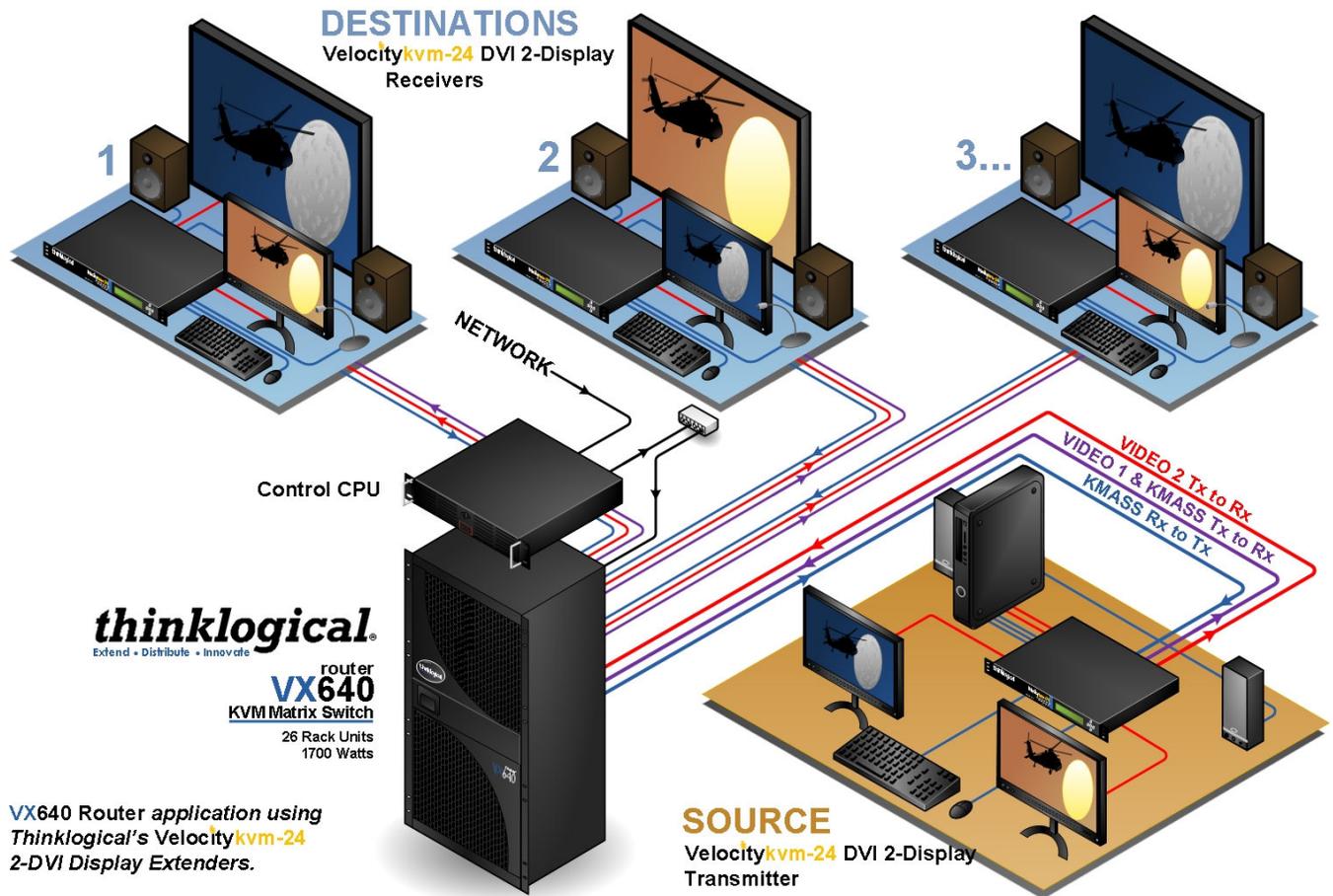
The VX640 is designed to work with all Thinklogical® products designed with MRTS technology (e.g. Velocity Extenders). The VX640 and Velocity Extenders are a new, unique class of cost-effective matrix switching and KVM extension designed for a variety of high-performance computing environments. Comprised of a fiber-in, fiber-out matrix switch and fiber-optic KVM 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 first connected to the Receiver using standard cables. Power can then be supplied to the unit. The Receiver then connects to the VX640 Receiver ports using fiber (Multi-mode fiber for distances up to 1000m; Single-mode fiber for distances beyond 1000m).

### Connecting to the Transmitter

The Transmitter serves as the Source (computer and video entities). Depending on your configuration, your local KMASS devices (keyboard, mouse, etc) are first connected. The video sources (e.g. computers) are then connected followed by any local video devices. Power can then be supplied to the unit. The Transmitter connects to the VX640 Transmitter ports using fiber (Multi-mode fiber for distances up to 1000m; Single-mode fiber for distances beyond 1000m).



VX640 Router application using Thinklogical's Velocitykvm-24 2-DVI Display Extenders.

## Connecting Thinklogical® VelocityKVM-24 Extenders to the VX640

### Connecting to a Control CPU



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

The VX640 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.

The network and serial RS-232 connection both use the same low level ASCII API syntax. This command syntax is defined in the document: **Router-ASCII-API.pdf**. 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 port **17567**. It accepts the same commands as the serial interface. You may use telnet to manually open a connection and control the VXRouter using port 17567.

Third-party controllers will control the router 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 'X4 Configurator'. This program is described in greater detail in the document: **Manual\_X4\_Configurator.pdf**, available on the Thinklogical web site.

## 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 X4 Configurator can be accessed and controlled via an OSD (on-screen display) technology. The X4 Configurator software can be installed on a designated OOB (out-of-band) PC which users can access from their workstation. A preconfigured hot-key sequence will deliver the X4 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 X4 Configurator loaded on it has a built in timeout function, therefore the PC cannot 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 Upgrade Application Installation**, page 31 and **APPENDIX D: FPGA Download Application Instructions** on page 32.

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 **VX640 Quick Start Guide** is also available in **Appendix A** (page 29).

## How to Install/Replace Modules

### How to Install or Replace Input/Output Cards



**Note:** A shutdown is not 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 out using both handles.



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

#### Step 2

Place the new module upright so that the POWER LED is on the top. Grasp the module by the handles. The card should slide freely until it reaches the backplane connector. At this point, 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

Once the module is completely seated, hand-tighten the thumbscrews.



