

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

EMX-2500

LXI-PXIe GIGABIT ETHERNET CONTROLLER

USER'S MANUAL

P/N: 82-0144-000
Rev. July 29, 2013

VTI Instruments Corp.

2031 Main Street
Irvine, CA 92614-6509
(949) 955-1894

TABLE OF CONTENTS

TABLE OF CONTENTS 2
Certification 4
Warranty 4
Limitation of Warranty 4
Trademarks 4
Restricted Rights Legend 4
GENERAL SAFETY INSTRUCTIONS 5
Terms and Symbols 5
Warnings 5
SUPPORT RESOURCES 7
SECTION 1 1
OVERVIEW 1
Overview 1
Features 1
EMX-2500 SPECIFICATIONS 3
SECTION 2 5
PREPARATION FOR USE 5
Overview 5
Unpacking 5
Required Equipment 5
Hardware Installation 5
Software Installation 6
Network Configuration 6
Synchronization Considerations 7
SECTION 3 1
MODULE DESCRIPTION 1
Block Diagrams 1
Theory of Operation 2
Software 4
Front Panel Details 4
SECTION 4 7
SOFTWARE INSTALLATION 7
Introduction 7
Prerequisites 7
Building and Running Example Programs 9
SECTION 5 11
WEB PAGE OPERATION 11
Opening the Web page 11
General Web page Operation 11
Login 11
Index 12
Cards 13
Network Configuration 14
Time Configuration 15
LXI Synchronization 16
LXI Identification 17
Blink LAN Indicator 18
Change Password 19
Upgrade 19

Reset 20
Reboot 21
SECTION 6 23
TRIGGER MECHANISMS 23
Overview 23
PXI Triggers 23
Front Panel Trigger 24
LAN Event Triggers 24
Alarms 25
SECTION 7 27
FIRMWARE UPDATES 27
Updating EMX-2500 Firmware 27
Updating Peripheral Firmware 29
INDEX 33

CERTIFICATION

VTI Instruments Corp. (VTI) certifies that this product met its published specifications at the time of shipment from the factory. VTI further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (formerly National Bureau of Standards), to the extent allowed by that organization's calibration facility, and to the calibration facilities of other International Standards Organization members. Note that the contents of this document are subject to change without notice.

WARRANTY

The product referred to herein is warranted against defects in material and workmanship for a period of one year from the receipt date of the product at customer's facility. The sole and exclusive remedy for breach of any warranty concerning these goods shall be repair or replacement of defective parts, or a refund of the purchase price, to be determined at the option of VTI. Note that specifications are subject to change without notice.

For warranty service or repair, this product must be returned to a VTI Instruments authorized service center. The product shall be shipped prepaid to VTI and VTI shall prepay all returns of the product to the buyer. However, the buyer shall pay all shipping charges, duties, and taxes for products returned to VTI from another country.

VTI warrants that its software and firmware designated by VTI for use with a product will execute its programming when properly installed on that product. VTI does not however warrant that the operation of the product, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The warranty shall not apply to defects resulting from improper or inadequate maintenance by the buyer, buyer-supplied products or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

VTI Instruments Corp. shall not be liable for injury to property other than the goods themselves. Other than the limited warranty stated above, VTI Instruments Corp. makes no other warranties, express or implied, with respect to the quality of product beyond the description of the goods on the face of the contract. VTI specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

TRADEMARKS

Java Runtime Environment™ are trademarks or registered trademarks of Sun Microsystems, Inc. or its subsidiaries in the United States and other countries. LabVIEW™ and LabWindows/CVI™ are trademarks of National Instruments Corporation. Visual Basic®, Windows®, and Internet Explorer® are registered trademarks of the Microsoft Corporation or its subsidiaries. Linux® is a registered trademark of the Linux Foundation. IVI™ is a trademark of the IVI Foundation. Bonjour™ is a trademark of Apple, Inc.

RESTRICTED RIGHTS LEGEND

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software clause in DFARS 252.227-7013.

VTI Instruments Corp.
2031 Main Street
Irvine, CA 92614-6509 U.S.A.

GENERAL SAFETY INSTRUCTIONS

Review the following safety precautions to avoid bodily injury and/or damage to the product. These precautions must be observed during all phases of operation or service of this product. Failure to comply with these precautions, or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture, and intended use of the product. Note that this product contains no user serviceable parts or spare parts.

Service should only be performed by qualified personnel. Disconnect all power before servicing.

TERMS AND SYMBOLS

These terms may appear in this manual:

WARNING Indicates that a procedure or condition may cause bodily injury or death.

CAUTION Indicates that a procedure or condition could possibly cause damage to equipment or loss of data.

These symbols may appear on the product or in the manual:



ATTENTION - Important safety instructions



Indicates hazardous voltage.

Frame or chassis ground



Indicates that the product was manufactured after August 13, 2005. This mark is placed in accordance with *EN 50419, Marking of electrical and electronic equipment in accordance with Article 11(2) of Directive 2002/96/EC (WEEE)*. End-of-life product can be returned to VTI by obtaining an RMA number. Fees for take-back and recycling will apply if not prohibited by national law.

WARNINGS

Follow these precautions to avoid injury or damage to the product:

Use Proper Power Cord To avoid hazard, only use the power cord specified for this product.

Use Proper Power Source To avoid electrical overload, electric shock, or fire hazard, do not use a power source that applies other than the specified voltage.

The mains outlet that is used to power the equipment must be within 3 meters of the device and shall be easily accessible.

User Proper Fuse To avoid fire hazard, only use the type and rating fuse specified for this product.

Power Consumption Prior to using EMX series plug-in modules, it is imperative that the power consumption of all modules that will be installed in the mainframe be calculated for all power supply rails. The required information can be found in *Appendix B* of the *EMX Series User's Manual* (P/N: 82-0142-100). *Failure to do so may result in damaging the instrument and the chassis.*

WARNINGS (CONT.)

Avoid Electric Shock

To avoid electric shock or fire hazard, do not operate this product with the covers removed. Do not connect or disconnect any cable, probes, test leads, etc. while they are connected to a voltage source. Remove all power and unplug unit before performing any service. ***Service should only be performed by qualified personnel.***

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground.

Operating Conditions

To avoid injury, electric shock or fire hazard:

- Do not operate in wet or damp conditions.
- Do not operate in an explosive atmosphere.
- Operate or store only in specified temperature range.
- Provide proper clearance for product ventilation to prevent overheating.
- When selecting the installation location, be certain that there is enough space around the power plug and the outlet so that they are readily accessible. Do not insert the power cord into an outlet where accessibility to the plug cord is poor.
- All unused slots should be closed with the dummy filler panels to ensure a proper air circulation. This is critical to avoid overheating of the cards.
- DO NOT operate if any damage to this product is suspected. ***Product should be inspected or serviced only by qualified personnel.***



Improper Use

The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.
Conformity is checked by inspection.

SUPPORT RESOURCES

Support resources for this product are available on the Internet and at VTI Instruments customer support centers.

VTI Instruments Corp.
World Headquarters

VTI Instruments Corp.
2031 Main Street
Irvine, CA 92614-6509

Phone: (949) 955-1894
Fax: (949) 955-3041



VTI Instruments
Cleveland Instrument Division

5425 Warner Road
Suite 13
Valley View, OH 44125

Phone: (216) 447-8950
Fax: (216) 447-8951



VTI Instruments, Pvt. Ltd.
Bangalore Instrument Division

Mallika
#75/76, Millers Road,
Bangalore – 560 052
India

Phone: +91 80 4040 7900
Fax: +91 80 4170 0200



Technical Support

Phone: (949) 955-1894
Fax: (949) 955-3041
E-mail: support@vtiinstruments.com

Visit http://www.vtiinstruments.com for worldwide support sites and service plan information.

SECTION 1

OVERVIEW

OVERVIEW

The EMX-2500 is the first Gigabit Ethernet-based interface for PXI Express based systems. It combines Ethernet's widespread usage and robust architecture with instrumentation-specific functionality, such as wired trigger bus and IEEE 1588-2008 synchronization, and extends it for use in a PXI Express environment, making it an ideal solution for data acquisition applications that integrate VTI's SentinelEX PXI Express modules.

FEATURES

- Up to 100 MB/s sustained throughput
- Allows remote access to VTI's SentinelEX family of PXIe instruments from anywhere in the world on any internet enabled device
- Multi-chassis synchronization using precision IEEE 1588-2008 standard time source
- Easy to set up for distributed data acquisition systems
- Simplified instrument discovery and usage – just type in the IP address to connect to the instrument
- IVI drivers supporting wide variety of application development environments and operating systems
- REST HTTP protocol for cloud support and advanced web applications

Precision Timing and Synchronization

The EMX-2500 contains a high-precision IEEE 1588 source for timestamping data and synchronizing VTI's SentinelEX modules within 100 ns accuracy. The precision timing sources can also be used to synchronize data across multiple mainframes in a distributed data acquisition system.

High Data Transfer Rates – Up to 100 MB/s Sustained Throughput

The EMX-2500 uses gigabit Ethernet to achieve up to 100 MB/s sustained data transfer rate from the PXI express mainframe.

Simplified Low Cost Cabling

Communication with the host processor is achieved using standard, low cost Cat 5e Ethernet cable. In addition, a standard Wi-Fi bridge can be used along with the EMX-2500 to wirelessly control the mainframe.

Software

Industry standard drivers and programming interfaces provide the flexibility and freedom of choice to select the application programming environment best suited for the application and specific development requirements.

All major programming environments are supported, including C/C++, C#, Visual Basic, Java, Python, Matlab, LabVIEW, and LabWindowsTM/CVI. VTI's innovative approach to driver development provides true OS independence without sacrificing the convenience that instrument drivers deliver. An IVI-like API can be imported into Linux and other operating systems. The intuitive APIs simplify programming; therefore, low-level coding is not required to access the full capability of the instrument.

In addition, depending on the application requirements, a wide variety of turn-key software solutions are available for use with the EMX-2500 and SentinelEX hardware.

EMX-2500 SPECIFICATIONS

Clock Specifications	
Clock Oscillator Accuracy	±50 ppm
Timestamp Accuracy	50 ns
Mechanical Specifications	
Front Panel Connectors	Dual RJ-45 Ethernet, USB MiniAB
Temperature	
Operating Temperature	0° C to 55° C
Storage Temperature	-40° C to 70° C
Humidity	5% to 95% (non-condensing)
Altitude	Up to 3,000 m
Shock and Vibration	Conforms to MIL-PRF-28800F, Paragraphs 4.5.5.3.1 (random vibration test), 4.5.5.3.2 (sinusoidal vibration test), and 4.5.5.4.1 (functional shock test)
Miscellaneous Specifications	
Power Consumption	
+3.3 V	3 A
+12 V	2 A
+5 V	500 mA
LXI Required Specifications	

Source	Destination	Min.	Typ.	Max.	Compensation[1]	Units
Alarm	EXT	22.5	22.8	23.1	20	ns
Alarm	PXI	18.1	18.8	19.1	20	ns
EXT	PXI	35.9	36.3	36.6	-	ns
PXI	EXT	19.2	19.5	19.8	-	ns
LAN	PXI	5.42	5.52	6.89	-	ms
EXT	LAN Timestamper[2]	28.4	28.7	28.8	-30	ns
PXI	LAN Timestamper[2]	13.3	13.6	14.1	-30	ns
LAN Timestamper	LAN Event	0.38	0.60	13.5	-	ms[3]

1) Timestamps are adjusted by this value to compensate for the known delay.
2) Represents the hardware signal delay between the trigger and the logic that detects and timestamps it. Delay for actually sending the LAN Event once it is detected and timestamped is given in the LAN Timestermp -> LAN Event specification.
3) The maximum time for events routed to the LAN depend on many factors (network traffic, bandwidth etc.) and can vary dramatically.

SECTION 2

PREPARATION FOR USE

OVERVIEW

This section provides a step-by-step process for setting up the EMX-2500 for use. It covers hardware installation, input connections, and cabling considerations.

UNPACKING



When the EMX-2500 is unpacked from its shipping carton, do not cut the plastic module retainer insert.

Remove the EMX-2500 from the retainer by properly unfolding the tension flaps that hold the module. Save the retainer insert and shipping carton as it can be used to ship the EMX-2500 in the event that it requires return to the manufacturer.

When the EMX-2500 is unpacked from its shipping carton, the contents should include the following items:

- EMX-2500 LXI-PXIe Controller Board with Gigabit Ethernet Interface
- EMX-2500 Quick Start Guide
- VTI Instruments' Drivers and Product Manuals Disc

All components should be inspected for damage. Also, take note of the MAC address indicated on the product ID label found on the modules shield. The MAC address may be required if problems arise when locating the module in the local network.

REQUIRED EQUIPMENT

In order to use the EMX-2500, the following items are required:

- A PXIe Mainframe/Chassis
- An unshielded Cat 5e Ethernet network cable not exceeding 100 m in length
- A Gigabit Ethernet switch (if multiple devices will be connected on the network)
- PXIe cards which are part of the test system

HARDWARE INSTALLATION

Once the system is defined and the EMX-2500 has been installed in the controller slot, connect the network cable from the EMX-2500 to the LAN switch or directly to the PC's NIC card. The EMX-2500 is auto-MDIX capable, making crossover cables unnecessary.

SOFTWARE INSTALLATION

The fastest way to begin controlling an EMX-2500 is to discover the unit using LXI Discovery Tool. To do this, the following software must be installed on the host PC

- A Microsoft™ Windows™ XP OS with Service Pack 2 (SP2) or higher
- Internet Explorer or similar internet browsers
- LXI Discovery Tool

The LXI Discovery Utility is open software provided by the LXI Consortium for development and distribution. After clicking the Search button, the utility uses VXI-11 and mDNS (multicast domain name service) discovery protocols to look for LXI products connected in the network. From the list of discovered products, the web page of an instrument can be accessed by double clicking on it.



Figure 2-1: LXI Discovery Tool

NETWORK CONFIGURATION

By default, the EMX-2500 will attempt to locate a DHCP server. If one is found, the IP address assigned by the DHCP server will be used. Otherwise, after a timeout of 20 seconds, the unit will attempt to obtain an IP address by using Auto IP.

Auto IP is a mechanism for finding an unused IP address in the range 169.254.X.Y, where X is in the range 1 through 254 and Y is in the range 0 through 255. The device will first attempt to obtain the specific address 169.254.X.Y, where X and Y are the second-to-last and last octets (bytes) of the device's MAC address. However, X will be set to 1 if it is 0 in the MAC address, and to 254 if it is 255 in the MAC address. This is in accordance with the Auto IP standard (RFC 3927). If this address is already in use, the unit will attempt to obtain other IP addresses in a pseudorandom fashion until it finds one that is available.

When installed into the VTI CMX09 chassis, the chassis' front panel button screen can be used to discover the IP Address and hostname of the EMX-2500. Press the up or down buttons until it displays the **ETH-A Addresses** screen. The hostname, IP Address, and MAC Address are displayed here.

SYNCHRONIZATION CONSIDERATIONS

The EMX-2500 itself and the EMX and SMX peripherals cards installed in the chassis that the EMX-2500 is acting as system controller for can be synchronized via two main methods: IEEE 1588 or hardware.

IEEE 1588

IEEE 1588 is a network protocol for synchronizing clocks. It allows more physical separation of devices while still providing synchronization to an accuracy of only a few dozen nanoseconds in some cases. It generally operates over UDP multicast within a local area network. See *Time Configuration* in *Section 5* for information on enabling IEEE 1588 on the EMX-2500.

When configured for IEEE 1588 synchronization and installed in a VTI CMX09 or CMX18 chassis, the EMX-2500 outputs a 50 MHz clock, synchronized to IEEE 1588, onto the ACQ_CLK backplane line. This clock is controlled via a DAC and VCXO (rather than by dropping and inserting edges, as some IEEE 1588 synchronized clocks), making it suitable for use as a stable sampling clock. See the user's manuals of the specific peripheral card(s) in use for details on how to synchronize that card's sampling and/or timestamping clocks to this line.

Many factors can contribute to noise in an IEEE 1588 synchronized system. Minimizing those noise sources will lead to better synchronization and better stability of the synchronized clocks.

Master Clock Drift

The stability of an IEEE 1588 system is only as good as the stability of the master clock. While the EMX-2500 itself can act as a master clock, the 248 clock class oscillator is designed to be widely adjustable, so that it can synchronize to a wide variety of masters. This makes it a good slave, but also causes its internal clock to drift with temperature when acting as master. It is recommended to use a high-quality (clock class 6) dedicated master clock with an oven-controlled oscillator and a good source of time (such as GPS) to minimize drift.

Network Infrastructure

Because IEEE 1588 messages are transported over Ethernet, network latency and jitter can affect the quality and stability of synchronization. Several different levels of mitigation can be used to minimize these factors.

- **Limit network depth** – Each hub or switch in between two clocks adds another opportunity for jitter and latency to be introduced. Ideally, all clocks would be connected to the same hub or switch.
- **Use a hub** – Since hubs directly connect the network ports to each other, there is minimal latency or jitter. This is not recommended when network traffic is high, as hubs provide more opportunity for packet collisions.
- **Use high-quality, deterministically timed switches** – Low quality switches may introduce more jitter by taking significantly longer to re-transmit some packets than others.
- **Use a transparent clock** – A transparent clock is essentially a network switch, with the added feature that it listens in on IEEE 1588 traffic, and edits the correction field of IEEE 1588 Event messages to accurately represent the time the packet spent resident in the switch. This makes latency a known quantity that the slave clocks can correct for much more easily.

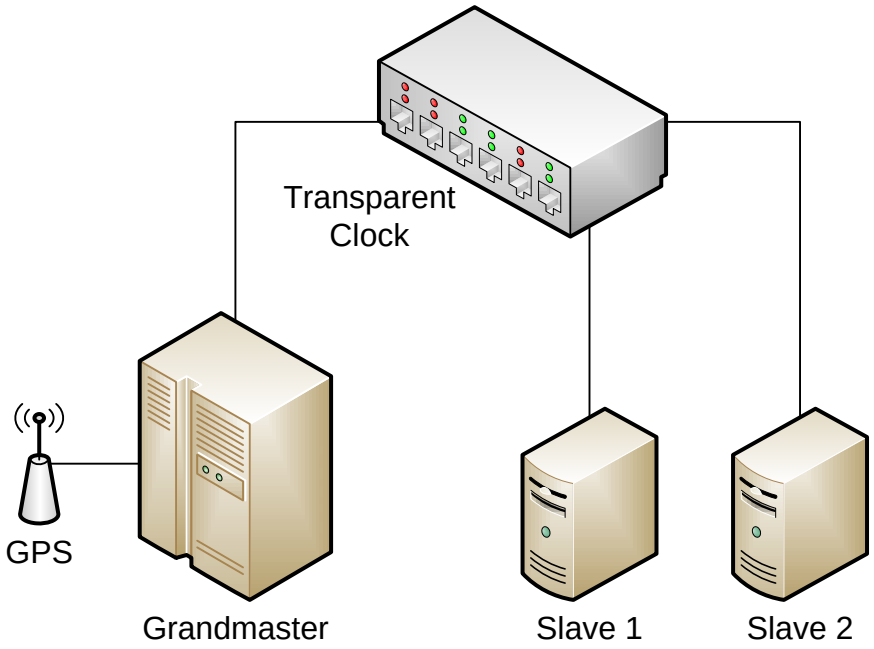


Figure 2-2: Ideal IEEE 1588 Configuration

Hardware Synchronization

Synchronizing peripherals via hardware provides the most accurate synchronization, but can only be done when the devices are in close proximity.

When using a VTI CMX09 or CMX18 chassis, the rear panel 10 MHz REF IN/OUT connectors can be used to precisely synchronize the PXI_CLK10 and PXIe_CLK100 signals of each chassis. Simply connect the OUT of the master chassis to the IN of the others. No software configuration is necessary to cause the chassis to import the external clock. Configure the peripheral cards to use PXIe_Clk100 (the default) or PXI_Clk10 to take advantage of this.

The Front Panel Trigger of the EMX-2500 can be used to import or export synchronization signals from the installed peripheral cards. See *Trigger Mechanisms* in *Section 6* and the peripheral card's specific manual for more details on how to configure this.