**Warning!** Do not tighten the thumbscrews with a screwdriver.

## How to Install or Replace an Interconnect Module



**Note:** Replacing the Interconnect Module will interrupt service.

To replace the Interconnect Module, the front door and front panel must first be removed. (See **Appendix B**, page 30.)

### Step 1

Turn both front door latches one quarter turn clockwise (arrow on knob pointing up) to release the door.

### Step 2

While holding the door steady with one hand, pull down the upper spring-loaded hinge release and pull the upper portion of the door outward until the latch clears the mounting hole. The door can now be removed and set aside.



**Warning!** KEEP THE DOOR CLOSED WHEN IN USE! The VX640 Front Door contains air-flow baffles that are integral to the router's cooling system. Do not leave the front door off the chassis for an extended length of time if the unit is running. Keeping the front door open for an extended period of time will lead to a malfunction of the VX640.

### Step 3

There are two thumb screws holding the front panel to the chassis. Loosen the thumb screws, remove the front panel and set it aside.

### Step 4

There are two thumbscrews on the Interconnect Module; turn the thumbscrews counterclockwise until they disengage from the chassis. Pull the Interconnect Module out using both black ejector handles.

### Step 5

Place the new module upright so that the four Status LEDs are at the bottom. Grasp the module by the handles. The card should slide in freely until it reaches the backplane connector. At this point, use just enough force to firmly engage the card with the mating connector.



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

### Step 6

Once the module is completely seated, hand-tighten the thumbscrews.



**Warning!** Do not tighten the thumbscrews with a screwdriver.

### Step 7

Replace the front panel that was removed in **Step 3**.

### Step 8

Replace the front door that was removed in **Steps 1 and 2**.

## How to Install or Replace a Switch Card



**Note:** The Switch Cards are hot-swappable; the VX640 system does not need to be shutdown to replace.

### Step 1

Turn the thumbscrews counterclockwise until they disengage from the chassis. Pull the Switch Card out using both black ejector handles.

### Step 2

Place the new module upright so that the integrated circuitry/components are on the right side of the card. Grasp the module by the handles or by the outer edge of the aluminum housing. The card should slide freely until it reaches the backplane connector. At this point, 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

Once the module is completely seated, hand-tighten the thumbscrews.



**Warning!** Do not tighten the thumbscrews with a screwdriver.

## How to Install or Replace a Controller Card



**Note:** When using a single Controller, the top Controller slot is always Primary.



**Note:** Replacing the Controller Card will interrupt service if a second (Fail-over Controller Card) is not installed.

### Step 1

Turn the thumbscrews counterclockwise until they disengage from the chassis. Pull the Controller Card out using both black handles.

### Step 2

Place the new module upright so that the ACTIVE LED is on the top. Grasp the module by the handles or by the outer edge of the aluminum housing. The card should slide freely until it reaches the backplane connector. At this point, 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

Once the module is completely seated, hand-tighten the thumbscrews.



**Warning!** Do not tighten the thumbscrews with a screwdriver.

## How to Replace a Fan Tray

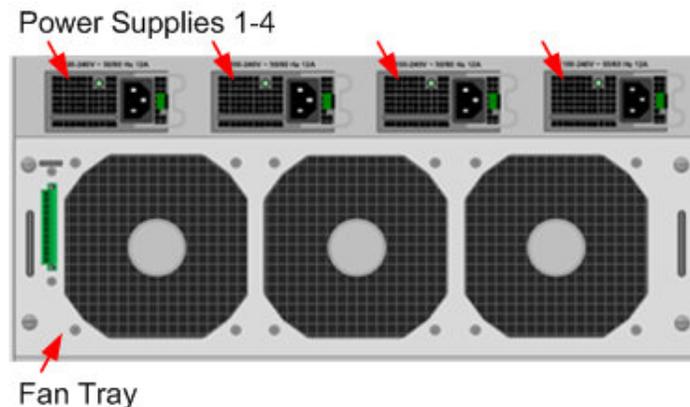
The VX640 uses three DC fans to move air horizontally through the enclosure. Be sure to not block the air vents on the front and rear of the unit, and leave at least 2" of space on both sides.



**Note:** Be sure to leave adequate ventilation space on both sides of the units (2" minimum), especially if units (e.g. Extenders) are being stacked above or below the VX640 KVM Matrix Switch.



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



### Step 1

Turn the four thumbscrews counterclockwise until they disengage from the chassis.

### Step 2

Pull the Fan Tray module out using both black handles.

### Step 3

Place the new module so that the aluminum housing is on the bottom. Hold the new Fan Tray by the black handles and slide the aluminum housing into the black card guides.



**Warning!** Do not operate the unit without a Fan Tray installed for more than 10 minutes.

### Step 4

Hand-tighten the thumbscrews.



**Warning!** Do not tighten the thumbscrews with a screwdriver.

## How to Replace a Power Supply



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



**Note:** If only TWO primary power supplies (1 & 3) are installed, shutdown IS required. If TWO primary power supplies (1 & 3) AND TWO back-up power supplies (2 & 4) are installed, shutdown IS NOT required.

The Power Modules are universal input 120-240VAC 50-60Hz. Use the proper power cord for your region (supplied with the unit). Although the router functions properly with two Primary Power Modules, it is recommended that all four Modules (two Primary, two Back-up) be connected to two independent power sources (for redundancy).

**Step 1**

Grasp the black handle with one hand.

**Step 2**

Slide the green tab to the left with the other hand.

**Step 3**

Pull the Power Module out of the chassis.

**Step 4**

Insert the new Power Module into the chassis and slide it in until it reaches the backplane connector. The module should slide freely until it reaches the backplane connector. At this point, use just enough force to firmly engage the card with the mating connector.



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

## **PART 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 domestic and many international requirements.

### **Regulatory Compliance**

Thinklogical® products are designed and made in the U.S.A. Our 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/UL60950-1: 1<sup>st</sup> Edition (2003)

CAN/CSA C22.2 No. 60950-1-03

**LASER Safety**

CDRH 21CFR 1040.10

Class 1 LASER Product

**Electromagnetic Interference**

FCC CFR47, Part 15, Class A

Industry Canada ICES-003 Issue 2, Revision 1

#### **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®**  
**100 Washington Street**  
**Milford, Connecticut 06460 USA**  
**Telephone 1-203-647-8700**

These products comply with the requirements of the Low Voltage Directive 72/23/EEC and the EMC Directive 89/336/EEC.

## Standards with Which Our Products Comply

### Safety

CENELEC EN 60950-1, 1<sup>st</sup> Edition (2001)

### LASER Safety

IEC60825:2001 Parts 1 and 2

Class 1 LASER Product

### Electromagnetic Emissions

EN55022: 1994 (IEC/CSP1R22: 1993)

EN61000-3-2/A14: 2000

EN61000-3-3: 1994

### Electromagnetic Immunity

EN55024: 1998 Information Technology Equipment-Immunity Characteristics

EN61000-4-2: 1995 Electro-Static Discharge Test

EN61000-4-3: 1996 Radiated Immunity Field Test

EN61000-4-4: 1995 Electrical Fast Transient Test

EN61000-4-5: 1995 Power Supply Surge Test

EN61000-4-6: 1996 Conducted Immunity Test

EN61000-4-8: 1993 Magnetic Field Test

EN61000-4-11: 1994 Voltage Dips & Interrupts Test

## Supplementary Information

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

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

*Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.*



**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 electromagnetic fields.



**Note:** If using a keyboard that is noise susceptible, a ferrite ring on the keyboard cable may be needed to comply with Immunity Requirements

## Product Serial Number

Thinklogical<sup>®</sup> products have a unique serial number, imprinted on an adhesive label that is fixed to the bottom of the chassis. The serial number includes a date-code. The format for the date-code is 2 digits for the month, 2 digits for the day and 2 digits for the year, plus two or three digits for a unique unit number. This serial number is also found on the original shipping carton.

## 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.

# PART 4: THINKLOGICAL<sup>®</sup> SUPPORT

## Customer Support

Thinklogical<sup>®</sup> is an engineering company and you will receive any information you require directly from our most knowledgeable engineers. We believe that the first lines of support are design engineers that developed each particular product. Therefore, your questions will be handled promptly by our in-house engineers who are most familiar with your products.

**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 firmware updates, support information and general information about all of the products we offer.

Our 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 helpful information.

Internet: [www.thinklogical.com](http://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](http://www.adobe.com) for a download.

## FTP Site

In addition to our web site, we also have an .ftp site that contains important documents and files. In addition to technical documents, it contains ISO files that may be used to burn copies of the CDs we include with our routers, the X4 Configurator manual and an installable version of X4 for Windows and Linux.

The ftp site is: [ftp.thinklogical.com](ftp://ftp.thinklogical.com)

These manuals are available on our ftp site for downloading:

- Router-ASCII-API.pdf
- Router\_Interfaces.pdf
- Configuring-the-ASCII-Interface.pdf
- Router\_SNMP\_Traps.pdf

Router SNMP MIB definition files are also available for downloading:

- LSI-ROOT.mib
- LSI-ROUTER-API-INTERFACE.mib
- LSI-SFP.mib
- LSI-VXROUTER.mib

## Email

Thinklogical® is staffed **Monday through Friday from 8:30am to 5:00pm**, Eastern Time Zone. We will try to respond to your email inquiries promptly, use the following email addresses for your different needs:

**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

Telephone Sales: Contact our expert sales staff via telephone in Milford, CT at **1-203-647-8700** or if in the continental US, you may use our **toll-free number 1-800-291-3211**. We are here Monday through Friday from 8:30am to 5:00pm, Eastern Time Zone. Ask for your representative's direct dial phone number when you call.

**Telephone Product Support:** Contact Product Support via telephone in Milford, CT at **1-203-647-8700**. The support lines are manned Monday through Friday, 8:30am to 5:00pm, Eastern Time Zone.

**International Sales:** Please contact our US sales staff in Milford, CT at **1-203-647-8700**. We are here Monday through Friday, 8:30am to 5:00pm, Eastern Time Zone (same as New York City). If leaving a voice message please provide a "best 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. You can leave voice messages for individuals at any time. Our Sales Representatives have direct numbers to speed up your next call to us.

## 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® Inc. 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

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 Material Authorization**.

Return address for products with Return Material Authorization:

**Thinklogical, LLC®**  
**Attn: RMA#**  
**100 Washington Street**  
**Milford, CT 06460 USA**  
**PH: 1-800-291-3211 (USA only)**