SECTION 3

MODULE DESCRIPTION

BLOCK DIAGRAMS

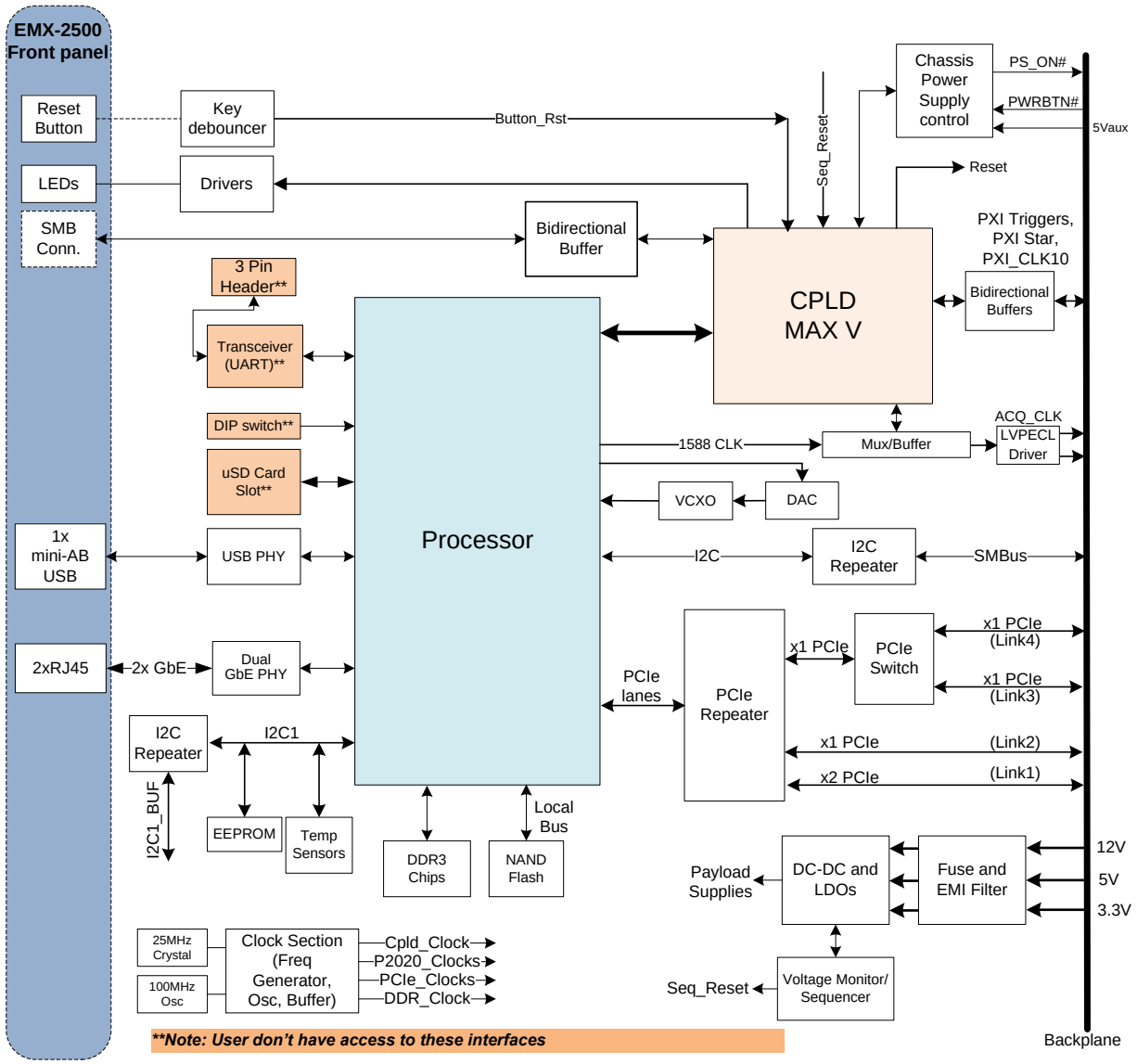


Figure 3-1: Hardware Block Diagram

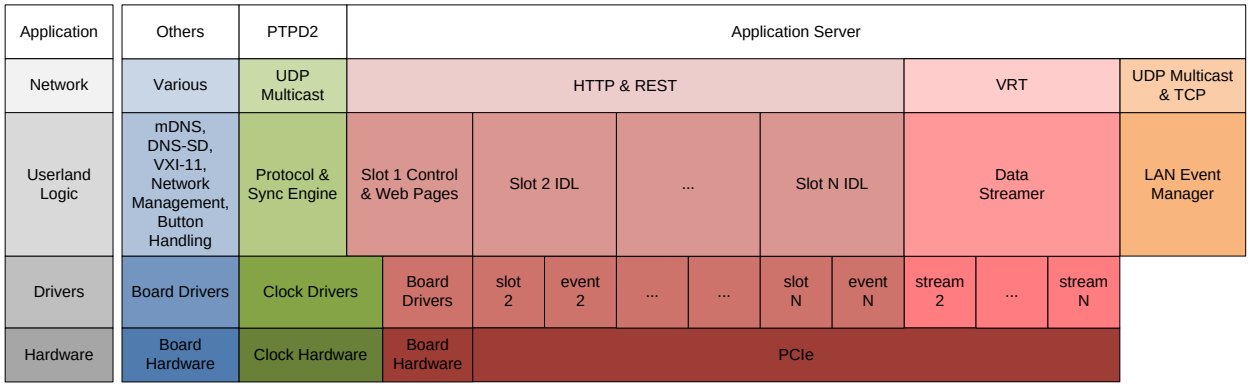


Figure 3-2: Software Block Diagram

THEORY OF OPERATION

Hardware

PXIe / cPCIe Compatibility

The EMX-2500 will work as a system board in a PXIe/cPCIe chassis system slot. This module provides four PCIe links that lead to the PCIe root complex, along with their associated PCI express reference clocks. It also provides the power supply control signaling, reset, and SMBus master functionality. It uses system board connectors including the XP1 7-position power connector, the XJ2 ADF connector, the XJ3 ADF connector, and the XJ4 eHM connector.

Chassis/System Power Supply Control Functionality

In general, the mechanical momentary switch in the chassis controls the chassis power supply on/off. As per cPCIe specifications, this control mechanism should be part of system board function.

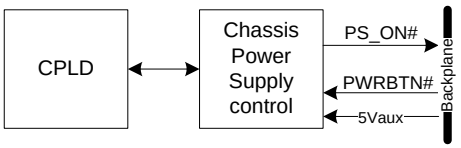


Figure 3-3: Chassis/System Power Supply Control Block Diagram

Figure 3-3 shows the signals used in the chassis/system power supply control mechanism. The PWRBTN# signal is an input signal to the EMX-2500 board from mechanical momentary switch which is a Power ON/OFF switch in chassis/system. Whenever the switch is pressed, the signal PWRBTN# changes state from open-circuit to ground to open-circuit. Based on this transition, the chassis' Power control signal, PS_ON#, will be activated to enable the power supply outputs from the chassis power supply. This circuit is powered by the 5Vaux line from the chassis power supply which is not controlled by the PS_ON# signal and the 5Vaux is always available whenever AC power is present.

Because the PWRBTN# signal is from a mechanical switch, it is debounced before use in the control circuit. Chassis/systems that don't support 5Vaux leave the PWRBTN# pin unconnected at the system slot.

During software shutdown, CPLD makes the PS_ON# inactive, so that chassis/system power supply shuts off.

The cPCIe chassis power supply generates a “power good” signal (PWR_OK) to the board, which indicates all DC power rails are within their regulation limits.

Reset

All the reset generation signals are connected to the CPLD and, in turn, controls the P2020 processor and its peripherals.

There is a voltage monitor control circuit on the board which enables the local power supply, in sequence, based on the PWR_OK signal from backplane. Until all the local power supplies are enabled, it keeps its voltage monitor reset# output signal in the active state.

The reset button is used for normal reset function of the board and for the LAN reset function.

Clock Distribution

The clock section distributes reference clock signals to CPLD, processor, PCIe lanes, DDR section, etc. from the 25 MHz crystal and 100 MHz oscillator.

I2C, SMBus

The processor has two I2C buses. Both the I2C buses are used in this board.

One of the I2C bus is directly connected to backplane via I2C repeater to communicate with backplane SMBus. The processor can use the SMBus to get all the chassis environment data, such as temperature, fan speed, backplane board details, trigger routing between trigger segments, etc.

The second I2C bus is connected to local peripheral components like EEPROM, onboard temperature sensors, etc.

VCXO, DAC

The board has VCXO which gives reference clock for generation of IEEE 1588 clock out from the Freescale P2020 processor. There is a DAC which controls the VCXO clock output resolution. This DAC is programmable from the processor via a SPI bus.

IEEE 1588 Clock Output

The Freescale P2020 processor’s 1588 clock output is given to the backplane as ACQ_CLK with LVPECL level. This ACQ_CLK clock can be used as a synchronization and timestamping clock for peripheral boards within the chassis, when EMX-2500 is used in VTI CMX09 or CMX18 chassis.

PXI Trigger, PXI STAR, PXI CLK10 lines

The PXI STAR trigger and PXI CLK10 10 MHz signals are routed to CPLD and, in turn, can be routed (user programmable) to front panel trigger or to the processor.

All eight PXI trigger lines are routed to CPLD and in turn can be routed to/from front panel trigger or to/from processor.

PCIe lanes

The EMX-2500 provides four PCIe links on backplane. The Freescale P2020 processor has three PCIe controllers/ports with four lanes. With help of a PCIe switch, four links has been created and connected to backplane with limited lanes. Link1 has x2 lanes. Link 2 has a dedicated x1 link, while links 3 and 4 share a single x1 link.

A PCIe repeater with programmable input and output termination, programmable receiver equalization and amplifier, signal detection with glitch filter, programmable output swing, slew

rate, and de-emphasis with delay control is included. It is used to compensate for PCB trace attenuation and ISI jitter, thereby extending connection reach. This allows the EMX-2500 to communicate in chassis with PCIe trace lengths of over 65 inches.

Gigabit Ethernet

This board has two 10/100/1000BASE-T Gigabit Ethernet ports with RJ-45 connector on the front panel. Currently, only ETH-A is implemented. ETH-B may be enabled via a future firmware update.

USB 2.0

This board has one USB OTG port with mini-AB USB connector on face plate. This interface is not yet implemented and may be enabled by a future firmware update.

SOFTWARE

Application Server

The bulk of the work in the EMX-2500 software is performed in the application server. It is chiefly an HTTP server that serves the web pages that provide a standard LXI interface to the EMX-2500, as well as a REST API for controlling the EMX-2500 hardware. It also dynamically loads an IDL file from the onboard nonvolatile memory of each installed EMX and SMX plugin card. Each IDL serves its own plugin's unique REST API, and contains application logic specific to that module.

The application server devotes an independent thread to copying high-speed streaming data between PCIe and Ethernet as quickly and efficiently as possible for each plugin. Data is encoded by the plugins into VRT format (See VITA 49.0), and transferred via DMA to the EMX-2500, which then writes it directly to the network. VRT-encoded data can also be sent to the EMX-2500 via Ethernet, and will be copied to the plugins similarly.

The application server also includes the LAN Event Manager, which manages the sending and receiving of all LXI LAN Event Messages on the EMX-2500. Both the Plugin IDL modules as well as the Slot 1 Control code can register to receive notification when a particular type of LAN Event packet arrives. They can also use it to send a LAN Event in response to internal events. These capabilities are provided transparently via the IVILXISync-compatible **Arm**, **Trigger**, and **Events** interfaces of the REST API and IVI Instrument Drivers.

PTPD2

The version 2 PTP daemon implements the IEEE 1588-2008 protocol. It provides the ability for the EMX-2500 to act as a master or slave in a PTP2 system. It makes use of a hardware clock and packet timestamper for increased synchronization accuracy.

Others

Other applications in the EMX-2500 provide discovery via mDNS/DNS-SD and VXI-11, manage network status and settings, and handle hardware button events.

FRONT PANEL DETAILS

This section details each element found on the EMX-2500 front panel and describes the intended use of these elements. See Figure 3-4 below as a reference while the EMX-2500 front panel is discussed.



Figure 3-4: EMX-2500 Front Panel

LEDs

- **PWR:** indicates that the power supply voltages lines are at the correct voltage. This LED will temporarily glow red when the EMX-2500 is initially powered up. During power-down or reboot, it will blink green. During normal operation it will be solid green.
- **LAN**: indicates the LAN status of the EMX-2500.
  A solid green LAN LED indicates normal operation.
  A flashing green, LAN LED indicates that the EMX-2500 has received a device identification command. The LAN LED will continue to flash until it is turned off via the web page.
  A solid red LAN LED indicates that a LAN fault has been detected. This may be a failure to acquire a valid IP address, to renew a DHCP IP lease, detection of a duplicate IP address, or that the LAN cable has been disconnected.
- **1588**: indicates the EMX-2500's IEEE 1588 synchronization status.
  A solid green 1588 LED indicates that the EMX-2500's device clock is an IEEE 1588 slave.
  A 1588 LED flashing green once per second indicates that its clock is the IEEE 1588 master.
  A 1588 LED flashing green once every two seconds indicates that the EMX-2500 is the IEEE 1588 grandmaster.
  If the LED is solid red, an IEEE 1588 fault has occurred.
  If this LED is not illuminated, it the EMX-2500 is not configured to use IEEE 1588.
- **Ethernet Link Status Indicators**
  - **ETH A/B**: provides link status for the established "GIGABIT ETHERNET" connection of both ports. When a cable is connected and the physical layer of the link is established successfully, the bottom LED is green. Otherwise, it is not lit.

NOTE	Ensure that LED control is returned to "Normal" when exiting the LED test or Device Identification section of the web interface.

Connectors

- **ETH-A and ETH-B**: an RJ-45 connector that accommodates Category 5e (Cat 5e) twisted pair.

- **TRIG IN/OUT**: SMB connector used to route high-precision triggering signal.
- **USB:** One OTG port, mini-AB USB connector , USB 2.0

LAN RST Button

LXI LAN Configuration Initialize (LCI) Mechanism

The LAN RST button, implemented according to the LXI LAN Configuration Initialize (LCI) Mechanism specification, on the EMX-2500 front panel provides a mechanism for recovery from an unknown or incorrect network configuration. If, for example, the EMX-2500 was statically configured for test or demonstration purposes and was not returned to "DHCP/AUTO IP" mode, the module may not be found by the original network setup. Pressing the LAN RST button will place the EMX-2500's IP configuration mode into "DHCP/AUTO IP", ensures that IPv6 is enabled, and resets any conflict-resolved hostnames or mDNS service names to their original user-configured values.

Gigabit Ethernet Functionality

The EMX-2500 has two twisted pair gigabit Ethernet interfaces with RJ-45 connectors (ETH-A and ETH-B). The EMX-2500 provides auto-MDIX functionality that automatically handles crossover in point-to-point connections. The unit will also detect and correct pairs that are wired backwards. Therefore, crossover cables can be used, but are not required.

ETH-A is the primary interface. At the time of this writing, ETH-B is not implemented and should not be used.

SECTION 4

SOFTWARE INSTALLATION

INTRODUCTION

System Requirements

- A PC with Windows or an LSB 3.1-compatible Linux distribution. For Windows, Windows XP, Windows Vista 32, Windows 7 (32-bit and 64-bit), Windows 8 (32-bit and 64-bit) are supported.
- An Ethernet port and a LAN cable to connect to EMX-2500 Ethernet controller.
- For Linux systems, a C++ compiler (such as g++) and associated toolchain. For Windows, any programming language that supports IVI-C, or IVI-COM, such as MS VisualStudio, Mathworks Matlab®, NI LabVIEW®.

PREREQUISITES

IVI Shared Components Installation (Windows Only)

If this component was installed during a previous LXI instrument installation, please proceed to the *VTEXPlatform Driver Installation* step. First, close all other open programs, leaving only Windows Explorer open. Navigate to the *<CD-ROM Drive>:\LXI Drivers\EX Platform Requisites* directory on the CD and run the **IVISharedComponents2.2.1.exe** program. Next, follow the on-screen instructions. Do not proceed to the next step until this installation completes successfully. If instructed to reboot the PC, it will be necessary to do so at that time.

Alternatively, the latest IVI shared components can be downloaded and installed from IVI Foundation webpage as shown below.

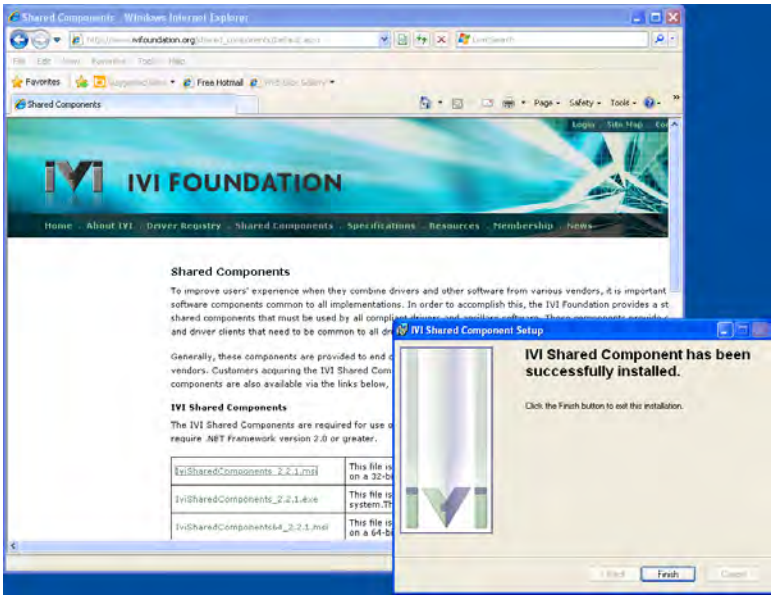


Figure 4-1: IVI Shared Component Installation

VTEXPlatform Driver Installation

To install the VTEXPlatform driver, navigate to *<CD-ROM Drive>:\LXI Drivers\EMX Driver, IVI* on the CD and run the .msi installer located in this directory.

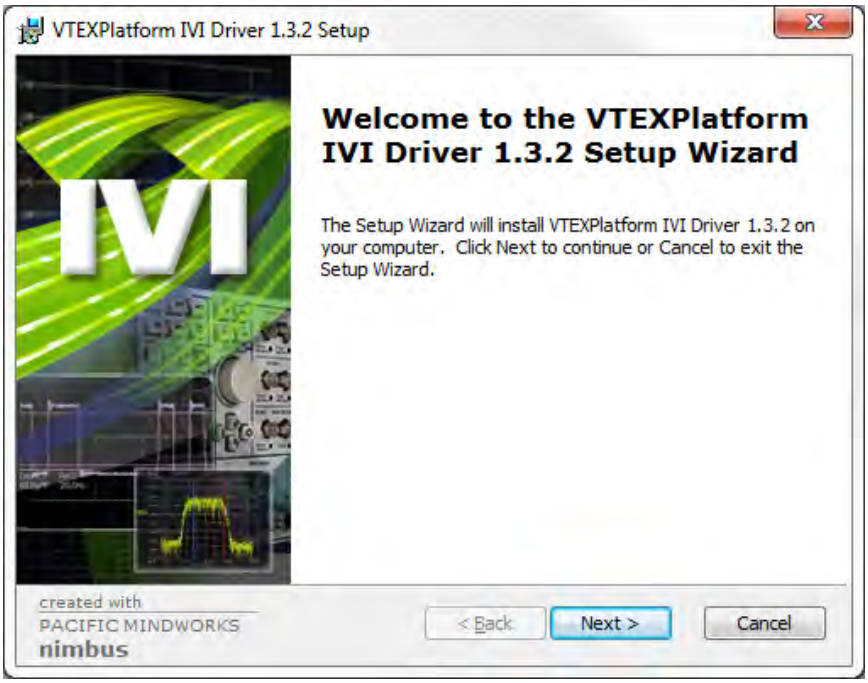


Figure 4-2: Instrument Driver Installation

The Linux driver (32-bit and 64-bit) is located under *<CD-ROM Drive>:*\Drivers\Linux Drivers\Linux EMX Series. Install the platform-independent lsb-vti-libcommon pacakage as well as the lsb-vti-libplatform package appropriate for your system's architecture.

BUILDING AND RUNNING EXAMPLE PROGRAMS

The instrument drivers come with example programs that the user can build and execute. Example programs are in C++ and C# (Windows only) programming language. They are installed in *Examples* sub-folder under standard IVI driver installation folder and can built and run using Microsoft Visual Studio.

Windows Examples

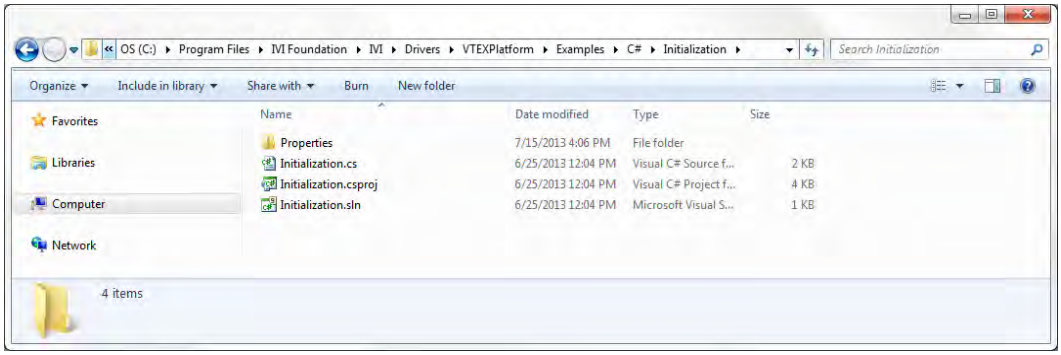


Figure 4-3 Example Programs

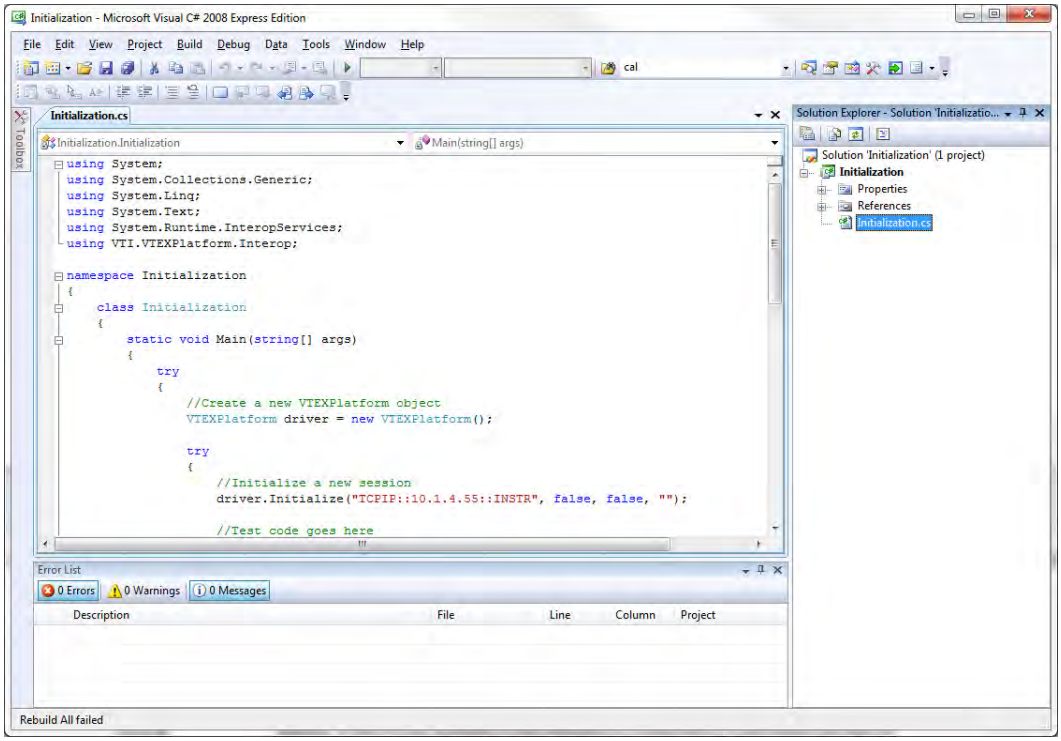


Figure 4-4: Building an Example

Linux Examples

Linux examples are stored at */opt/vti/share/doc/platform/examples/*. To build them, copy that folder to a writable location, change directory to the *examples* folder and run *make*.

```
~$ cd /tmp

/tmp$ cp -r /opt/vti/share/doc/platform/examples/ .

/tmp$ cd examples/

/tmp/examples$ make

g++ -o Initialization Initialization.cpp -I/opt/vti/include  -L/opt/vti/lib -Wl,-
rpath=/opt/vti/lib -lPlatform

/tmp/examples$ ./Initialization 10.20.10.158
```

SECTION 5

WEB PAGE OPERATION

OPENING THE WEB PAGE

To open the embedded web page, open any web browser and enter the IP address or hostname of the EMX-2500 into the address bar. By default, the EMX-2500 will first attempt to use DHCP to set its IP address. If DHCP is not available on the network, it will instead use Auto IP. Determining the Auto IP address is discussed in the *Network Configuration* discussion in *Section 2*. Alternatively, other discovery methods, such as VXI-11, can be used as well.

GENERAL WEB PAGE OPERATION

When initially connected to the EMX-2500, the instrument home page, or **Index**, appears. This page displays instrument-specific information (see the *Index* section for details). This page is accessible from any other instrument page by clicking on the EMX-2500 web page header. The EMX-2500 Navigation Menu is displayed on the left hand side of every internal web page. The entries on the Navigation Menu represent two types of pages:

- **Status**: These pages perform no actions and accept no entries. It provides operational status and information only. The **Index** page is an example of a status page.
- **Entry**: These pages display and accept changes to the configuration of the instrument. The **Network Configuration** page is an example of an entry page.

Use of the entry-type web pages in the EMX-2500 are governed by a common set of operational characteristics:

- Pages initially load with the currently-entered selections displayed.
- Each page contains a **Submit** button to accept newly entered changes. Leaving a page before submitting any changes has the effect of canceling the changes, leaving the instrument in its original state.
- Navigation through a parameter screen is done with the *Tab* key. The *Enter* key has the same function as clicking the Submit button and cannot be used for navigation.

LOGIN

When accessing a page that changes EMX-2500 configuration parameters, a password may be required. If so, the **Login** page will appear.

To log in, simply enter the password in the given text field, and press the *Submit* button. By default, the EMX-2500 has no password. To change the password, visit the **Change Password** page. If the password is unknown, pressing the LAN RST Button will reset the EMX-2500 to no password.



Figure 5-1: EMX-2500 Login Page

INDEX

The **Index** page provides the general information about the EMX-2500.