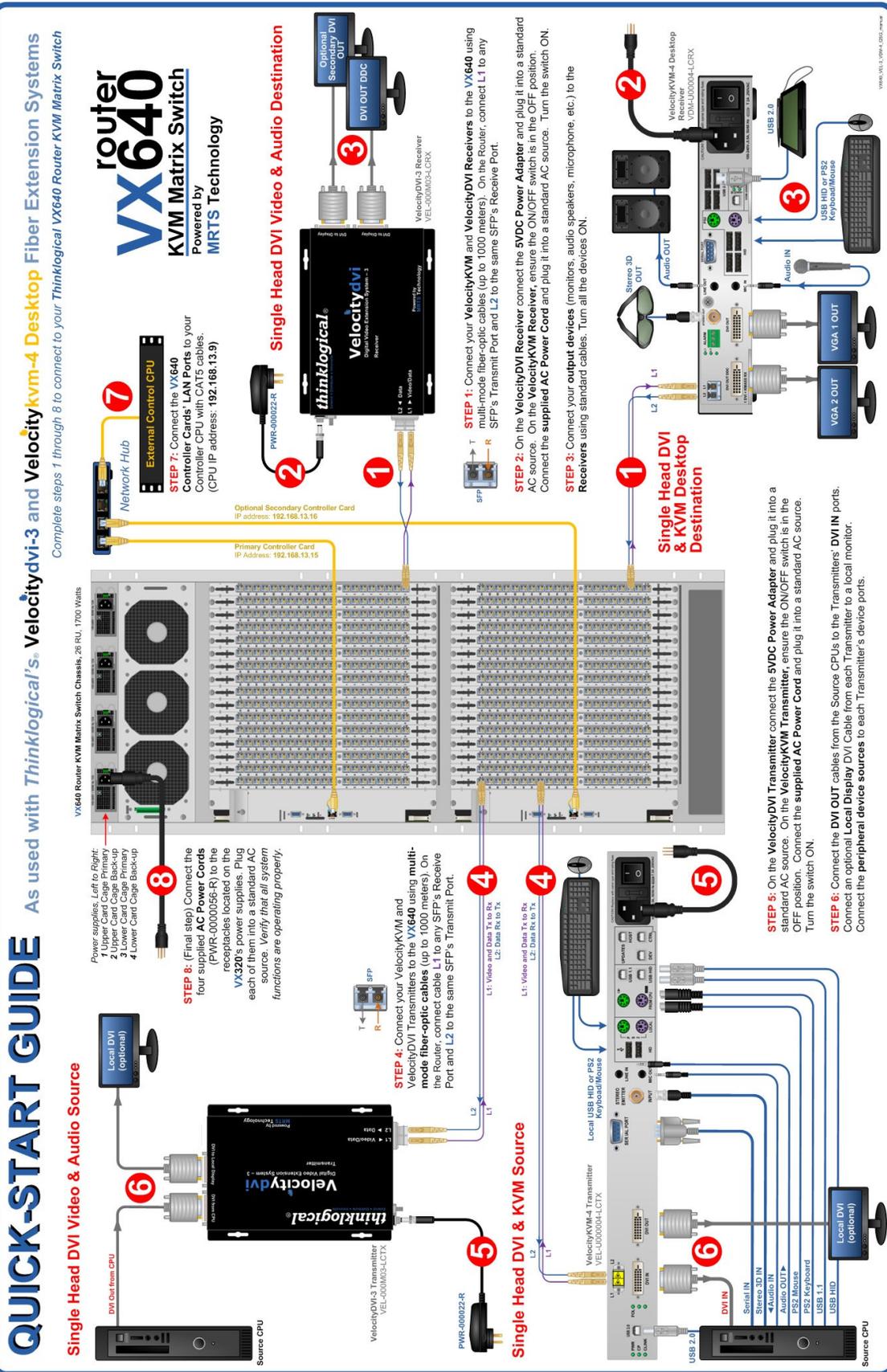
## **Our Address**

If you have any issue with a product, have product 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'd like to write us, our mailing address is:

**Thinklogical, LLC®**  
**100 Washington Street**  
**Milford, CT 06460 USA**



APPENDIX A: VX640 QUICK START GUIDE



## Appendix B: Setting the DIP Switch Instruction



**2**



**1**



**5**



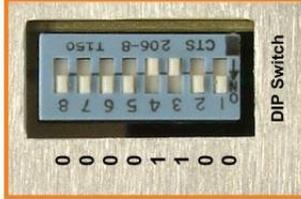
**2**



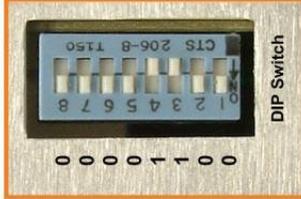
**3**



**3**



**4**



**4**

**router VX640 KVM Matrix Switch**  
**Setting the DIP Switch**  
 Complete Steps 1-5 to change the VX640 DIP Switch settings.

*(Example of a typical DIP Switch setting)*

DIP Switch	Primary Controller IP Addresses	Back-up Controller IP Address	
8	00000000	192.168.13.15 & 192.168.13.115	192.168.13.16
7	00000000	192.168.13.17 & 192.168.13.117	192.168.13.18
6	00000000	192.168.13.19 & 192.168.13.119	192.168.13.20
5	00000000	192.168.13.21 & 192.168.13.121	192.168.13.22
4	00000000	192.168.13.23 & 192.168.13.123	192.168.13.24
3	00000000	192.168.13.25 & 192.168.13.125	192.168.13.26
2	00000000	192.168.13.27 & 192.168.13.127	192.168.13.28
1	00000000	192.168.13.29 & 192.168.13.129	192.168.13.30
0	00000000	192.168.13.31 & 192.168.13.131	192.168.13.32
0	00000000	192.168.13.33 & 192.168.13.133	192.168.13.34
0	00000000	192.168.13.35 & 192.168.13.135	192.168.13.36
0	00000000	192.168.13.37 & 192.168.13.137	192.168.13.38
0	00000000	192.168.13.39 & 192.168.13.139	192.168.13.40
0	00000000	192.168.13.41 & 192.168.13.141	192.168.13.42
0	00000000	192.168.13.43 & 192.168.13.143	192.168.13.44
0	00000000	192.168.13.45 & 192.168.13.145	192.168.13.46

Thumb screws (2) on the front panel.

Front Panel Removed

Front Panel

Front Door

**To set the VX640 DIP Switch, the front door and front panel must first be removed.**

**STEP 1:** Turn both front door latches one quarter turn clockwise (arrow pointing up) to release the door.

**STEP 2:** Holding the door steady with one hand, pull down the upper spring-loaded hinge release and pull the upper portion of the door outward until the latch clears the mounting hole. The door can now be removed and set aside.\*

**STEP 3:** There are two thumb screws holding the front panel to the chassis. Loosen the thumb screws, remove the front panel and set it aside. The DIP Switch will now be exposed.

**STEP 4:** Using the chart on the right, set the 8 DIP switches to the desired settings and reinstall the front panel that was removed in Step 3.

**STEP 5:** When reinstalling the door, insert the lower hinge first, then, while pulling down the upper hinge spring-release, guide the door into place and allow the upper hinge to insert itself into the mounting hole. Turn the door latches (see Step 1) one quarter turn counter-clockwise to secure the door closed.

\*The VX640 Front Door contains air-flow baffles that are integral to the router's cooling system. Do not leave the front door off the chassis for an extended length of time if the unit is running.

# Appendix C: FPGA Upgrade Application Installation

## thinklogical® VX640 KVM Matrix Router FPGA Upgrade Application Installation

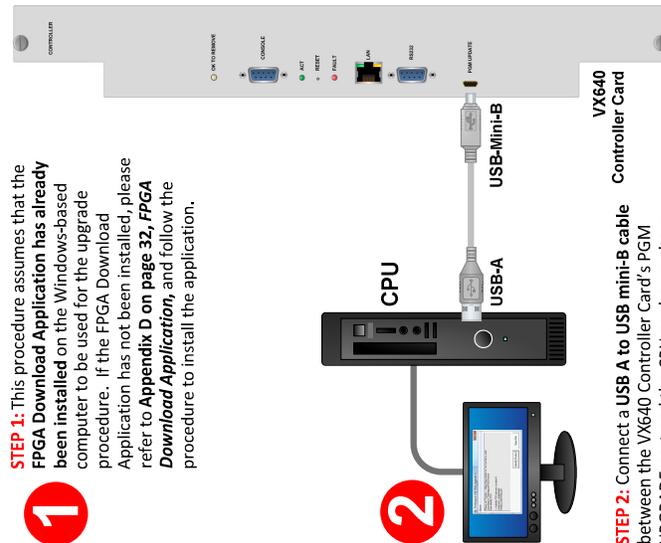
The following procedure documents the steps necessary to install the FPGA Upgrade Application on a VX640 Router using a Windows-based computer.