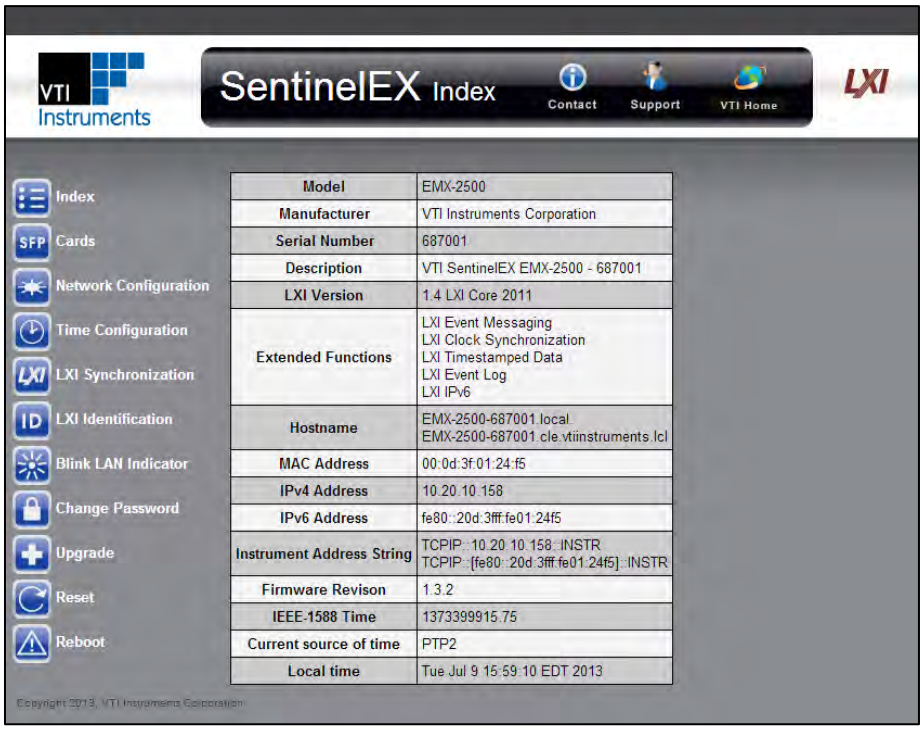


Figure 5-2: EMX-2500 Index Page

- **Model**: The model number of the module.
- **Manufacturer**: The module manufacturer.
- **Serial Number**: The module's serial number.
- **Description**: A brief, user-configurable description of the module.
- **LXI Version**: Indicates the LXI specification version to which the module conforms.
- **Extended Functions**: Indicates which LXI Extended functions are supported.
- **Hostname**: Indicates the Full Qualified Domain Names of the module. The first part of each FQDN is the user-configured hostname.
- **MAC Address**: Indicates the factory-assigned MAC address of the module.
- **IPv4 Address**: Indicate the current IPv4 address of the module.
- **IPv6 Address**: Indicates the current IPv6 address(es) of the module.
- **Instrument Address String**: Indicates the resource string(s) by which the module can be accessed via its instrument driver.
- **Firmware Revision**: Indicates the current revision of the module's firmware.
- **IEEE 1588 Time**: The current IEEE 1588 time.
- **Current Source of Time**: Indicates from which source the module is deriving its time.
- **Local Time**: The module's current time, as expressed in the currently configured time zone.

CARDS

The **Cards** page lists all modules currently installed in the chassis in which the EMX-2500 is acting as controller module.



Figure 5-3: EMX-2500 Cards Web page

The following information is provided for each module:

- **Device**: The bus and slot number of the module.
- **Model**: The model number of the module.
- **Revision**: The firmware version of the module.
- **Serial**: The serial number of the module.
- **Description**: A brief description of the module.
- **Resource**: A resource string that can be used to access the module via its instrument driver.

NETWORK CONFIGURATION

The **Network Configuration** page contains information concerning the configuration of the EMX-2500's network interfaces, and provides the ability to modify it.

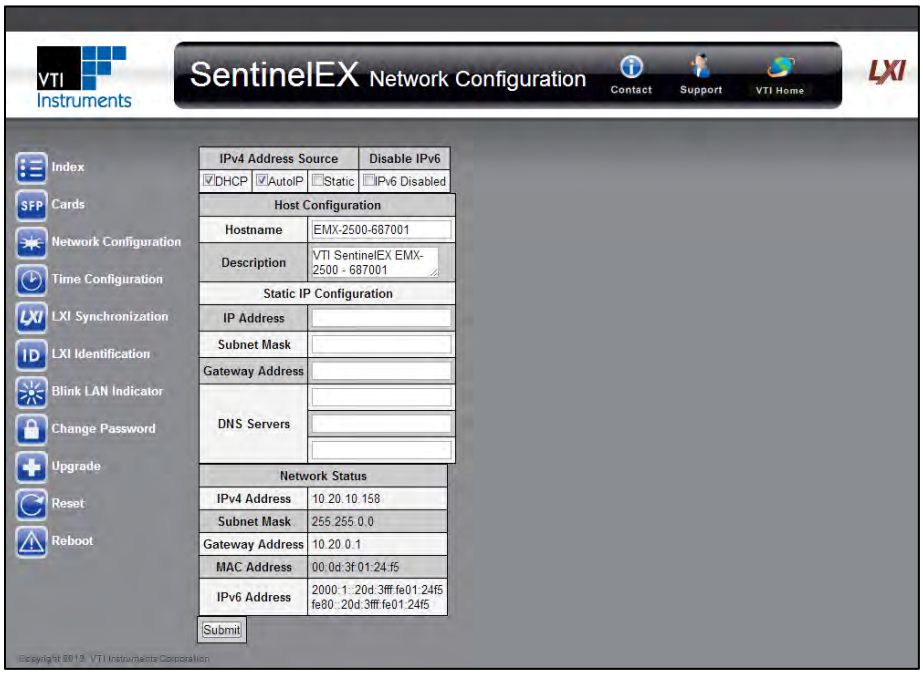


Figure 5-4: EMX-2500 Network Configuration Page

- **IPv4 Address Source**: The IPv4 address for the EMX-2500 is determined by one of three sequenced mechanisms: **DHCP → AutoIP → Static**. If an IP address cannot be obtained with the first mechanism, it will progress to the next method. The user also has the ability to enable or disable either of these methods by utilizing the adjacent checkboxes.
  - **DHCP**: A protocol that obtains an IP address automatically if the EMX-2500 is connected to a network with a DHCP server. By default, the EMX-2500 will attempt to locate a DHCP server. If one is found, the IP address assigned by the DHCP server will be assumed. Otherwise, after a timeout of 20 seconds, the unit will attempt to obtain an IP address by using AutoIP.
  - **AutoIP**: A protocol that automatically creates a link-local IP address based on the EMX-2500's MAC address. If the IP address created is not available on a network, another IP will be chosen randomly.
  - **Static**: A user-configured IP address which remains constant. Both DHCP and AutoIP generated IP addresses may change after a reset condition.
- **Disable IPv6**: When checked, IPv6 addressing will be disabled and the EMX-2500 will only be accessible via IPv4.
- **Hostname**: Indicates a name which other devices may use to communicate with the EMX-2500 instead of using its IP address. When mDNS service discovery is used, the host name for the unit will appear. The default hostname is "EMX-2500-[serial number]". To reset the hostname to the factory default, delete the current value and submit the page with nothing in this field.
- **Device Description**: This user-configurable field can be used to provide additional information regarding the module (i.e. location, use, etc.). This is visible on the **Index** page without the need for a password. If set, this description will be used as the Service Name for mDNS service discover instead of the hostname above. To reset the description to the factory default, delete the current value and submit the page with nothing in this field.

- **Static IP Configuration**: This configuration section is used to create a static IP address.
  - **IP Address**: The user-configured IP address is entered into this text field.
  - **Subnet Mask**: Defines the range of IP addresses the EMX-2500 will attempt to connect to directly (255.255.255.0 means match all but the last number, etc.).
  - **Gateway Address**: The IP address of a server that EMX-2500 can use to contact IP addresses external to its network.
  - **DNS Servers**: This field is used to provide the IP addresses of servers that the EMX-2500 module may use to look up hostnames (e.g. www.vtiinstruments.com).
- **Network Status**: Indicates the current network settings for the EMX-2500's IPv4 Address, Subnet Mask, Gateway Address, MAC Address, and IPv6 Address.

TIME CONFIGURATION

The **Time Configuration** page contains information concerning the configuration of the EMX-2500's source of time and provides the ability to modify it.



Figure 5-5: EMX-2500 Time Configuration Page

- **Time Configuration**
  - **Time Zone**: Allows the user to select the time zone for displaying the current local time.
  - **Time Source**: Selects the method to use for setting the EMX-2500's time.
    - **PTP2**: *Precision Time Protocol Version 2* (IEEE 1588-2008) will be used to synchronize the EMX-2500's time with a master clock on the network, or to act as master clock based on the IEEE 1588 Best Master Clock algorithm.
    - **NTP**: *Network Time Protocol* will be used to synchronize the EMX-2500's time to a remote server, which is specified in the **NTP Server** field below.
    - **Manual**: The time will be set manually by the user via the **Set Time** option below.
  - **NTP Server**: The IP address or hostname of the server from which to derive time when the **NTP** option is selected. If this is left blank, one of the following values will be used by instead:
    - If the EMX-2500 is configured for DHCP, and if the DHCP server supplies the address of an NTP server, that will be used. Otherwise, the default value of pool.ntp.org will be used.

- **Set Time**: Checking the **Set Time** box causes the **Date** and **Time** fields to appear. They will be automatically populated with the current time of the user's PC. When using the **Manual** option, this sets the EMX-2500's current date and time. When using the **PTP2** option, this causes a message to be sent to the current master clock, requesting that it set its time.

- **Time Status**
  - **Current Time**: The current date and time of the EMX-2500, translated to the UTC time-base and the selected time zone.
  - **PTP Status**: The current state of the **PTP2** protocol within the EMX-2500.
  - **Offset From Master (ns)**: An estimate of the current error, in nanoseconds, of the EMX-2500's time from that of its PTP master.

LXI SYNCHRONIZATION

The **LXI Synchronization** page provides status on the EMX-2500's synchronization status.