Perform steps 1-7 as described:

### FPGA Update Preparation:

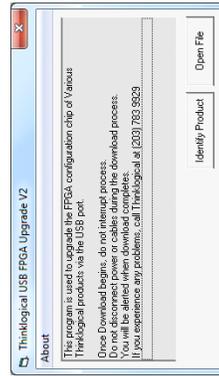
- The FPGA\_Download.exe application is stored in: [http://ftp.thinklogical.com/ftp/visualization/updates/FPGA\\_upgradeVxxx.zip](http://ftp.thinklogical.com/ftp/visualization/updates/FPGA_upgradeVxxx.zip) (where 'Vxxx' is the version number).
- Open the FPGA\_upgradeVxxx.zip file and extract the contents to a temporary directory.

**STEP 1:** This procedure assumes that the FPGA Download Application has already been installed on the Windows-based computer to be used for the upgrade procedure. If the FPGA Download Application has not been installed, please refer to **Appendix D on page 32, FPGA Download Application**, and follow the procedure to install the application.



**1**

**STEP 3:** Run the Thinklogical FPGA Upgrade application. You will see the following window. Click on *Identify Product*.



**4**

**STEP 4:** You may see a window similar to this, identifying the desired file name. Click *Open File*.



**5**

**STEP 5:** Select OK. A dialog box similar to this will open.



**6**

**STEP 6:** Verify the response below during the process.



**7**

**STEP 7:** When FPGA download is complete, you will see the window above. The Upgrade Procedure is now complete. Remove the USB cable from the PGM Update port.



Browse to and select the file: **VX640\_ctrL\_fpga\_rev\_xxxx.lbf** and press OPEN to begin.

**STEP 2:** Connect a USB A to USB mini-B cable between the VX640 Controller Card's PGM UPGRADE port and the CPU as shown above.

VX640\_FPGA\_Upgrade\_Installation\_Guide\_en.html

# Appendix D: FPGA Download Application Instructions

## thinklogical® Procedure for the FPGA Download Installation

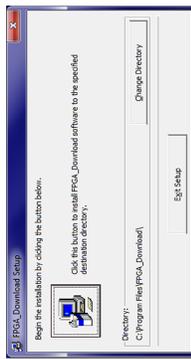
### FPGA Update Preparation:

- The **FPGA\_Download.exe** application is stored in: [http://ftp.thinklogical.com/ftp/visualization/updates/FPGA\\_upgradeVxxx.zip](http://ftp.thinklogical.com/ftp/visualization/updates/FPGA_upgradeVxxx.zip) (where 'Vxxx' is the version number).
- Open the **FPGA\_upgradeVxxx.zip** file and extract the contents to a temporary directory.

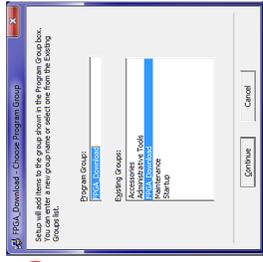
 Perform steps 1-5 as described:

The following procedure documents the steps necessary to install the **FPGA Download Application** using a **Windows-based computer**:

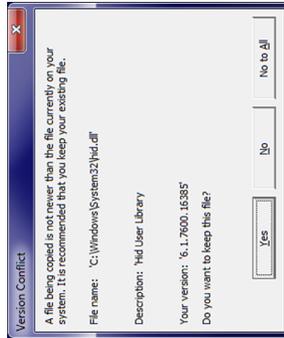
**STEP 1:** To install the application, double click on **setup.exe (Contained in FPGA\_upgradeVxxx.zip)**. If asked for permission to make changes, select **Yes**. At the **Welcome** screen shown here, select **OK**.



**STEP 2:** Begin the installation by clicking the displayed button.



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



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



**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).



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



**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**.



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

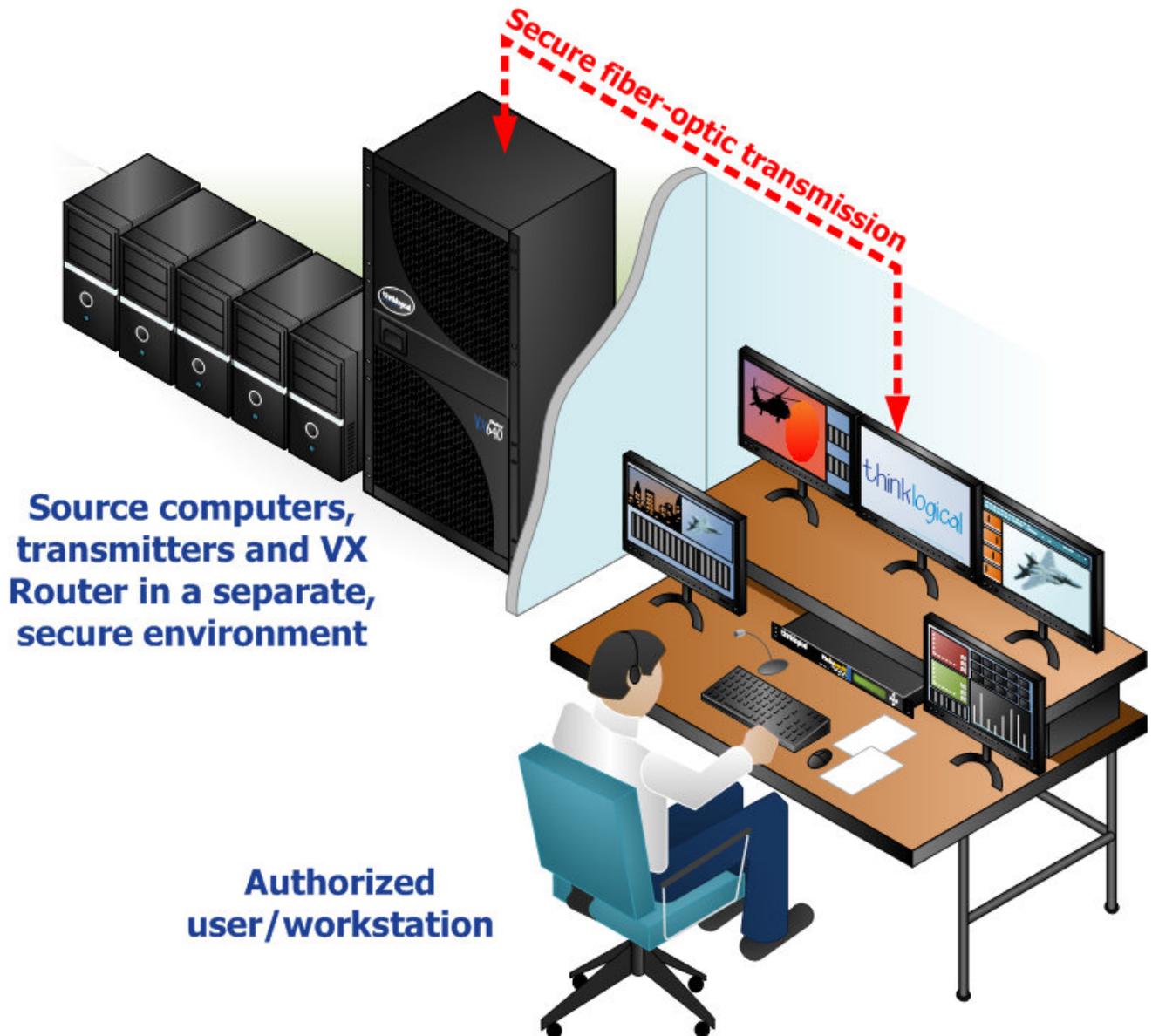


**STEP D:** Follow the instructions for the **Completing the Found New Hardware Wizard** Box. Click on **Finish**.

## Appendix E: Secure Applications

### VX Router Control

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



Thinklogical's VX Router uses 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 VX Router. Each destination must ensure that no unauthorized content is displayed or accessed, therefore, each input and output needs to be prioritized. Priorities can range from 1 to the total number of ports in the VX

Router. An output can connect to an input with a priority greater than, or equal to, its priority. 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:

I/O	Number	Priority
"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 VX Router will interpret the Restricted Switching Table (csv file) during the boot-up. Any errors that occur during the Restricted Switching Table interpretation process will be logged in the messages file at the following location: **var/log/messages**

It is recommended that the **Messages File** be reviewed and any errors in the Restricted Switching Table be corrected before implementing multiple levels of security classification domains on the same VX Router. It is also recommended that **Restricted Switching** be fully tested before implementing multiple levels of security classification domains on the same VX Router.

The Restricted Switching Table files for the VX640 Router are stored on the Controller Card at the following location:

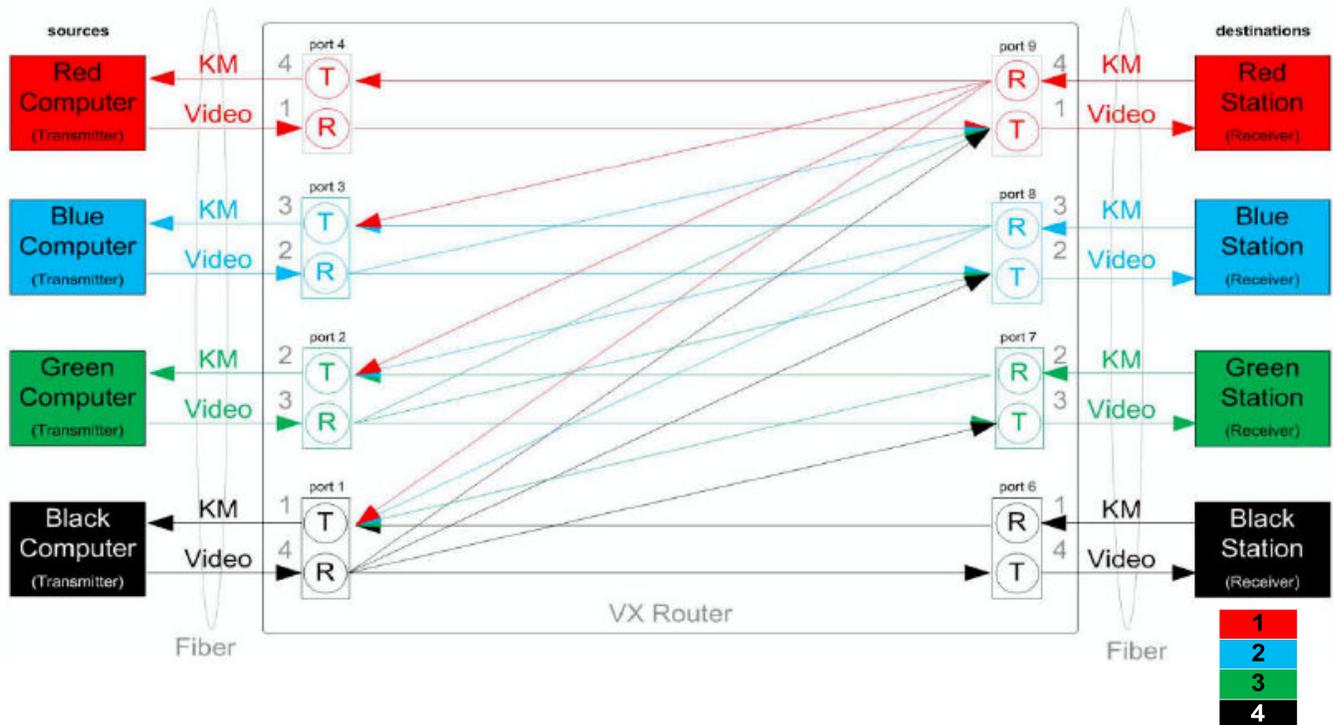
**var/local/vxrouter/restrict/upstream.csv**  
**var/local/vxrouter/restrict/downstream.csv**

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 VX Routers are shipped without Restricted Switching Table files stored on the Controller card and therefore do not restrict any connection.