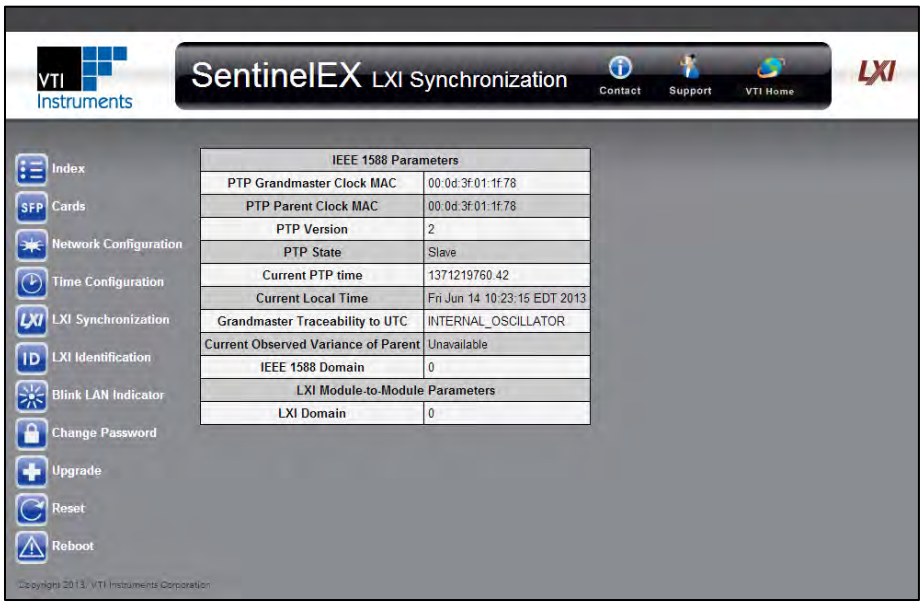


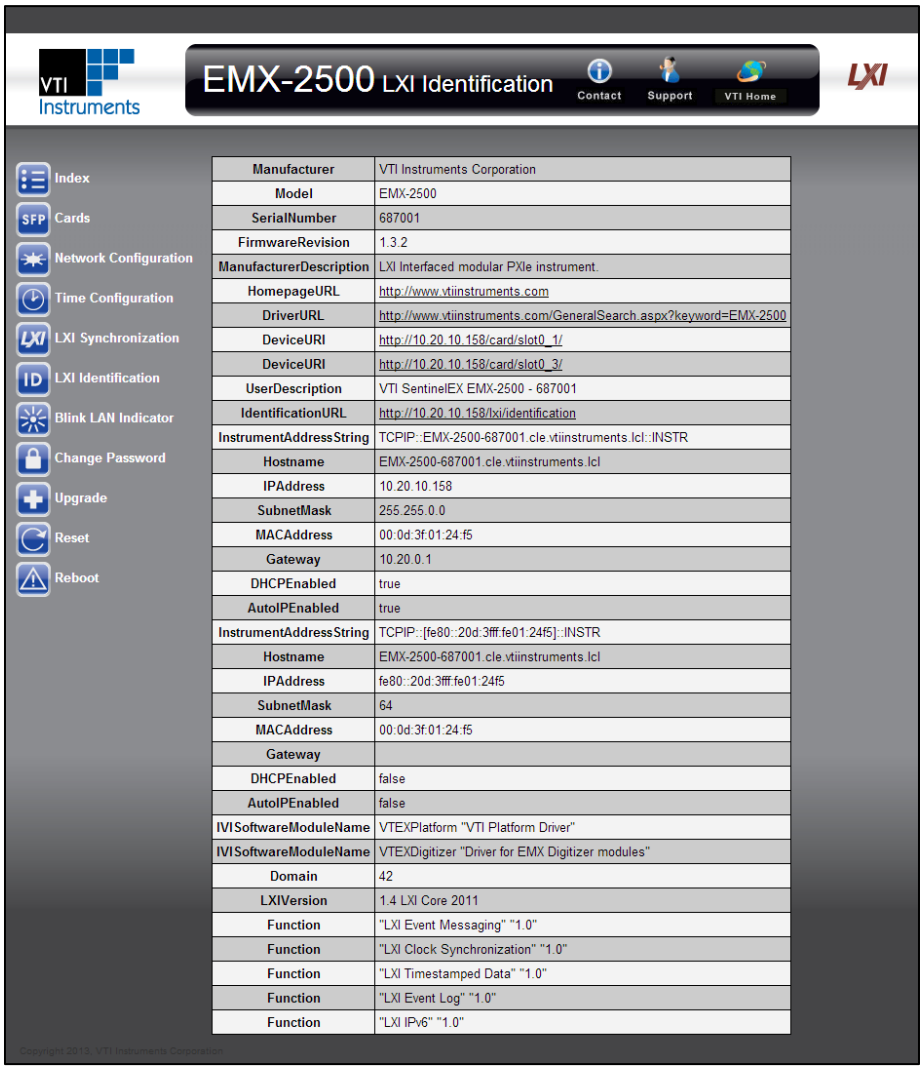
Figure 5-6: EMX-2500 LXI Synchronization Page

- **IEEE 1588 Parameters**
  - **PTP Grandmaster Clock MAC**: The MAC address of the device on the network to which all other IEEE 1588 compliant devices are synchronized.
  - **PTP Parent Clock MAC**: The MAC address of the device to which the EMX-2500 is synchronized. In a hierarchical IEEE 1588 system with boundary clocks, this indicates the MAC address of the parent clock on the local link.
  - **PTP State**: Indicates whether the EMX-2500 is initializing, faulty, disabled, listening, pre-master, master, passive, uncalibrated, or slave.
  - **Current PTP Time**: The current time on the EMX-2500, expressed as the number of seconds since midnight January 1, 1970 TAI.
  - **Current Local Time**: The current date and time of the EMX-2500, translated to the UTC time-base and the selected time zone.
  - **Grandmaster Traceability to UTC**: Indicates how the grandmaster is synchronized to UTC. The values provide an indicator of how closely synchronized the grandmaster is to UTC time.
  - **Current Observed Variance of Parent**: This function is not supported by the EMX-2500.

- **IEEE 1588 Domain**: The instrument's PTP domain. Typically, this indicator is 0.
- **LXI Module to Module Parameters**
  - **LXI Domain**: An 8-bit number, 0 to 255, which indicates the domain the EMX-2500 is using for LAN Events. All events sent by this device will include this number. Likewise, the device will only accept events that include the same LXI Domain number.

LXI IDENTIFICATION

The **LXI Identification** page is an XML document providing identifying information on the EMX-2500 and the other modules installed in the chassis in which it is acting as controller.



Manufacturer	VTI Instruments Corporation
Model	EMX-2500
SerialNumber	687001
FirmwareRevision	1.3.2
ManufacturerDescription	LXI Interfaced modular PXIe instrument.
HomepageURL	http://www.vtiinstruments.com
DriverURL	http://www.vtiinstruments.com/GeneralSearch.aspx?keyword=EMX-2500
DeviceURI	http://10.20.10.158/card/slot0_1/
DeviceURI	http://10.20.10.158/card/slot0_3/
UserDescription	VTI SentinelEX EMX-2500 - 687001
IdentificationURL	http://10.20.10.158/lxi/identification
InstrumentAddressString	TCPIP::EMX-2500-687001.cle.vtiinstruments.lcl::INSTR
Hostname	EMX-2500-687001.cle.vtiinstruments.lcl
IPAddress	10.20.10.158
SubnetMask	255.255.0.0
MACAddress	00:0d:3f:01:24:f5
Gateway	10.20.0.1
DHCPEnabled	true
AutoIPEnabled	true
InstrumentAddressString	TCPIP::[fe80::20d:3fff:fe01:24f5]::INSTR
Hostname	EMX-2500-687001.cle.vtiinstruments.lcl
IPAddress	fe80::20d:3fff:fe01:24f5
SubnetMask	64
MACAddress	00:0d:3f:01:24:f5
Gateway	
DHCPEnabled	false
AutoIPEnabled	false
IVISoftwareModuleName	VTEXPlatform "VTI Platform Driver"
IVISoftwareModuleName	VTEXDigitizer "Driver for EMX Digitizer modules"
Domain	42
LXIVersion	1.4 LXI Core 2011
Function	"LXI Event Messaging" "1.0"
Function	"LXI Clock Synchronization" "1.0"
Function	"LXI Timestamped Data" "1.0"
Function	"LXI Event Log" "1.0"
Function	"LXI IPv6" "1.0"

Figure 5-7: EMX-2500LXI Identification Page

- **Manufacturer**: The module manufacturer.
- **Model**: The model number of the module.
- **SerialNumber**: The module's serial number.
- **FirmwareRevision**: Indicates the current revision of the module's firmware.
- **ManufacturerDescription**: A brief description of the module.
- **HomepageURL**: The address of the manufacturer home page.

- **DeviceURI**: Indicates the URI of the identification page of a sub-device connected to the module.
- **UserDescription**: The user-configurable description field.
- **IdenficiationURL**: The canonical URL of this document.
- **Network Interface Information**: The following fields will be repeated once for each network interface present in the module:
  - **InstrumentAddressString**: Indicates the resource string by which the module can be accessed via its instrument driver.
  - **Hostname**: Indicates the Full Qualified Domain Name of the module. The first part of the FQDN is the user-configured hostname.
  - **IP Address**: Indicate the current IP address of the module.
  - **SubnetMask**: Indicates the range of IP addresses the EMX-2500 will attempt to connect to directly.
  - **MAC Address**: Indicates the factory-assigned MAC address of the module.
  - **Gateway**: The IP address of a server that EMX-2500 can use to contact IP addresses external to its network.
  - **DHCPEnabled**: Indicates whether DHCP is enabled on the interface.
  - **AutoIPEnabled**: Indicates whether AutoIP is enabled on the interface.
- **IVISoftwareModuleName**: Indicates the name and description of an IVI-compliant instrument driver that can be used to control the instrument.
- **Domain**: The LXI LAN Event Domain number, 0-255.
- **LXIVersion**: Indicates the LXI specification version to which the module conforms.
- **Function**: Indicates an LXI Extended Function, and its version, that is supported by the module.

BLINK LAN INDICATOR

The **Blink LAN Indicator** page allows identification of the device being accessed by causing its LAN LED to blink.

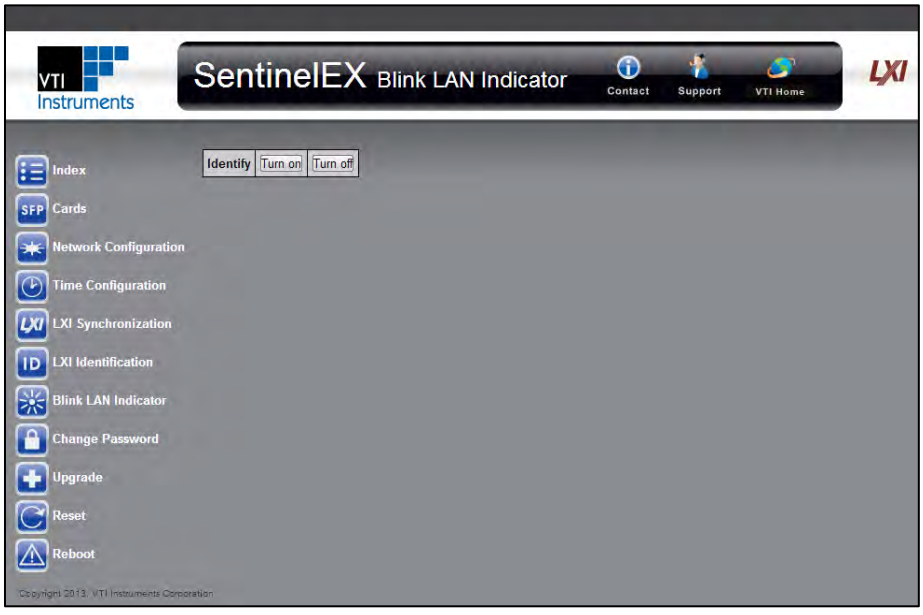


Figure 5-8: EMX-2500 Blink LAN Indicator Page

- **Turn On**: Cause the EMX-2500's LAN LED to blink.
- **Turn Off**: Cause the EMX-2500's LAN LED to stop blinking.

CHANGE PASSWORD

The **Change Password** page allows the password to be updated.



Figure 5-9: EMX-2500 Change Password Page

- **Password**: Set a new password to control access to configuring the EMX-2500. Setting an empty password disables password requirements.

UPGRADE

The **Upgrade** web page provides the ability to upgrade the firmware of the EMX-2500 and other modules in the chassis it is acting as controller of. Upgrade files are available from the *VTI Instruments User's Manuals and Drivers CD*, or from the VTI Instruments web site, at http://www.vtiinstruments.com/Downloads.aspx.

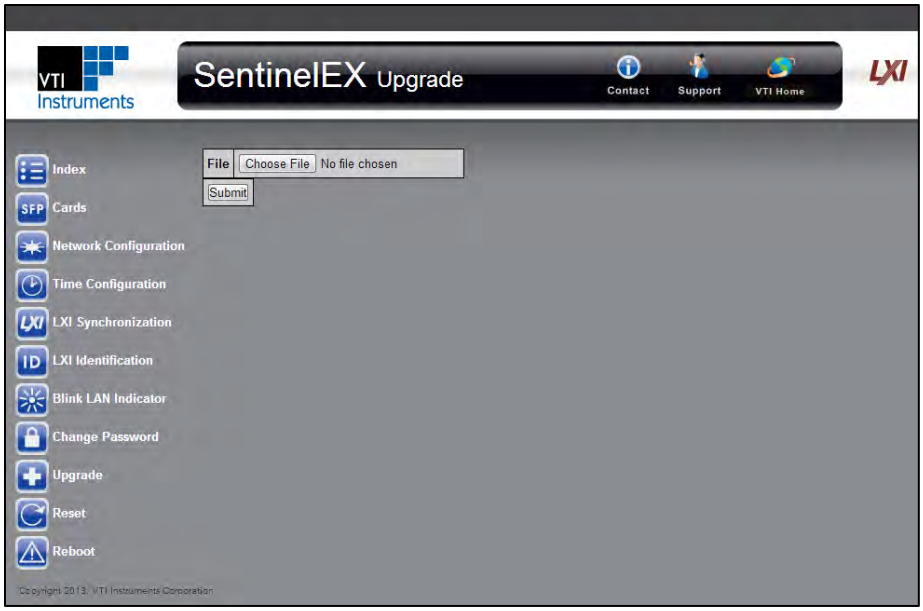


Figure 5-10: EMX2500 Upgrade Page

- **File**: Allows the user to browse to find their desired upgrade file.

RESET

The **Reset** page allows all the EMX-2500 and modules in the chassis it is acting as controller of to be returned to power-on default settings. This operation is faster than a reboot, but does not load new firmware.

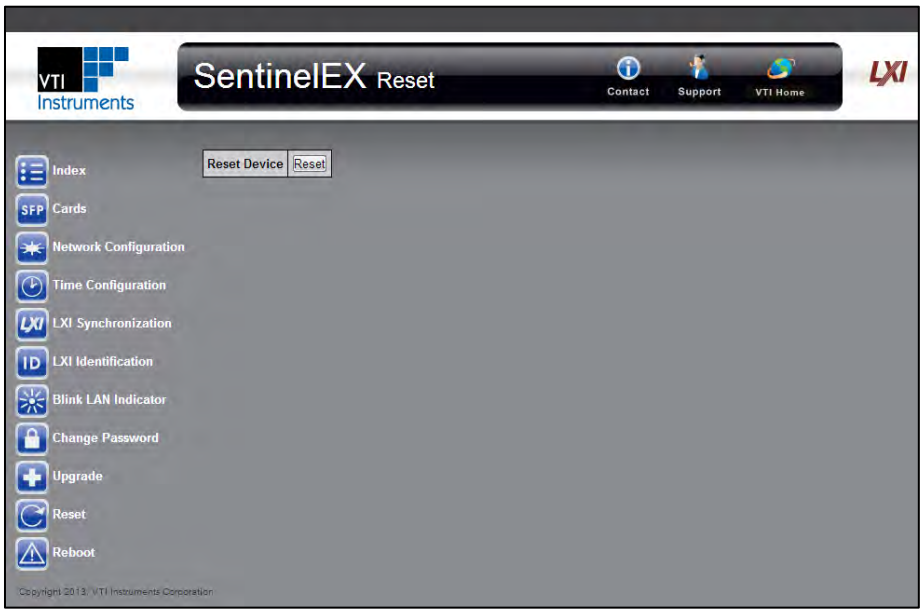


Figure 5-11: Reset Web page

- **Reset**: Click this button to reset the EMX-2500 and all peripheral cards to power-on defaults.

REBOOT

The **Reboot** web page allows the EMX-2500 to reboot the chassis it is installed into. This operation has the same effect as power-cycling the chassis – all modules will re-load firmware from nonvolatile memory and return to power-on defaults.

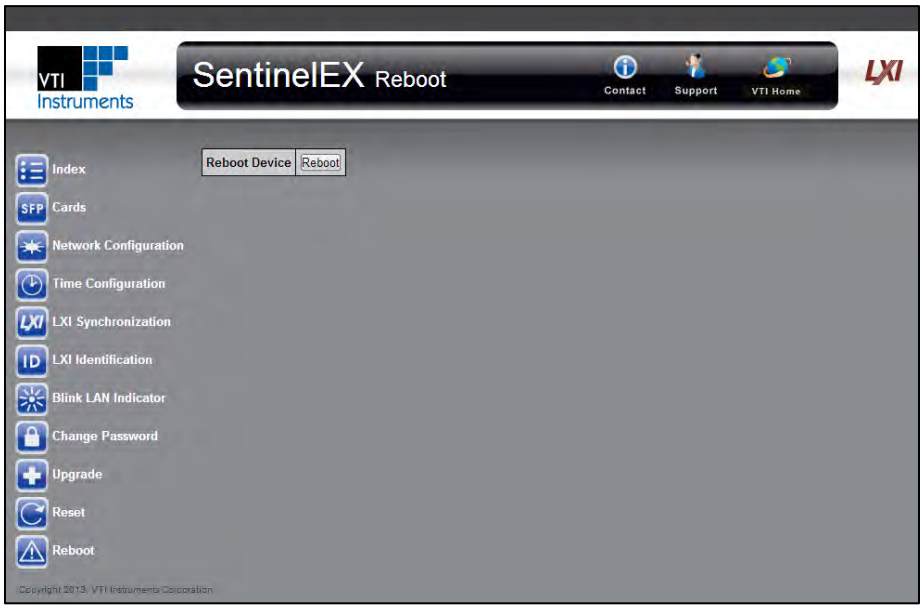


Figure 5-12: EMX-2500 Reboot Page

- **Reboot Device**: Click this button to reboot the EMX-2500, the chassis in which its installed, and all peripheral cards.

SECTION 6

TRIGGER MECHANISMS

OVERVIEW

The EMX-2500 provides triggering capabilities to installed peripheral cards through several different trigger mechanisms: PXI Triggers, the Front Panel Trigger, LAN Events, and Alarms. The capabilities and features of each of these will be examined in the following sections.

PXI TRIGGERS

The PXI Triggers consist of eight bussed trigger lines (PXI0-7) as well as one star trigger connected directly to the system timing slot (PXI_STAR).

PXI0-7

The EMX-2500 can use any of these eight triggers as inputs or outputs. When used as an output, the input read-back state reflects the state of the EMX-2500's driver, not necessarily the state of the PXI trigger itself (if other modules are also driving it). When output is disabled, reading reflects the actual state of the line.

Note that configuring a PXI trigger as input or output overrides any previous configuration of that line. For example, in order to configure PXI0 as an output and also redirect the same signal to EXT, PXI0 must first be set up as an input to EXT, then last as an output.

It is also important to note that when the EMX-2500 is installed in a chassis with multiple trigger segments it can only read input from, or write output to, the PXI triggers on its own segment. The chassis must be configured to route one trigger segment to another for the EMX-2500 to access other trigger segments. To configure this on the CMX18, use the VTEXPlatform driver's **Chassis** interface – call *Chassis.Routes.Add()* to configure a new route.

Configuring the PXI triggers as outputs is accomplished via the VTEXPlatform driver's **Trigger** interface:

- Set *Trigger.Lines* to a comma-separated-list of all PXI triggers to be driven
- Set *Trigger.TriggerSource* to the stimulus that will provide the trigger. Valid values include EXT, LAN0-7, ALARM0, and Software.
  - For EXT, the logical state at input of the EXT trigger connector will be mirrored onto the selected PXI trigger line(s).
  - For LAN0-7, TriggerSource.Detection can be set to VTEXPlatformTriggerSourceDetectionRise or VTEXPlatformTriggerSourceDetectionFall to indicate whether rising or falling edge LAN Events should cause the trigger. Note that, in compliance with the LXI Specification, the arrival of two consecutive falling edge events implies a rising edge immediately before the second, so may trigger fire even when events of the wrong sense arrive.

- For ALARM0 and LAN0-7, when the time configured in the alarm or included in the LAN Event packet arrives, a short low-going pulse will be driven onto the selected trigger line(s). If this time is in the past when the alarm is enabled or the packet is received, the pulse will be driven immediately.
- For Software, call *Trigger.SendSoftwareTrigger()* to cause a short low-going pulse to be driven onto the selected PXI trigger line(s).

Using the PXI triggers as inputs is accomplished via the VTEXPlatform driver's **Events** interface. Set the *Event.Source* property of a LAN Event or EXT to the name of the chosen trigger line. See the *Front Panel Trigger* and *LAN Event Triggers* sections for more details.

PXI_STAR

The PXI_STAR trigger can only act as an input to the EMX-2500. Similar to the PXI0-7 triggers, using PXI_STAR as an input is accomplished via the VTEXPlatform driver's **Events** interface. Set the *Event.Source* property of a LAN Event or EXT to "PXI_STAR". See the *Front Panel Trigger* and *LAN Event Triggers* sections for more details.

FRONT PANEL TRIGGER

The EMX-2500's front panel trigger is an SMB connector, labeled on the front panel as "TRIG". It is represented in the API as "EXT". It uses TTL signals and can act as an input or output.

Using the EXT trigger as an output is accomplished through the VTEXPlatform driver's **Events** interface:

- To enable the EXT trigger as an output, set Events->Item["EXT"]->DriveMode to VTEXPlatformEventDriveModeDriven.
- To disable it, use the value VTEXPlatformEventDriveModeOff.
- When enabled as an output, the current logic level of the EXT trigger can be controlled via software by setting Events->Item["EXT"]->Source to "0" or "1" for low or high, respectively.
- The logic level of the EXT trigger can alternately be controlled by other trigger lines, by setting Events->Item["EXT"]->Source to "LAN0" - "LAN7", "PXI0" - "PXI7", "PXI_STAR", or "ALARM0".
  - If a PXI line is chosen, its logic level will be mirrored onto the EXT trigger.
  - For ALARM0 and LAN0-7, when the time configured in the alarm or included in the LAN Event packet arrives, a short low-going pulse will be driven onto the EXT trigger. If this time is in the past when the alarm is enabled or the packet is received, the pulse will be driven immediately.

Using the Front Panel trigger as an input is accomplished with the **Trigger** interface. Set Trigger->TriggerSource to the "EXT", and Trigger->Lines to the PXI lines that it should drive. See the PXI Triggers section for more details.

LAN EVENT TRIGGERS

The EMX-2500 provides eight LAN Event triggers as both inputs and outputs. Installed EMX or SMX peripherals cards can make direct use of these triggers via their model-specific Instrument Drivers, such as VTEXDigitizer. Refer to the user's manual the specific peripheral card for more information.

To use a LAN Event trigger as an output within the EMX-2500, use the **Events** interface. The following examples illustrate using LAN0, but any of the eight can be substituted:

- To enable LAN0 as an output, Events->Item["LAN0"]->DriveMode to VTEXPlatformEventDriveModeWiredor. -Driven mode is not supported for LAN events as only one edge of the hardware triggers can be detected at a time.

- To disable it, use the valueVTEXPlatformEventDriveModeOff instead.
- To send a LAN Event via software control, set Events->Item[“LAN0”]->Source to “0” or “1”. A LAN Event representing a falling or rising edge, respectively, will be sent immediately.
- To send LAN Events automatically in response to hardware triggers, set Events->Item[“LAN0”]->Source to “PXI0”-“PXI7”, “PXI_STAR”, or “EXT”. Set Events->Item[“LAN0”]->Slope to VTEXPlatformSourceSlopeRise or VTEXPlatformSourceSlopeFall to select which hardware trigger edge to send in response to the event. LAN Events will include the precise IEEE 1588 timestamp of the trigger event.

Using an LAN Event trigger as an input within the EMX-2500 is accomplished with the **Trigger** interface. Set Trigger->TriggerSource to the LAN Event name and Trigger->Lines to the PXI lines that it should drive. See the *PXI Triggers* section for more details.

ALARMS

The EMX-2500 provides one alarm, identified in the VTEXPlatform driver as ALARM0. This can be configured to drive a pulse onto the Front Panel Trigger, or a PXI trigger at a specific IEEE 1588 time, and to repeat that pulse at a specified period for a specified number of times. First, use the **Alarm** interface to set the time, period, and repeat count. Then, use the **Trigger** or **Events** interface to configure PXI0-7 or EXT, respectively. See the *Front Panel Trigger*, *PXI Triggers*, and *LAN Event Triggers* sections for more details.

SECTION 7

FIRMWARE UPDATES

UPDATING EMX-2500 FIRMWARE

Firmware for the EMX-2500 is available on the *VTI Instruments User's Manuals and Drivers* disc or on the VTI Instruments website at http://www.vtiinstruments.com/Downloads.aspx.