# Restricted Switching with VX Routers

## Restricted Switching Priority Scheme

The following example shows a priority scheme for four levels of security managed by one VX Router:



### For Video:

- Destination workstations in the **RED** network can see what is transmitted by source computers in the **BLACK, GREEN, BLUE & RED** networks.
- Destination workstations in the **BLUE** network can see what is transmitted by source computers in the **BLACK, GREEN & BLUE** networks.
- Destination workstations in the **GREEN** network can see what is transmitted by source computers in the **BLACK & GREEN** networks.
- Destination workstations in the **BLACK** network can see what is transmitted by source computers in the **BLACK** network only.

### For Keyboard & Mouse:

- Destination workstations in the **RED** network can control source computers in the **BLACK, GREEN, BLUE & RED** networks.
- Destination workstations in the **BLUE** network can control source computers in the **BLACK, GREEN & BLUE** networks.
- Destination workstations in the **GREEN** network can control source computers in the **BLACK & GREEN** networks.
- Destination workstations in the **BLACK** network can control source computers in the **BLACK** network only.

- Restricted switching is configured via firmware loaded into the VX Router. The configuration file for this scenario would look like this (where the first value is "i" for input or "o" for output, the second value is the port number and the third value is the priority level).

### Important Notes:

- In this scenario, ports 1-4 in card 1 and ports 6-9 in card 2 are used. However, any ports on any cards can be used. (Each card has five ports numbered 1-5, bottom to top.)
- The number of priority levels that can be managed by one VX Router is the same as the number of ports in the VX Router: The VX40 and VX80 can support 80 priority levels. The VX160 can support 160 priority levels and a VX320 or VX320Video can support 320 priority levels.

```

"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
    
```

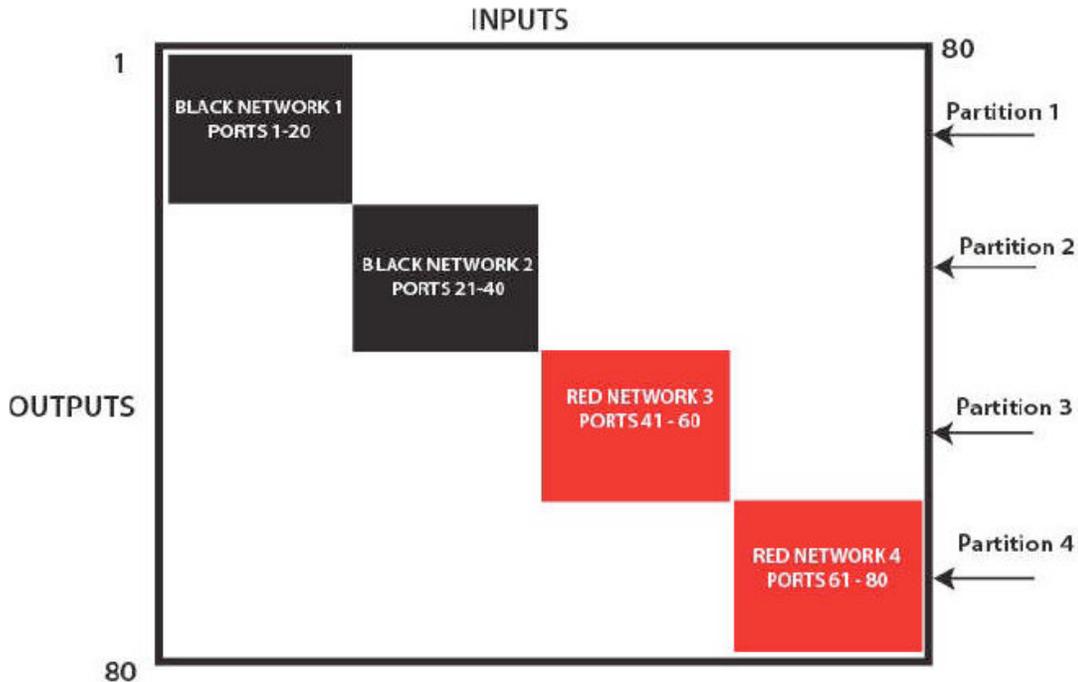


**Note:** When using a Back-up Controller configuration, both controllers must have the same Restricted Switching Table file(s).

## Partitioning

Partitions allow VX Router sources and destinations to be segregated. Therefore, destination workstations 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.

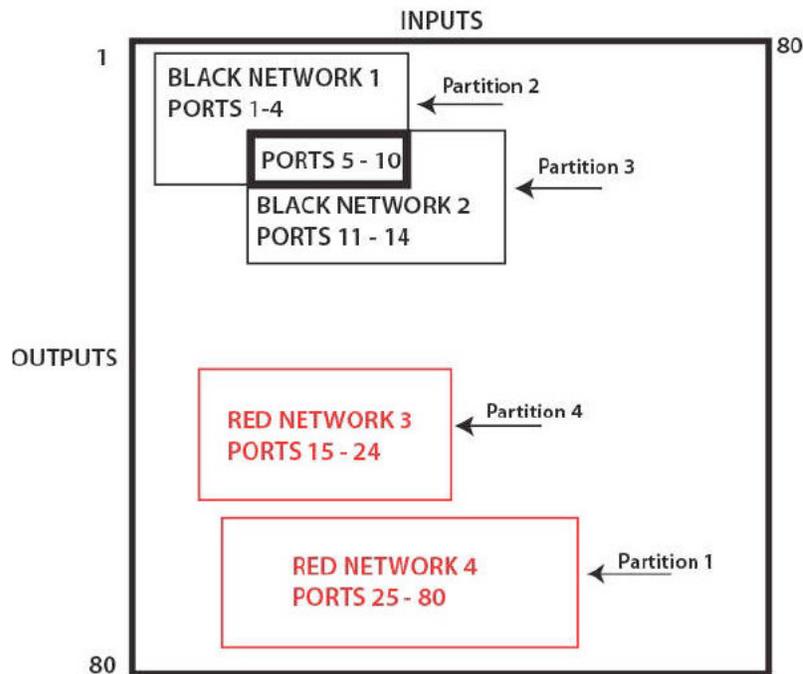
Example: VX80 Router with four distinct partitions:



**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 VX Router (80, 160, 320, 640). A VX40 or VX80 Router can be configured with up to 80 partitions, a VX160 up to 160, and so forth. There are also overlapping partition configurations.

The following example shows a VX80 Router with an overlapping partition:



**A VX80 with four partitions: Ports 5-10 are accessible to both partitions 2 and 3.**

The user must provide a table defining the partitions. This table is in the form of a comma separated value (CSV) file located in `/var/local/router/partition` on the VX Router. This file contains the port number and the partitions to which it belongs. The configuration file for the above scenario looks like this:

“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

All ports not listed will default to partition 1. Ports can be manually added to partition 1.

### Administration Access

There are only two methods by which the administrator can access the VX Router Controller Configurations:

1. **Using the serial console directly connected to the VX Router.** (It should be noted that while no administrator password is required to use the serial console, physical access to the router is required, therefore the router should be stored in a physically secure location to avoid unauthorized access.)
2. **Using SSH access**

The router allows SSH connections to the router for management purposes. SSH sessions are authenticated using an encrypted password file.

### Password Security

For security purposes, the router 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 router 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 LETTERS AND NUMBERS.** Intersperse numbers within the password to enhance its strength.

INCLUDE NON-ALPHANUMERIC CHARACTERS. Special characters (& \$ % >) and punctuation marks (? "- !) can increase the strength of a password.

### Secure Application Examples

The Diagram on page 39 shows the VX640 Matrix Router 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 VX Router, the computer server used to manage the Router, and the Network Hub. The Network Hub is a dedicated network used only to connect the VX Router 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 VX Router and the computer server.



**Note:** The VX Router and the computer server used to manage the Router must be protected according to the highest security classification of any component in the entire network application.



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

The VX Router can be configured to prevent accidental connection from the Red Network to the Black Network using the Restricted Switching feature. For example, the VX640 Matrix Router Network Diagram should be configured with the following csv file:

```
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 will apply:

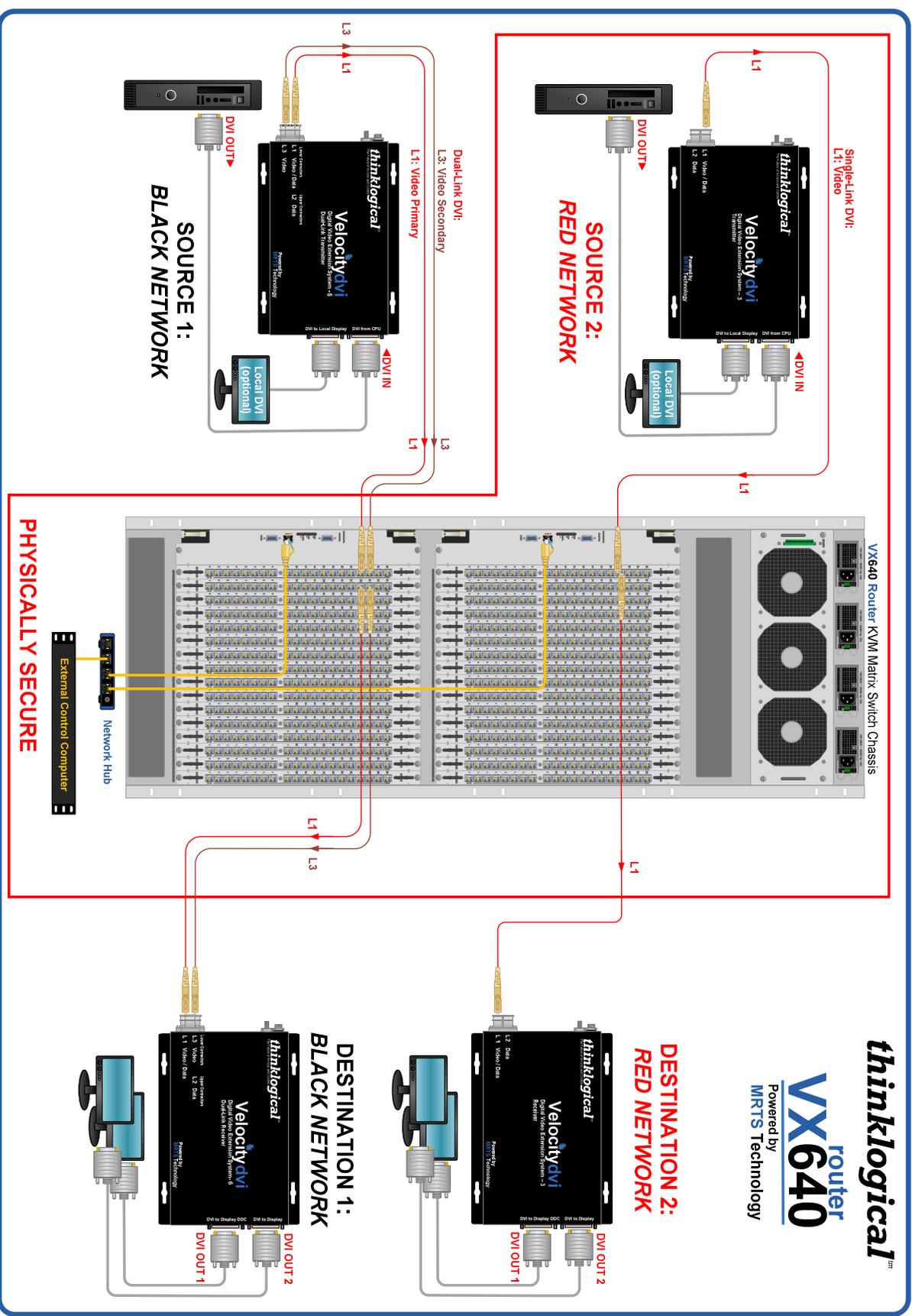
SOURCE 2 can be connected only to DESTINATION 2.

SOURCE 1 can be connected to both DESTINATION 1 and DESTINATION 2.

The configuration of the VX Router should be reviewed regularly to ensure that it continues to meet organizational security policies concerning:

- Changes in the VX Router configuration
- Changes in the organizational security policy
- Changes in the threats presented from non-trusted network interfaces
- Changes in the administration and operation staff or the physical environment of the VX Router





VX640 Video Secure Application