To update the EMX-2500's firmware, visit the **Upgrade** webpage. Click the **Choose File** button, browse to the upgrade image, and select it. Then, click the **Submit** button.

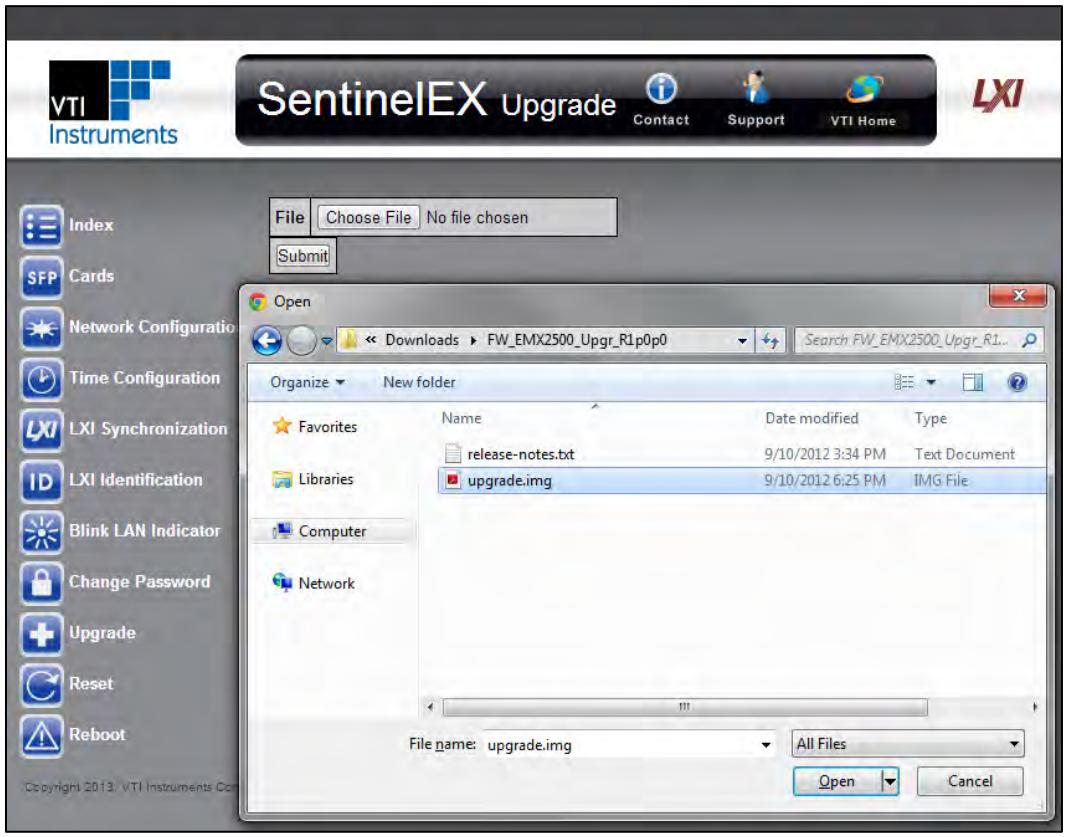


Figure 7-1: Selecting a New Firmware Image

The page will auto-refresh showing the upgrade progress until it is complete.



Figure 7-2: EMX-2500 Firmware Upgrade In Process

After the upgrade completes, the EMX-2500 must be rebooted to load the new firmware. Use either the **Reboot** webpage to reboot the EMX-2500 or power cycle the chassis in which it is installed.

If peripheral cards in the same chassis also need to be upgraded, this can be accomplished without rebooting the EMX-2500 after each individual upgrade – a single reboot after all upgrades are complete will suffice.



Figure 7-3: Firmware Upgrade Complete Indicator

NOTE	DO NOT power down the EMX-2500 or its chassis while the upgrade is in progress. If power is lost during the upgrade, the instrument may be put into an inoperable state, requiring return to the factory.

UPDATING PERIPHERAL FIRMWARE

The EMX-2500 can also be used to upgrading the firmware of peripheral SentinelEX cards in the same chassis. This process is much the same as upgrading the EMX-2500's firmware.

Firmware for peripheral cards is available from the *VTI Instruments User's Manuals and Drivers* disc or from the VTI Instruments website at http://www.vtiinstruments.com/Downloads.aspx.

To update the firmware of the peripheral cards, visit the **Upgrade** web page. Click the **Choose File** button, browse to the upgrade image, and select it. Then, click the **Submit** button.

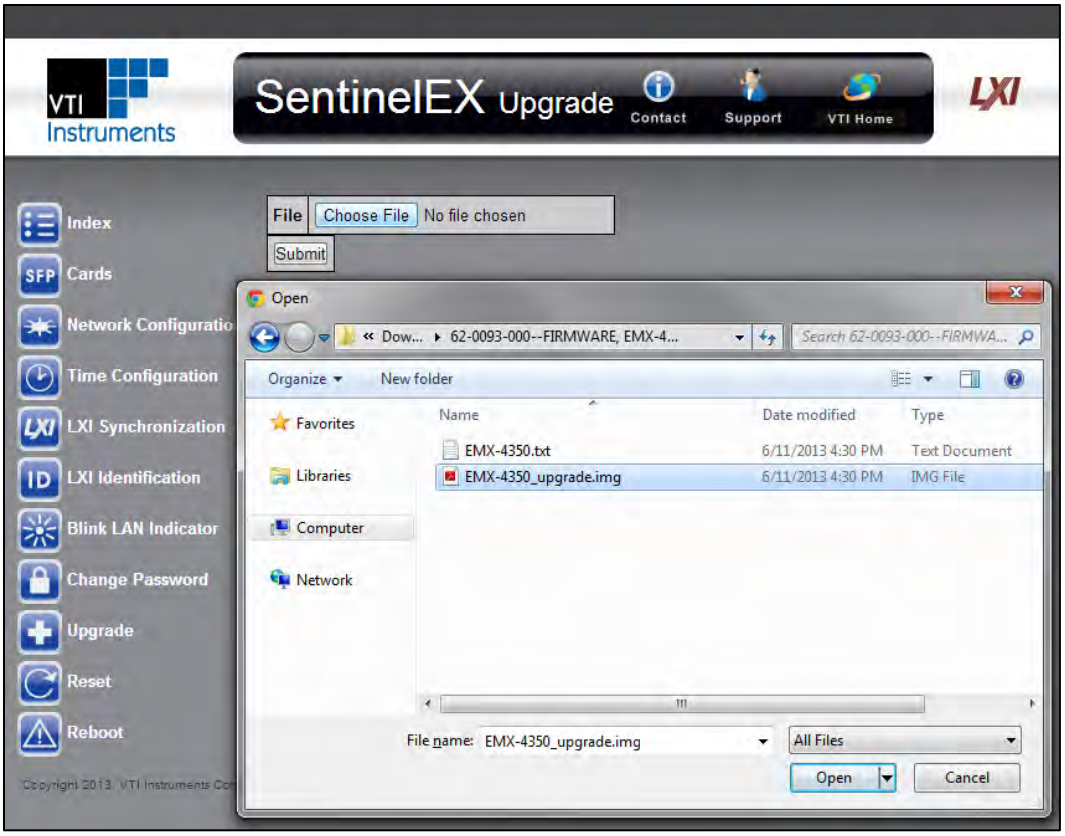


Figure 7-4: EMX-4350 Firmware Upgrade Image Selection

All installed peripherals cards that are supported by the selected firmware image will be upgraded. Cards that are not supported will be listed with the status **Skipped**. The page will auto-refresh showing the upgrade progress until it is complete.

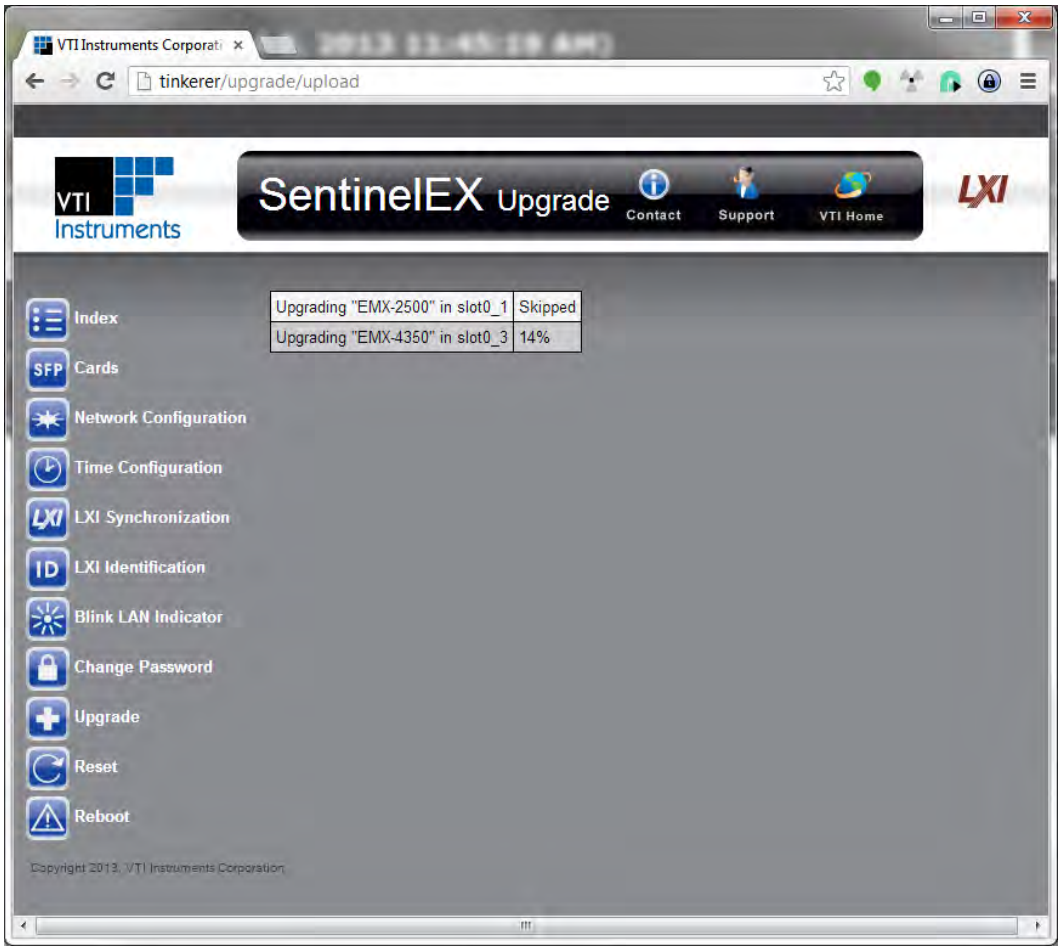


Figure 7-5: Firmware Upgrade In Process with Skipped Status

After the upgrade completes, the EMX-2500 must be rebooted to load the new firmware. Use either the **Reboot** webpage to reboot the EMX-2500 and the peripheral cards in the chassis or power cycle the chassis.

If other peripheral cards in the same chassis (or the EMX-2500 itself) also need to be upgraded, that can be done without rebooting the EMX-2500 after each individual upgrade – a single reboot after all upgrades are complete will suffice.



Figure 7-6: EMX-4350 Firmware Upgrade Complete Indicator

NOTE	**DO NOT** power down the EMX-2500 or its chassis while the upgrade is in progress. If power is lost during the upgrade, the instrument may be put into an inoperable state, requiring return to the factory.

INDEX

C

connectors
- Cat 5e 29
- TRIG IN 29
- TRIG OUT 29

D

declaration of conformity 5
driver installation
- IVI shared components 31

F

front panel
- LEDs 28

L

LAN Configuration Initialize 29
LEDs 28
- Ethernet link status indicators 29

R

required equipment 17

U

unpacking instructions 17

W

WEEE 6

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP